Chapter 4 Risk Assessment

Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

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

This risk assessment followed the methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:

1. Identify Hazards;
2. Profile Hazard Events;
3. Inventory Assets; and
4. Estimate Losses.

Data collected through this process has been incorporated into the following sections of this chapter:

- **Section 4.1: Hazard Identification** identifies the natural hazards that threaten the Plumas County Planning Area and describes why some hazards have been omitted from further consideration.
- **Section 4.2: Plumas County Assets at Risk** identifies the property values; populations; critical facilities; and cultural, historical, and natural resources at risk. This information is not hazard specific and covers the entire Plumas County Planning Area.
- **Section 4.3: Hazard Profiles and Vulnerability Assessment** provides an overview of each hazard, its location and extent, and discusses the risk, vulnerability, and impacts of each natural hazard to the Planning Area. The hazard profile also describes previous occurrences of hazard events and the likelihood of future occurrences. The vulnerability assessment evaluates the Planning Areas' exposure to natural hazards; considering assets at risk, critical facilities, future development trends, and, where possible, estimates potential hazard losses.
- **Section 4.4: Capability Assessment** inventories existing local mitigation activities and policies, regulations, plans, and projects that pertain to mitigation and can affect net vulnerability.

This risk assessment covers the entire geographical extent of unincorporated Plumas County area (i.e., the Plumas County Planning Area), and does not include the City of Portola which is covered under its own LHMP. Additionally, as required by FEMA, this risk assessment for the Plumas County Planning Area also includes an evaluation of how the hazards and risks vary across the Planning Area.

This LHMP Update involved a comprehensive review and update of each section of the 2014 risk assessment. Information from the 2014 LHMP was used in this Update where valid and applicable. As part of the risk assessment update, new data was used, where available, and new analyses were conducted. Where data from existing studies and reports was used, the source is referenced throughout this risk assessment. Refinements, changes, and new methodologies used in the development of this risk assessment update are summarized in Chapter 2 What's New and are also detailed in this risk assessment portion of this Plan.

4.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The Plumas County Hazard Mitigation Planning Committee (HMPC) conducted a hazard identification assessment to determine the hazards that threaten the Planning Area. This section details the methodology and results of this effort.

Data Sources

The following data sources were used for this Hazard Identification portion of this Plan:

- California Office of Emergency Services (Cal OES)
- HMPC input
- National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) Storm Events Database
- 2014 Plumas County LHMP
- 2018 State of California Hazard Mitigation Plan
- 2019 City of Portola Local Hazard Mitigation Plan (Draft)
- FEMA Disaster Declaration Database

4.1.1. Results and Methodology

Using existing hazards data and input gained through planning meetings, the HMPC agreed upon a list of hazards that could affect the Plumas County Planning Area. Hazards data from Cal OES, FEMA, the NOAA NCDC database, and many other sources were examined to assess the significance of these hazards to the Planning Area.

The following hazards in Table 4-1, listed alphabetically, were identified and investigated for this LHMP Update. As a starting point, the 2018 California State Hazard Mitigation Plan was consulted to evaluate the applicability of hazards of concern to the State, to the Plumas County Planning Area. Building upon this effort, hazards from the 2014 Plumas County LHMP were also identified, and comments explain how hazards were updated from the 2014 plan. All hazards from the 2014 Plan were profiled in this LHMP Update. New hazards include localized flooding (broken out from the Flood hazard), levee failure, pandemic, and tree mortality. Water shortage was added to the drought hazard.

Table 4-1 Plumas County Hazard Identification and Comparison from 2014 LHMP

2020 Hazards	2014 Hazards	Comment
Avalanche	Avalanche (part of geologic hazards)	This hazard was broken out and more detail was added to the hazard profile and the vulnerability assessment.
Climate Change	Climate Change	Added additional information in both the hazard profiled and the vulnerability assessment.
Dam Failure	Dam Failure	Additional analysis was performed using the updated Cal OES and California Division of Safety of Dams (DSOD) hazard rating classes.
Drought and Water Shortage	Drought	Water shortage was added and a greater discussion of vulnerability to both drought and water shortage was added.
Earthquake (including liquefaction)	Earthquake (part of geologic hazards)	Liquefaction was added. A detailed Hazus run for the County was performed and added to the vulnerability assessment.
Flood: 1%/0.2% annual chance	Floods: 100/500 year	Additional analysis was added in the vulnerability assessment, including an update of values, populations, and critical facilities at risk.
Flood: Localized/Stormwater	–	New hazard
Landslide, Mudslide, and Debris Flows	Landslides (part of geologic hazards)	This hazard was broken out and more detail was added to the hazard profile and the vulnerability assessment.
Levee Failure	–	New hazard
Pandemic	–	New hazard
Severe Weather: Extreme Heat	Severe Weather (consolidated hazard)	This hazard was broken out and more detail was added to the hazard profile and the vulnerability assessment.
Severe Weather: Heavy Rains and Storms	Severe Weather (consolidated hazard)	This hazard was broken out and more detail was added to the hazard profile and the vulnerability assessment.
Severe Weather: High Winds and Tornadoes	Severe Weather (consolidated hazard)	This hazard was broken out and more detail was added to the hazard profile and the vulnerability assessment.
Severe Weather: Winter Storm and Freeze	Severe Weather (consolidated hazard)	This hazard was broken out and more detail was added to the hazard profile and the vulnerability assessment.
Tree Mortality	–	New hazard
Volcano	Volcanoes (part of geologic hazards)	Similar analysis was performed.

2020 Hazards	2014 Hazards	Comment
Wildfire	Wildfire	Additional analysis was added in the vulnerability assessment, including an update of values, populations, and critical facilities at risk.

Certain hazards were excluded from consideration for this LHMP Update. They are shown in Table 4-2.

Table 4-2 Plumas County – Excluded Hazards

Hazard Excluded	Why Excluded
Tsunami	The County is not on the coast.
Air Pollution	The County did consider this a hazard for this Plan, it is dealt with in other planning mechanisms in the County. Smoke is discussed in the wildfire hazard.
Coastal Flooding, Erosion, and Sea Level Rise	The County is not on the coast.
Energy Shortage and Energy Resilience	The County did consider this a hazard, it is dealt with in other planning mechanisms in the County.
Natural Gas Pipeline Hazards	The County did not consider this a hazard due to the low number of gas pipelines traversing the County.
Oil Spills	The County did not consider this a hazard, as there are few pipelines or oil wells in the County.
Radiological Accidents	There are no areas in the County at risk to this hazard.
Subsidence	There are few areas of the County where subsidence is a risk. In addition, most subsidence is related to drought and water shortage, and will be discussed in that hazard profile and vulnerability assessment.
Cyber Threats	The County did consider this a hazard, but it is dealt with in other planning mechanisms in the County.
Airline Crashes	There have been few past occurrences in the County of airplane crashes. This is not a hazard to be included in the LHMP.
Civil Disturbance	The County did consider this a hazard, but it is dealt with in other planning mechanisms in the County.
Well Stimulation and Hydraulic Fracking	This is not occurring in the County.

Table 4-3 was completed by the County and HMPC to identify, profile, and rate the significance of identified hazards. Those hazards identified as a high or medium significance are considered priority hazards for mitigation planning. Those hazards that occur infrequently or have little or no impact on the Planning Area were determined to be of low significance and not considered a priority hazard. Significance was determined based on the hazard profile, focusing on key criteria such as frequency, extent, and resulting damage, including deaths/injuries and property, crop, and economic damage. The ability of a community to reduce losses through implementation of existing and new mitigation measures was also considered as to the significance of a hazard. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the Plumas County Planning Area, enabling the County to focus resources where they are most needed.

Table 4-3 Plumas County Hazard Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Avalanche	Limited	Highly Likely	Negligible	Low	Medium
Climate Change	Extensive	Likely	Limited	Medium	–
Dam Failure	Extensive	Unlikely	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Limited	Medium	High
Earthquake	Extensive	Occasional	Critical	Medium	Low
Floods: 1%/0.2% annual chance	Significant	Occasional/ Unlikely	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Negligible	Medium	Medium
Landslide, Mudslide, and Debris Flow	Significant	Likely	Negligible	Medium	Medium
Levee Failure	Limited	Unlikely	Limited	Medium	Medium
Pandemic	Extensive	Likely	Critical	Medium	Low
Severe Weather: Extreme Heat	Extensive	Highly Likely	Negligible	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Medium	Medium
Severe Weather: High Winds and Tornadoes	Extensive	Highly Likely/ Unlikely	Limited	Medium	Low
Severe Weather: Winter Storms and Freeze	Extensive	Highly Likely	Negligible	Medium	Medium
Tree Mortality	Significant	Likely	Limited	Medium	High
Volcano	Extensive	Unlikely	Catastrophic	Low	Low
Wildfire	Extensive	Highly Likely	Catastrophic	High	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

4.1.2. Disaster Declaration History

One method the HMPC used to identify hazards was the researching of past events that triggered federal and/or state emergency or disaster declarations in the Plumas County Planning Area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

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

Based on the disaster declaration history provided in Table 4-4, Plumas County is among the many counties in California susceptible to disaster. Details on federal and state disaster declarations were obtained by the FEMA and Cal OES and compiled in chronological order in Table 4-4. A review of state declared disasters indicates that Plumas County received 23 state declarations between 1950 and 2020. Of the 23 state declarations: 16 were associated with severe winter storms, heavy rains, or flooding; 2 were for drought; 1 were from economic disasters, 1 was from pandemic, and 3 were for wildfire. A review of federal disasters shows 21 federal disaster declarations. Of these 21 federal declarations: 15 were associated with severe winter storms, heavy rains, or flooding, 4 for wildfire, 1 was from pandemic, and 1 was for hurricane (a nationwide declaration for Katrina evacuations). A summary of these events by disaster type is shown in Table 4-5.

Table 4-4 Plumas County State and Federal Disaster Declarations, 1950-2020

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
2020	Bear Fire	Fire	Fire	FM-5363	–	9/9/2020
2020	California Wildfires	Fire	Fire	DR-4458	–	8/22/2020
2020	Covid-19	Pandemic	Pandemic	DR-4482	3/4/2020	1/20/2020
2017	California Severe Winter Storms, Flooding, Mudslides	Flood	Storms	DR-4308	–	4/1/2017
2017	California Severe Winter Storms, Flooding, Mudslides	Flood	Storms	DR-4301	–	2/14/2017
2014	California Drought	Drought	Drought	GP 2014-13	1/17/2014	–
2008	Wildfires	Fire	Fire	EM-3287	–	6/28/2008

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
2005/2006	2005/06 Winter Storms	Flood	Storms	DR-1628	–	2/3/2006
2005	Hurricane Katrina Evacuations	Economic	Hurricane	EM-3248 2005	–	9/13/2005
2001	Energy Emergency	Economic	Greed	GP 2001	1/1/2001	–
1999	California Wildfires	Fire	Fire	EM-3140	8/26/1999	9/1/1999
1997	1997 January Floods	Flood	Storms	DR-1155	1/2/97-1/31/97	1/4/1997
1996	Torrential Wind and Rains	Flood	Storms	GP 96-01	1/2/1996	–
1995	California Severe Winter Storms, Flooding, Landslides, Mud Flows	Flood	Storms	DR-1046	Proclaimed	3/12/1995
1995	1995 Severe Winter Storms	Flood	Storms	DR-1044	1/6/95-3/14/95	1/13/1995
1993	California Severe Storm, Winter Storm, Mud & Landslides, Flooding	Flood	Storms	DR-979	–	2/3/1993
1992	1992 Late Winter Storms	Flood	Storms	DR-979	1/7/93 - 2/19/93	1/15/1993
1987	1987 Wildland Fires	Fire	Fire	GP	9/10/1987, 9/3/1987	–
1986	1986 Storms	Flood	Storms	DR-758	2/18-86-3/12/86	2/18/1986
1980	April Storms	Flood	Storms	–	4/1/1980	–
1977	1977 Drought	Drought	Drought	EM-3023	1/20/1977	–
1970	1970 Northern California Flooding	Flood	Flood	DR 283	1/27/1970 - 3/2/1970	2/16/1970
1969	California Severe Storms, Flooding	Flood	Storms	DR-253	1/23/69, 1/25,69, 1/28/69, 1/29/69, 2/8/69, 2/10/69, 2/16/69, 3/12/69	1/26/1969
1964	1964 Late Winter Storms	Flood	Storms	DR-183	12/22/64, 12/23/64, 12/28/64, 1/5/65, & 1/14/65	12/24/1964

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
1963	1963 Floods and Rains	Flood	Storms	DR-145	2/7/63, 2/26/63, 2/29/63, & 4/22/63	2/25/63
1963	1963 Floods	Flood	Storms	–	2/14/1964	–
1960	1960 Widespread Wildfires	Fire	Fire	–	8/16/1960	–
1958	1958 April Storms and Floods	Flood	Storms	DR-52	4/5/1958	4/4/1958
1958	1958 February Storms and Floods	Flood	Storms	CDO 58-03	2/26/1958	–
1955	1955 Floods	Flood	Flood	DR-47	12/22/1955	12/23/1955
1950	1950 Floods	Flood	Flood	OCD 50-01	11/21/1950	–

Source: Cal OES, FEMA

Table 4-5 Plumas County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Drought	2	1977, 2014	0	–
Economic	1	2001	0	–
Fire	3	1960, 1987, 1999	4	1999, 2008, 2020 (twice)
Flood (including heavy rains and storms)	16	1950, 1955, 1958 (twice), 1963 (twice), 1964, 1969, 1970, 1980, 1986, 1992, 1995 (twice), 1996, 1997	15	1955, 1958, 1963, 1964, 1969, 1970, 1986, 1992, 1993, 1995 (twice), 1997, 2006, 2017 (twice)
Hurricane	0	–	1	2005
Pandemic	1	2020	1	2020
Totals	**23**	–	**21**	**–**

Source: Cal OES, FEMA

Disasters since 2014

As detailed above, there have been five federal disaster declarations and two state disaster declarations since the 2014 plan:

- 2014 Drought (state)
- 2017 Flood (two federal)
- 2020 Pandemic (state and federal)
- 2020 Wildfires (two federal)

EOC Activations since 2014

There have been six EOC activations since 2014:

- January 2 – 12, 2017 – Winter Storm Event
- February 1 – 12, 2017 – Winter Storm Event
- July 30 – August 17, 2017 – Minerva Fire Activation
- November 8 – November 28, 2018 – CAMP Fire Activation
- March 18, 2020 to current – Pandemic
- August 27, 2020 to current – North Complex and Bear Fires

4.2 Plumas County Assets at Risk

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

- Values at risk;
- Critical facility inventory;
- Cultural, historical, and natural resources; and
- Growth and development trends.

Data Sources

Data used to support this assessment included the sources listed below. Where data and information from these studies, plans, reports, and other data sources were used, the source is referenced as appropriate throughout this vulnerability assessment.

- 2019-2024 Plumas County Housing Element
- 2019-2024 Plumas County Housing Element Background Report
- 2017 Climate Change and Health Profile Report – Plumas County
- CalAtlas
- California Department of Finance
- California Department of Fish and Wildlife
- California Department of Parks and Recreation Office of Historic Preservation
- California Department of Water Resources Proposition 84 Integrated Regional Water Management
- California Natural Diversity Database
- Hazus MH 4.2
- Plumas County 2035 General Plan Conservation Open Space Element
- Plumas County 2035 General Plan Land Use Element
- Plumas County Building Department
- Plumas County GIS Department
- Plumas County Planning Department
- Plumas County's February 2020 Assessor Data
- State of California Department of Conservation
- US Census Bureau

4.2.1. Values at Risk

Parcel Inventory and Assessed Values

This analysis captures the values associated with assessed values located within Plumas County. The February 2020 Plumas County Parcel/Assessor's data, obtained from Plumas County, was used for as the basis of this analysis. This data provided by Plumas County represents best available data.

Understanding the total assessed value of Plumas County is a starting point to understanding the overall value of identified values at risk in the County. When the total assessed values are combined with potential values associated with other community assets such as public and private critical infrastructure, historic and cultural resources, and natural resources, the big picture emerges as to what is potentially at risk and vulnerable to the damaging effects of natural hazards within the County.

Methodology

Plumas County's February 2020 Assessor Data and the County's GIS parcel data were used as the basis for the inventory of assessed values for both improved and unimproved parcels within the County. This data provides the land, improved, and property values assessed for each parcel, along with key information such as property use. Other GIS data, such as jurisdictional boundaries, roads, streams, and area features, was also obtained from Plumas County and CalAtlas to support countywide mapping and analysis of values at risk. The Plumas County GIS parcel data contained 26,056 parcels for the County and the City of Portola. This plan focuses on the unincorporated Plumas County, and therefore the GIS parcel data exclusively contained 24,406 parcels.

Data Limitations & Notations

Although based on best available data, the resulting information should only be used as an initial guide to overall values in the County. In the event of a disaster, structures and other infrastructure improvements are at the greatest risk of damage. Depending on the type of hazard and resulting damages, the land itself may not suffer a significant loss. For that reason, the values of structures and other infrastructure improvements are of greatest concern. As such, it is critical to note a specific limitation to the assessed values data within the County, created by Proposition 13. Instead of adjusting property values annually, no adjustments are made until a property transfer occurs. As a result, overall property value information is most likely low and may not reflect current market or true potential loss values for properties within the County.

Another limitation to this data is found in the Williamson Act, also known as the California Land Conservation Act of 1965, that enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. When the County enters into a contract with the landowners under the Williamson Act, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least ten years and the County agrees to tax the land at a rate based on the agricultural production of the land rather than its real estate market value. This further affects the County's overall values for assessed taxable lands.

The February 2020 GIS parcel and Assessor data was obtained to perform the spatial analysis. GIS was used to convert the parcel polygons into centroids representing each record in the assessor database. For the purposes of this analysis, the centroids which were not coincident in locations were re-positioned to overlay on the corresponding polygons so that each assessor record (with a unique assessor parcel number) was spatially positioned on the corresponding parcel. In addition, multiple parcels polygons in the GIS data were constructed as multi-part features, of which only one centroid was representative of each parcel polygon. The position of the centroids may result in less accurate hazard analysis overlay results. The data did not contain duplicate records.

Property Use Categories

Plumas County's GIS data contained land use designations which provide detailed descriptive information about how each property is generally used, such as agricultural, commercial, government, industrial, institutional, recreational, residential, and right of way. The land use codes from County assessor data were refined and categorized into ten property use categories and linked back to the Plumas County Assessor data. The final property use categories for Plumas County are:

- Agricultural
- Commercial
- Federal Lands
- Government
- Industrial
- Institutional
- Miscellaneous
- Recreational
- Residential
- ROW/Utilities

Once the land use descriptions were grouped into categories, the number of total and improved parcels, as well as land, improved, and personal property values were inventoried for the County by property use.

Estimated Content Replacement Values

Plumas County's assigned property use categories were used to develop estimated content replacement values (CRVs) that are potentially at loss from hazards. FEMA's standard CRV factors were utilized to develop more accurate loss estimates for all mapped hazard analyses. FEMA's CRV factors estimate value as a percent of improved structure value by property use. Table 4-6 shows the breakdown of the different property uses in the County and their estimated CRV factors.

Table 4-6 Plumas County – Content Replacement Factors by Property Use

Plumas County Property Use Categories	Hazus Property Use Categories	Hazus Content Replacement Values
Agricultural	Agricultural	100%
Commercial	Commercial	100%
Federal Lands	Government	100%

Plumas County Property Use Categories	Hazus Property Use Categories	Hazus Content Replacement Values
Government	Government	100%
Industrial	Industrial	150%
Institutional	Institutional	100%
Miscellaneous	–	100%
Recreational	Other	100%
Residential	Residential	50%
ROW/Utilities	Other	100%

Source: Hazus

Plumas County Values at Risk Results

Values associated with land, improved structures, and personal property, were identified and summed in order to determine assessed values at risk in the Plumas County Planning Area. Together, the land, improved structure, and personal property values make up the majority of assessed values associated with each identified parcel or asset. Improved parcel counts were based on the assumption that a parcel was improved if a structure value was present. Content replacement values were then added to the assessed values, as described below, to provide an estimate of values at risk in the Planning Area.

Table 4-7 shows the values or exposure for Plumas County and the City of Portola (using CRV multipliers from Table 4-6). This table is important as potential losses to the County include structure contents. In addition, loss estimates contained in the hazard vulnerability sections of this Chapter will use calculations based on these values, including content replacement values. Portola is included here to show how much of Plumas County's values lie in the unincorporated County as well as the values in the City. The hazard specific tables in each hazard will not include an analysis of Portola values at risk, as they are not a participating jurisdiction to this LHMP Update.

Table 4-7 Plumas County and City of Portola – Values at Risk by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
City of Portola	1,650	1,021	$30,134,780	$99,138,500	$884,356	$60,746,025	$190,903,661
Unincorporated Plumas County	24,406	13,736	$1,286,142,794	$2,433,091,778	$18,634,395	$1,394,561,101	$5,132,430,068
Grand Total	**26,056**	**14,757**	**$1,316,277,574**	**$2,532,230,278**	**$19,518,751**	**$1,455,307,126**	**$5,323,333,729**

Source: Plumas County February 2020 Parcel/Assessor's Data

The values for unincorporated Plumas County are broken out by property use and are provided in Table 4-8. The remainder of the analysis by hazard in this Chapter will focus on these values at risk in the unincorporated County.

Table 4-8 Unincorporated Plumas County – Values at Risk by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Agricultural	1,985	278	$105,940,628	$23,866,908	$2,293,939	$23,866,908	$155,968,383
Commercial	867	609	$68,665,448	$198,890,953	$9,768,708	$198,890,953	$476,216,062
Federal Lands	214	0	$0	$0	$0	$0	$0
Government	590	0	$143,742	$0	$0	$0	$143,742
Industrial	147	84	$9,699,636	$45,102,146	$314,544	$67,653,219	$122,769,545
Institutional	87	45	$1,884,400	$12,698,132	$79,905	$12,698,132	$27,360,569
Miscellaneous	129	0	$8,119	$0	$0	$0	$8,119
Recreational	522	97	$14,115,908	$30,370,139	$1,429,945	$30,370,139	$76,286,131
Residential	18,805	12,623	$1,085,684,913	$2,122,163,500	$4,747,354	$1,061,081,750	$4,273,677,517
ROW/Utilities	1,060	0	$0	$0	$0	$0	$0
Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**

Source: Plumas County February 2020 Parcel/Assessor's Data

4.2.2. Critical Facility Inventory

The Plumas County worked with members of the HMPC and Plumas County Disaster Council to develop a definition of critical facilities for the Plumas County Planning Area. For purposes of this plan, a critical facility is defined as:

Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health, safety, and the environment or interrupt essential services and operations for the community at any time before, during, and after the hazard event.

A critical facility is classified by the following categories: (1) Essential Services Facilities: (2) At-Risk Populations Facilities, and (3) Hazardous Materials Facilities.

- **Essential Services Facilities** include, without limitation, public safety, emergency response, emergency medical, designated emergency shelters, communications, public utility facilities and equipment, and government operations. Sub-Categories include:
  - ✓ Public Safety – Sheriff station and substations, California highway patrol stations, fire and rescue stations, emergency operations centers, and any facility deemed critical or leased by Pacific Gas & Electric (PG&E) for the purposes of a community resource center during Public Safety Power Shutoff (PSPS) events.
  - ✓ Emergency Response – Emergency vehicle and equipment storage and essential governmental work centers for continuity of government operations.
  - ✓ Emergency Medical – Hospitals, emergency care, clinics, wellness centers, pharmacies, and ambulance services.

- ✓ Designated Emergency Shelters – Plumas Sierra County Fairgrounds, Quincy Veterans Hall, and Chester Veterans Memorial Hall.
- ✓ Communication Sites and Facilities – Main broadcasting equipment and systems, cell towers, data transmission, and other emergency warning systems (hubs for telephone, television, cable, radio, and internet).
- ✓ Public Utility Plant and Substation Facilities – Equipment for treatment, generation, storage, pumping, and distribution (hubs for surface water, groundwater, wastewater, power, and fuel).
- ✓ Essential Government Operations – County Courthouse (public records, elections, government administration and risk management, information technology, and courts), jails, probation, building permitting and inspection services, Public Works (maintenance and equipment yards), Child Support Services, Assessor, and County Annex (public health, behavioral health, social services, and environmental health).
- ✓ Transportation Lifeline Systems – Airports, heliports, helipads, critical highways, critical roadways, bridges, railroads, and other transportation infrastructure.[1]

- ➢ **At-Risk Populations Facilities** include, without limitation, pre-schools, public and private primary and secondary schools, before and after school care centers with 12 or more students, daycare centers with 12 or more children, group homes, and assisted living residential or congregate care facilities with 12 or more residents.
- ➢ **Hazardous Materials Facilities** include, without limitation, any facility that could, if adversely impacted, release hazardous material(s) in sufficient amounts during a hazard event that would significantly impact public health, safety, and the environment. For the purposes of this plan, those facilities storing threshold quantities of regulated substances subject to the California Accidental Release Response Plan (CalARP) program as specified in 19 CCR § 2770.5 are considered as meeting this criteria.

A summary of critical facilities in the Plumas County Planning Area can be found in Figure 4-1 and Table 4-9. Table 4-10 details critical facilities by category. Additional details of individual critical facilities can be found in Appendix F of this Plan.

[1] Note: critical linear transportation routes and systems such as highways and roadways will be determined during any hazard-specific evacuation planning and, for those reasons, are not specifically identified in this plan.

Figure 4-1 Plumas County Planning Area – Critical Facilities

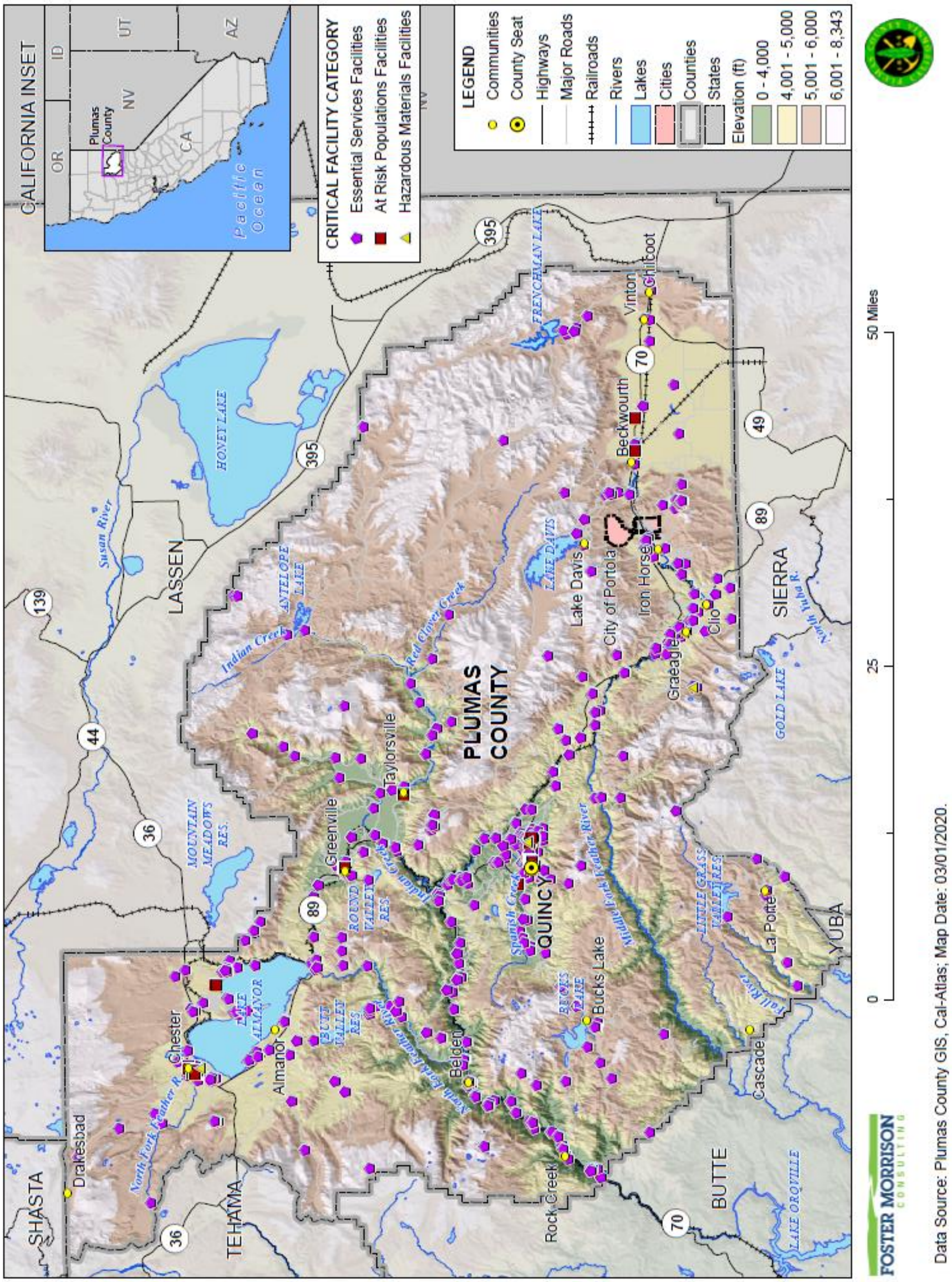


Table 4-9 Plumas County Planning Area – Critical Facility Summary

Critical Facility Category	Facility Count
Essential Services Facilities	773
At Risk Populations Facilities	38
Hazardous Materials Facilities	4
Grand Total	**815**

Source: Plumas County GIS

Table 4-10 Plumas County Planning Area – Critical Facilities by Facility Type

Critical Facility Category	Critical Facility Type	Facility Count
Essential Services Facilities	Communication Sites and Facilities	494
	Designated Emergency Shelter	3
	Emergency Medical	13
	Emergency Response	5
	Essential Government Operations	14
	Public Safety	42
	Public Utility Plant and Substation Facilites	84
	Transportation Lifeline Systems	118
	Total	**773**
At Risk Populations Facilities	Nursing, Congregate, or Assisted Living	3
	School	35
	Total	**38**
Hazardous Materials Facilities	Industrial	1
	Unknown	3
	Total	**4**
Grand Total		**815**

Source: Plumas County GIS

4.2.3. Cultural, Historical, and Natural Resources

Assessing Plumas County's vulnerability to disasters also involves inventorying the cultural, historical, and natural resource assets of the area. This information is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of cultural, historical and natural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.

- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian and sensitive habitats which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Cultural and Historical Resources

Plumas County has a large stock of historically significant homes, public buildings, and landmarks. To inventory these resources, the HMPC collected information from a number of sources. The California Department of Parks and Recreation Office of Historic Preservation (OHP) was the primary source of information. The OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs. Each program has different eligibility criteria and procedural requirements.

- The **National Register of Historic Places** is the nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.
- The **California Register of Historical Resources** program encourages public recognition and protection of resources of architectural, historical, archeological, and cultural significance and identifies historical resources for state and local planning purposes; determines eligibility for state historic preservation grant funding; and affords certain protections under the California Environmental Quality Act. The Register is the authoritative guide to the state's significant historical and archeological resources.
- **California Historical Landmarks** are sites, buildings, features, or events that are of statewide significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Landmarks #770 and above are automatically listed in the California Register of Historical Resources.
- **California Points of Historical Interest** are sites, buildings, features, or events that are of local (city or county) significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Points designated after December 1997 and recommended by the State Historical Resources Commission are also listed in the California Register.

Historical resources included in the programs above are identified in Table 4-11.

Table 4-11 Plumas County Planning Area – Historical Resources

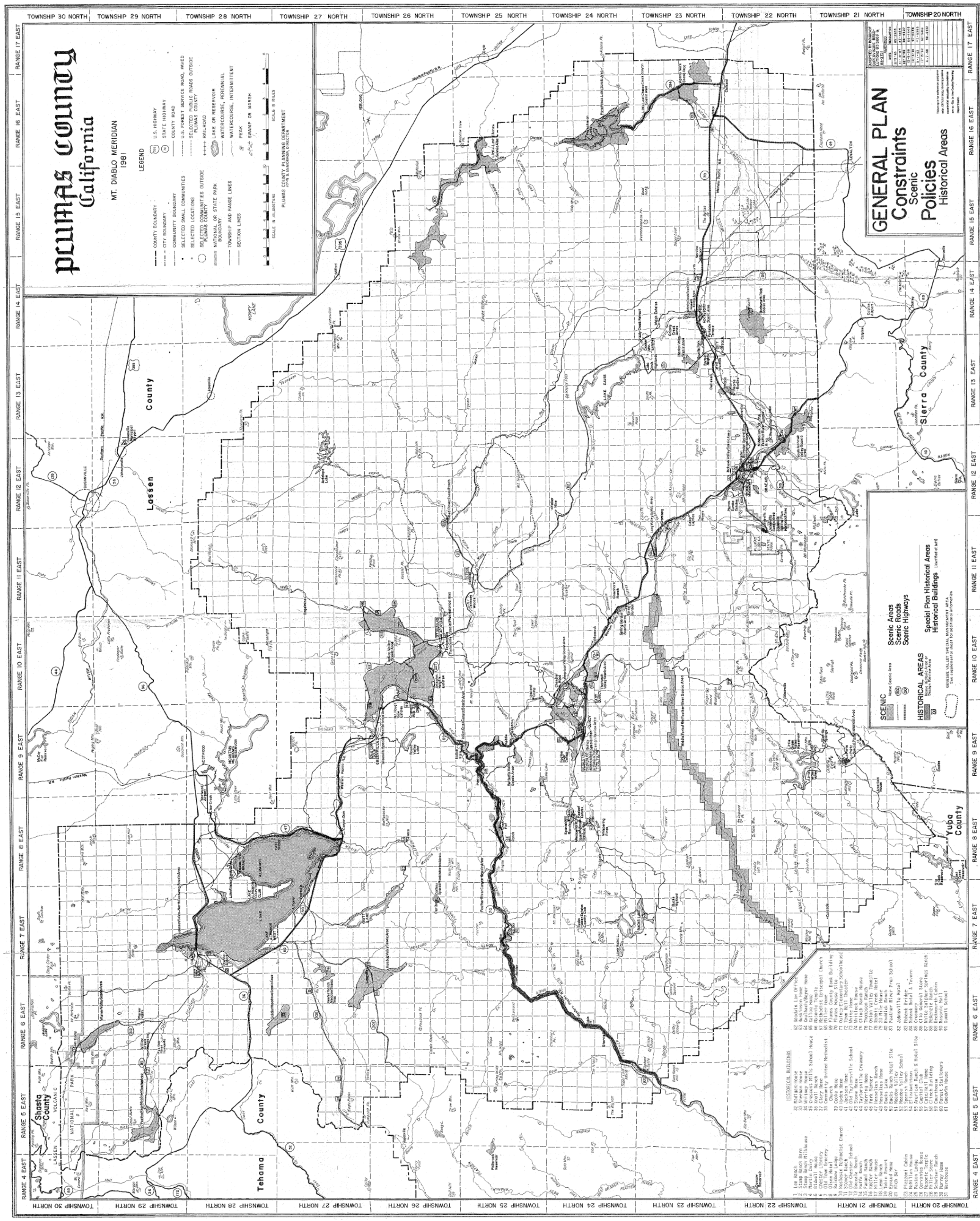
Resource Name (Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/ Community
Beckwourth Pass (336)		X			8/8/1939	Chilcoot
Buck's Lake (197)		X			6/20/1935	Quincy

Resource Name (Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/ Community
Ch'ichu'yam-Bam (N2213)	X				9/25/2003	Crescent Mills
Chinese American Cemetery, Plumas County Memorial Park (P770)				X	5/11/1992	Quincy
Drakesbad Guest Ranch (N2216)	X				10/22/2003	Chester
Elizabethtown (231)		X			6/20/1935	Quincy
James P. Beckwourth Ranch & Trading Post (P183)				X	9/24/1970	Beckwourth
Jamison City, Eureka Mills, Johnstown, and The Famous Eureka Mine (196)		X			6/20/1935	Blairsden
Lakes Basin Petroglyphs (N85)	X				5/6/1971	Gold Lake
Marysville-Carson City Trail (P620)				X	8/16/1983	Plumas National Forest
Peter Lassen Marker (Site Of Lassen Trading Post) (184)		X			6/20/1935	Greenville
Pioneer Grave (Grizzly Creek) (212)		X			6/20/1935	Quincy
Pioneer Schoolhouse (625)		X			1/13/1958	Quincy
Pioneer Ski Area of America, Johnsville (723)		X			1/18/1960	Blairsden
Plumas-Eureka Mill, Jamison Mines District (N249)	X				7/16/1973	Blairsden
Rabbit Creek Hotel Monument (213)		X			6/20/1935	La Porte
Rich Bar (337)		X			8/8/1939	Quincy
Site of American Ranch And Hotel (479)		X			11/9/1950	Quincy
Site Of Plumas House (480)		X			11/9/1950	Quincy
Spanish Ranch and Meadow Valley (481)		X			11/9/1950	Quincy
Taylorsville Schoolhouse (P742)				X	5/8/1991	Taylorsville
Town Of Taylorsville (P318)				X	9/12/1973	Taylorsville
Warner Valley Ranger Station (N579)	X				4/3/1978	Chester

Source: California Department of Parks and Recreation Office of Historic Preservation, http://ohp.parks.ca.gov/

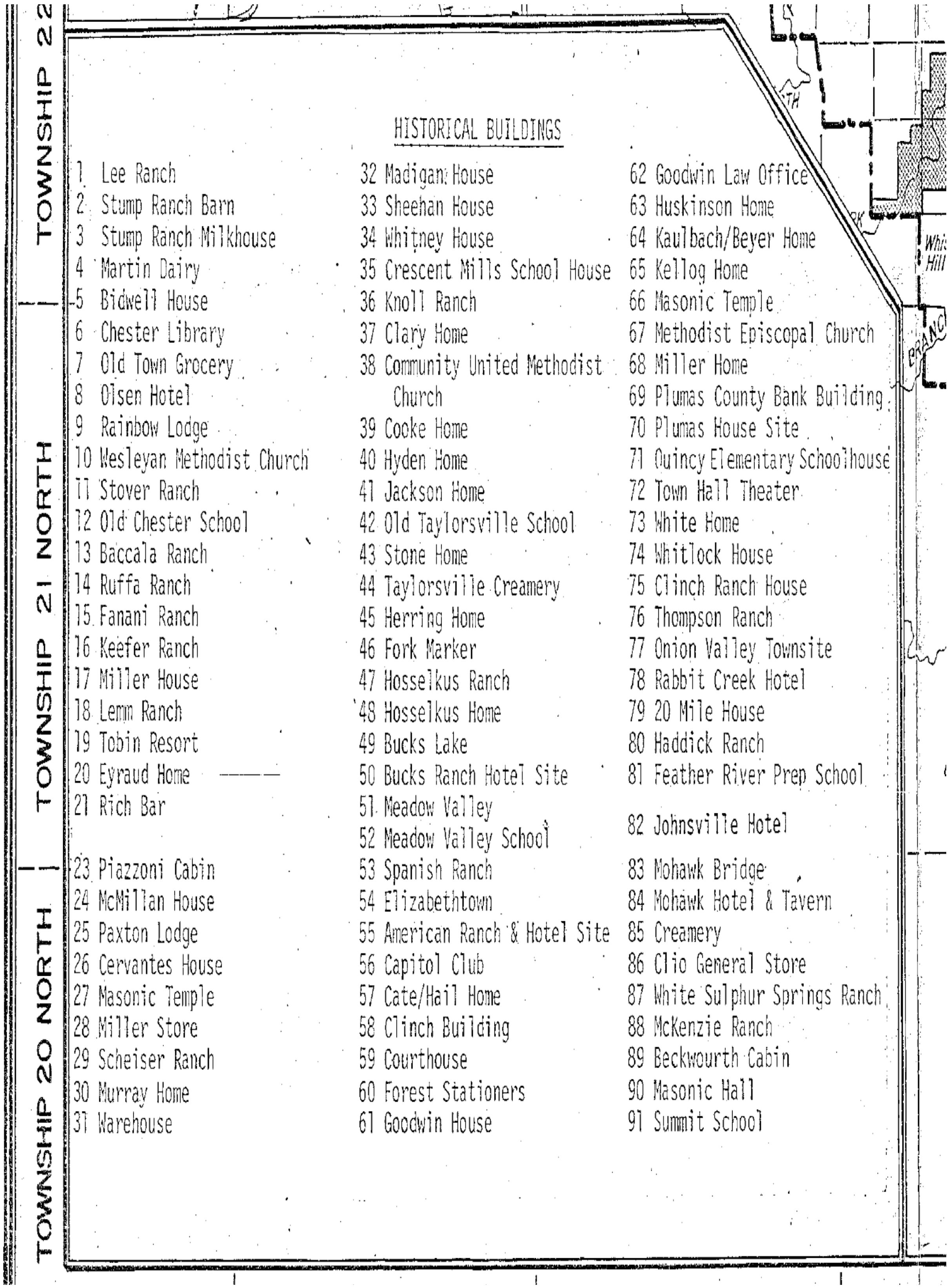
In addition, Plumas County maintains a map of historical areas. This can be seen on Figure 4-2. A close up of the list in the lower right corner of Figure 4-2 is shown on Figure 4-3.

Figure 4-2 Plumas County – Historical Areas



Source: Plumas County

Figure 4-3 Plumas County – Historical Buildings



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

Natural Resources

Natural resources are important to include in cost/benefit analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetland areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

The Plumas County 2035 General Plan Conservation Open Space Element noted that Plumas County is located in an area of varying topography and slopes, with elevations ranging from approximately 1,800 feet in the Feather River Canyon to 8,300 feet near the summit of Mount Ingalls. With a majority of land associated with agricultural activities, forestry, or other managed resource uses, approximately 94% of the total County area, the primary land use in Plumas County is considered an open space use. Additionally, many of these lands are managed for a combination of resource values, including but not limited to recreation, mining, timber production, and cultural and historic resources.

Plumas County is comprised of a range of habitat types many of which influence the water quality and quantity of the Feather River Watershed. These habitats, or vegetation communities, provide food, shelter, movement corridors, and breeding opportunities for a variety of wildlife species, many unique to the Feather River Watershed and the larger Sierra Mountain region. Conifer (including Mixed Conifer) habitat types comprise approximately 72% of land coverage in the County and are habitats commonly found at higher elevations. Plants characteristic of this habitat include a variety of pines and firs. As one gets farther away from the higher elevation Sierra regions of the County, the pines and firs give way to sagebrush, annual grasslands, and the freshwater emergent wetland habitat types more common at lower elevations.

Plumas County and the larger Feather River Watershed area contain a variety of aquatic habitats. Within the watershed, two types of fisheries are found: cold water river/stream species and warm water lake/ reservoir species. Historically, the watershed was habitat to Chinook salmon and steelhead. Special-status species are plants or animals that are legally protected under the State and/or federal Endangered Species Acts (ESAs) or other regulations, and species that are considered by the scientific community to be sufficiently rare to qualify for such listing. The California Department of Fish and Wildlife has documented habitat for over 90 different species of special concern in the County. These include several amphibians, such as the red-legged frog, bald eagles, osprey, several mammals, and plant/wildlife species associated with wetland habitats.

Special Status Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the Planning Area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

The California Natural Diversity Database, a program that inventories the status and locations of rare plants and animals in California, was queried to create an inventory of special status species in Plumas County. A summary list of these species is found below in Table 4-12. Appendix E list the name, federal status, state status, California Department of Fish and Wildlife status, and the California Rare Plant rank of species in Plumas County.

Table 4-12 Plumas County Planning Area – Summary of Special Status Species

Type	Number
Animals - Amphibians	6
Animals - Birds	30
Animals - Fish	3
Animals - Insects	9
Animals - Mammals	21
Animals – Mollusks	5
Animals – Reptiles	1
Community – Terrestrial	5
Plants - Bryophytes	6
Plants - Lichens	1
Plants – Vascular	137

Source: California Natural Diversity Database

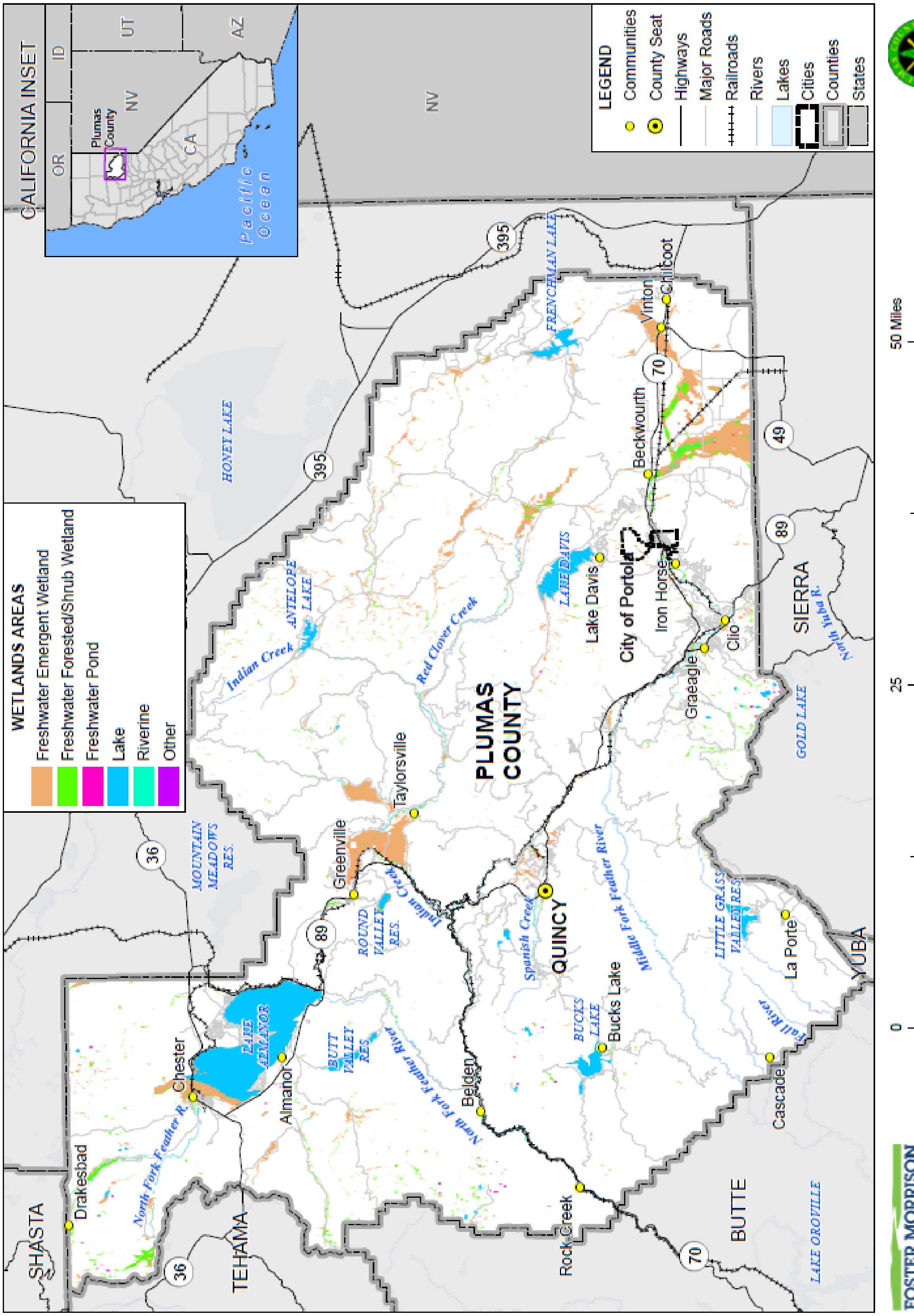
Wetlands

Wetlands are habitats in which soils are intermittently or permanently saturated or inundated. Wetland habitats vary from rivers to seasonal ponding of alkaline flats and include swamps, bogs, marshes, vernal pools, and riparian woodlands. Wetlands are considered to be waters of the United States and are subject to the jurisdiction of the U.S. Army Corps of Engineers as well as the California Department of Fish and Wildlife. Where the waters provide habitat for federally endangered species, the U.S. Fish and Wildlife Service (USFWS) may also have authority.

Wetlands are a valuable natural resource for communities providing beneficial impact to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands provide drought relief in water-scarce areas where the relationship between water storage and streamflow regulation is vital, and reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water.

The US Fish and Wildlife Service has mapped wetlands areas throughout the United States. Figure 4-4 shows the wetlands areas in the County. These areas are detailed in Table 4-13 by wetland type.

Figure 4-4 Plumas County – Wetlands Areas



Data Source: U.S. Fish and Wildlife Service National Wetlands Inventory 10/2017, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Table 4-13 Plumas County Planning Area – Wetlands Areas by Area Type

Wetlands Area Type	Wetlands Count	Wetlands Area (in Acres)
Freshwater Emergent Wetland	3,536	45,904
Freshwater Forested/Shrub Wetland	3,753	11,686
Freshwater Pond	537	730
Lake	116	37,796
Riverine	480	2,959
Other	32	25
Grand Total	**8,454**	**99,098**

Source: US Fish and Wildlife Service

Natural and Beneficial Functions

Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flow. Wetlands perform a variety of ecosystem functions including food web support, habitat for insects and other invertebrates, fish and wildlife habitat, filtering of waterborne and dry-deposited anthropogenic pollutants, carbon storage, water flow regulation (e.g., flood abatement), groundwater recharge, and other human and economic benefits.

Wetlands, and other riparian and sensitive areas, provide habitat for insects and other invertebrates that are critical food sources to a variety of wildlife species, particularly birds. There are species that depend on these areas during all parts of their lifecycle for food, overwintering, and reproductive habitat. Other species use wetlands and riparian areas for one or two specific functions or parts of the lifecycle, most commonly for food resources. In addition, these areas produce substantial plant growth that serves as a food source to herbivores (wild and domesticated) and a secondary food source to carnivores.

Wetlands slow the flow of water through the vegetation and soil, and pollutants are often held in the soil. In addition, because the water is slowed, sediments tend to fall out, thus improving water quality and reducing turbidity downstream.

These natural floodplain functions associated with the natural or relatively undisturbed floodplain that moderates flooding, such as wetland areas, are critical for maintaining water quality, recharging groundwater, reducing erosion, redistributing sand and sediment, and providing fish and wildlife habitat. Preserving and protecting these areas and associated functions are a vital component of sound floodplain management practices for the Plumas County Planning Area.

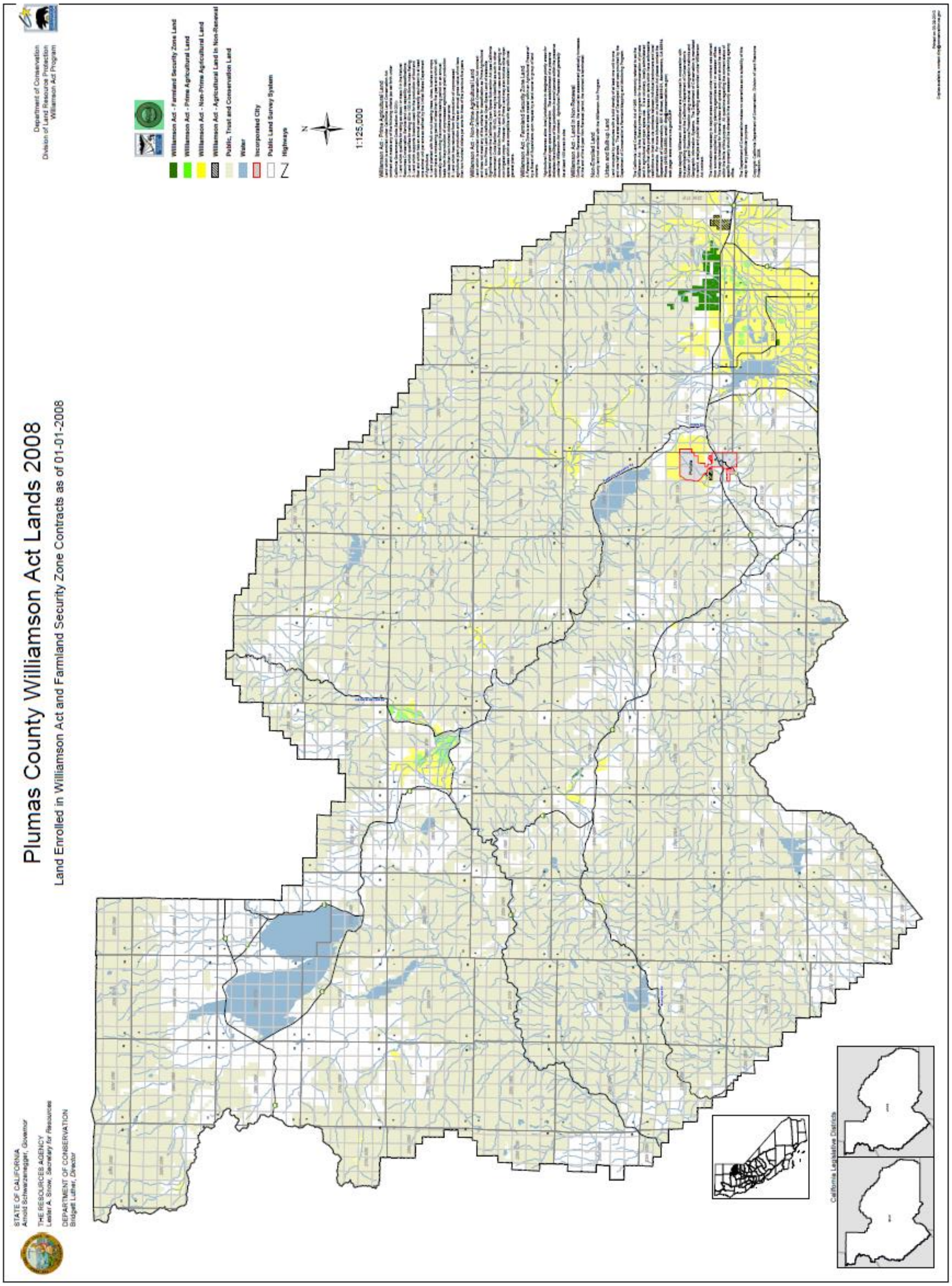
Farmlands

Farmlands are important considerations in rural counties in California.

Williamson Act

The Williamson Act, also known as the California Land Conservation Act of 1965, enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. When the County enters into a contract with the landowners under the Williamson Act, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least ten years and the County agrees to tax the land at a rate based on the agricultural production of the land rather than its real estate market value. This affects the County's overall values for assessed taxable lands. Plumas County has approximately 72,000 acres under Williamson Act contracts and 4,500 acres under the Farmland Security Zone. Of the qualifying acreage in Agricultural Preserve zoning, approximately 78% is under contract. Plumas County is not mapped as part of the California Department of Conservation's Farmland Mapping and Monitoring Program, with the exception of the Sierra Valley. These are shown on Figure 4-5. The County is not currently entertaining contracts due to the loss of subvention funding from the State.

Figure 4-5 Plumas County – Williamson Act Lands



Source: Plumas County

4.2.4. Growth and Development Trends

As part of the planning process, the HMPC looked at changes in growth and development, both past and future, and examined these changes in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability over time. Information from the Plumas County General Plan Housing Element, the California Department of Finance, and the US Census Bureau form the basis of this discussion.

Current Status and Past Populations

The estimated population of Plumas County (both incorporated communities and the unincorporated County) for January 1, 2019 was 19,979 (of which 17,803 were in the unincorporated County), representing a two-fold increase from 11,548 people in 1940. Table 4-14 illustrates the pace of population growth in Plumas County dating back to 1940. Growth in the County occurred in the 1970s, with other decades seeing small growth and small losses.

Table 4-14 Plumas County Planning Area - Population Growth 1940-2019

Year	Population	Percent Increase
1940	11,548	–
1950	13,519	17.1%
1960	11,620	-14.0%
1970	11,707	0.7%
1980	17,340	48.1%
1990	19,739	13.8%
2000	20,824	5.5%
2010	20,007	-3.9%
2019	19,979	-0.1%

Sources: 2014-2019 Plumas County Housing Element Background Report, California Department of Finance, US Census Bureau

Special Populations and Disadvantaged Communities

There are certain categories of households in Plumas County that, because of their physical or economic condition, require particular housing, space, or support services. Special needs households include the elderly, persons with mobility and/or self-care limitations, large families, families with female heads of household, farmworkers, homeless or families with insecure housing that includes persons in need of emergency shelter, and student resident housing. Some of these increase the risk of hazards. These are discussed below.

- **Senior Households** – many elderly people have physical disabilities and dependence needs that limit their mobility and increase their need for accessible health care and transportation. It is not uncommon for the elderly to have higher poverty rates even though Social Security and other retirement benefits provide a guaranteed minimum income. As of 2017, the American Community Survey estimated there were 4,364 seniors age 65 years and over, living in unincorporated Plumas County, which represented over one-quarter of the total unincorporated County population, and approximately 6.8 percent of those 65 and older were below the poverty rate.

- **Persons with Disabilities** – As defined by the California Government Code, disabilities include physical and mental disabilities. A "mental disability" involves any mental or psychological disorder or condition, such as mental retardation, organic brain syndrome, emotional or mental illness, or specific learning disabilities that limit a major life activity. A "physical disability" includes any physiological disease, disorder, condition, cosmetic disfigurement, or anatomical loss of body functions. Physical disabilities include those that are neurological, immunological, or musculoskeletal in nature as well as those that involve the respiratory, cardiovascular, reproductive, genitourinary, hemic and lymphatic, or digestive systems and those involving the special sense organs, speech organs, skin, or endocrine system. Residents of Plumas County have a relatively high rate of disability. About 17 percent of the total population (5 years old or older) has some type of disability, and more than half of those are below the age of 65.
- **Farmworkers** – Migrant farmworkers, many of whom speak Spanish, work seasonally in Plumas County. Language barriers can make announcements of hazards and evacuations more difficult.
- **Homeless** – In 2019, the NorCal Continuum of Care Point-in-Time count identified 1,249 homeless people in Del Norte, Lassen Modoc, Plumas, Shasta, Sierra, and Siskiyou counties, which is a slight decrease of 23 from the 2016 Point-in-Time count, which identified 1,272 homeless. The vast majority (806 people) of the homeless counted in 2019 were unsheltered while only 443 people had access to shelter. In Plumas County specifically, the Point-in-Time count identified 53 homeless people, or 4 percent of the homeless population counted in the seven-county region—11 had been experiencing chronic homelessness, and 24 were female, though only 5 of the women were unsheltered. The Plumas Crisis Intervention & Resource Center (PCIRC) offers homeless prevention and rapid re-housing programs, based on an evidence-based Housing First Model, utilizing available annual funding to those experiencing homeless in Plumas County. Program examples include emergency motel sheltering, mental health transitional housing, Pathways Home (Housing First Model for transitioning offenders), emergency and transitional housing for youth, Ohana House in Quincy (emergency and transitional housing for adults age 18+), and Plumas House (transitional sober living environment for men). The Sierra Safe Program in Loyalton (Sierra County) provides emergency shelter through the women's shelter under correct criteria and/or motels. Plumas County provides emergency shelter service through use of County buildings and facilities. During the Camp Fire disaster in Paradise, Butte County, Plumas County provided temporary emergency shelters in the Chester Memorial Hall, the Quincy Veteran's Hall, and the Plumas-Sierra County Fairgrounds in Quincy. The 2020 point-in-time homeless count in Plumas County conducted in January identified 107 homeless individuals. The survey is done by Plumas Crisis Intervention and Resource Center

The HMPC noted that the County has two homeless day shelters (Quincy and Portola) and a group home (Quincy) that were recently funded for backup generators. The facilities are used for sheltering during times of cold, as these facilities are heated, but there is no air conditioning at these facilities. These are facilities operated by PCIRC, a non-profit.

CA DWR Special Population and Disadvantaged Community Mapping

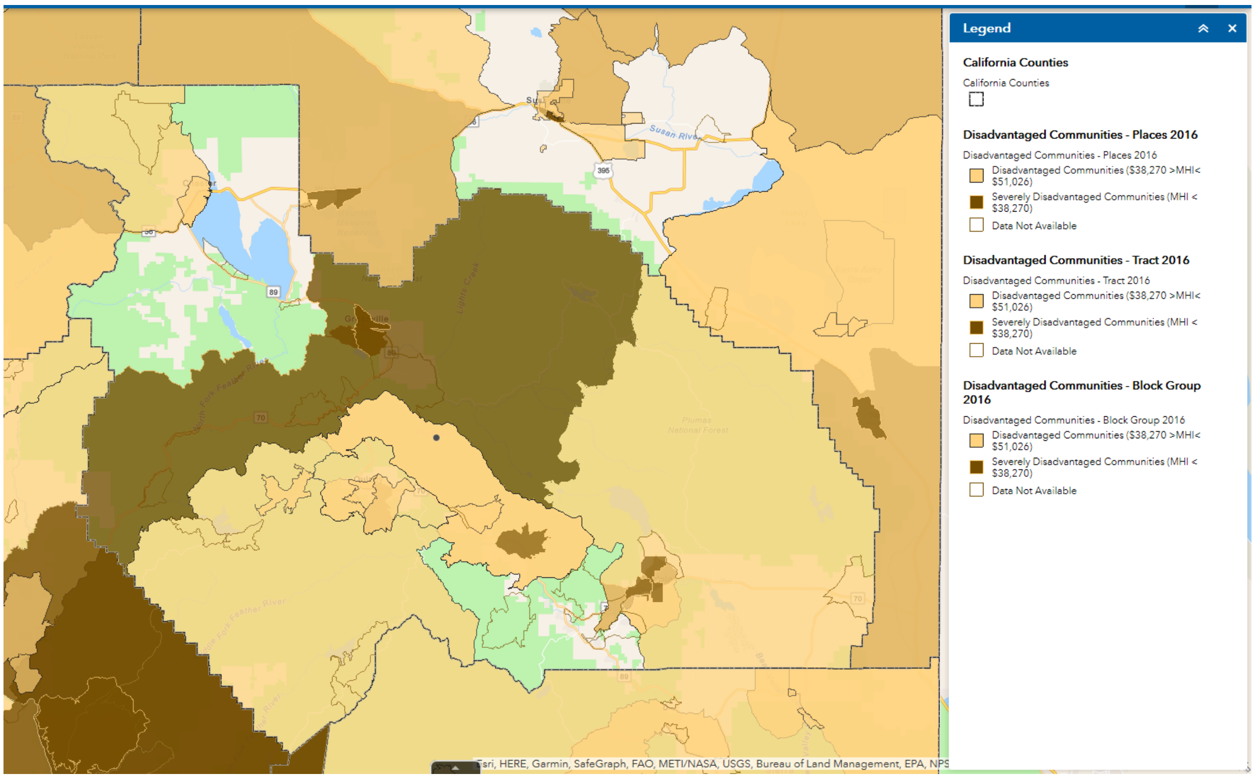
CA DWR has developed a web-based application to assist local agencies and other interested parties in evaluating disadvantaged community (DAC) status throughout the State, using the definition provided by Proposition 84 Integrated Regional Water Management (IRWM) Guidelines (2015). The DAC Mapping

Tool is an interactive map application that allows users to overlay the following three US Census geographies as separate data layers:

- Census Place
- Census Tract
- Census Block Group

Only those census geographies that meet the DAC definition are shown on the map (i.e., only those with an annual median household income (MHI) that is less than 80 percent of the Statewide annual MHI (PRC Section 75005(g)). In addition, those census geographies having an annual MHI that is less than 60 percent of the Statewide annual MHI are shown as "Severely Disadvantaged Communities" (SDAC). The DAC map for Plumas County is shown in Figure 4-6.

Figure 4-6 Plumas County – Disadvantaged Communities



Source: CA DWR

Climate Change and Health Profile Report – Plumas County

The 2017 Climate Change and Health Profile Report for Plumas County was done by the California Department of Public Health and the University of California-Davis. The report noted that there are special populations in the County.

> ***In 2010, the age-adjusted death rate in Plumas County was higher than the state average. Pooled with several nearby counties (Nevada and Sierra), nearly 41% of adults (44,447) reported one or more chronic health conditions like heart***

disease, diabetes, asthma, severe mental stress, or high blood pressure in 2012. In 2012, 14% of adults reported having been diagnosed with asthma (pooled for Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, and Trinity Counties). In 2012 approximately 18% of adults were obese (pooled for Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, and Trinity Counties; statewide average was 25%). In 2012, nearly 74% of residents aged 5 years and older had a mental or physical disability (statewide average was 10%).

In 2005-2010, there was an annual average of 5 heat-related emergency room visits and an age-adjusted rate of 22 emergency room visits per 100,000 persons (the statewide age-adjusted rate was 10 emergency room visits per 100,000 persons).

Among climate-vulnerable groups in 2010 were 883 children under the age of 5 years and 4,154 adults aged 65 years and older. In 2010, there were approximately 277 people living in nursing homes, dormitories, and other group quarters where institutional authorities would need to provide transportation in the event of emergencies.

Social and demographic factors and inequities affect individual and community vulnerability to the health impacts of climate change. In 2010, 1% of households (101) did not have a household member 14 years or older who spoke English proficiently (called linguistically isolated; statewide average was 10%). In 2010, approximately 8% of adults aged 25 years and older had less than a high school education (statewide average was 19%).

In 2010, 12% of the population had incomes below the poverty level (the statewide average was 14%). Nineteen percent of households paid 50% or more of their annual income on rent or a home mortgage (statewide average was 22%). In 2012, approximately 46% (pooled for Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, and Trinity Counties) of low-income residents reported they did not have reliable access to a sufficient amount of affordable, nutritious food (called food insecurity; statewide average was 42%).

In 2010, Plumas County had approximately 1,236 outdoor workers whose occupation increased their risk of heat illness. In 2010, roughly 4% of households did not own a vehicle that could be used for evacuation (statewide average was 8%).

In 2009, approximately 92% of households were estimated to lack air conditioning, a strategy to counter adverse effects of heat (statewide average was 36%). In 2011, tree canopy, which provides shade and other environmental

benefits, was present on 30% of the county's land area (statewide average was 8%).

Development since 2014 Plan

The Plumas County Building Department tracks total building permits issued since 2014 for unincorporated Plumas County. A summary of this development is shown in Table 4-15. Development by known flood, fire, and other hazard areas is shown in Table 4-16. All development in the identified hazard areas, including the 1% annual chance floodplains and high wildfire risk areas, were completed in accordance with all current and applicable development codes and standards and should be adequately protected. Thus, with the exception of more people living in the area potentially exposed to natural hazards, this growth should not cause a significant change in vulnerability of the County to identified priority hazards.

Table 4-15 Plumas County Development 2014-2019 Summary

Property Use	2015	2016	2017	2018	2019
Residential	43	64	38	57	52
Commercial	5	0	2	2	6
Industrial	0	2	0	3	1
Total	**48**	**66**	**40**	**62**	**59**

Source: Plumas County Building Department and Planning Department, April 2020

Table 4-16 Plumas County Development in Hazard Zones since 2014

Property Use	1% Annual Chance Flood	Wildfire Risk Area	Other
Residential	5	254	0
Commercial	1	15	0
Industrial	0	6	0
Other	0	0	0
Total	**6**	**275**	**0**

Source: Plumas County Building Department and Planning Department

Future Development

Future development in the County is discussed in the sections below.

Population Projections

As indicated in the previous section, Plumas County had been steadily growing from 1940 to 2010, with a recent slowing in population growth. Long term forecasts by the California Department of Finance project population growth in Plumas County continuing through the 2060. Table 4-17 shows the population projections for the County as a whole through 2060. Based on this data, population growth continues to gradually decline through 2060.

Table 4-17 Population Projections for Plumas County (incorporated and unincorporated), 2020-2060

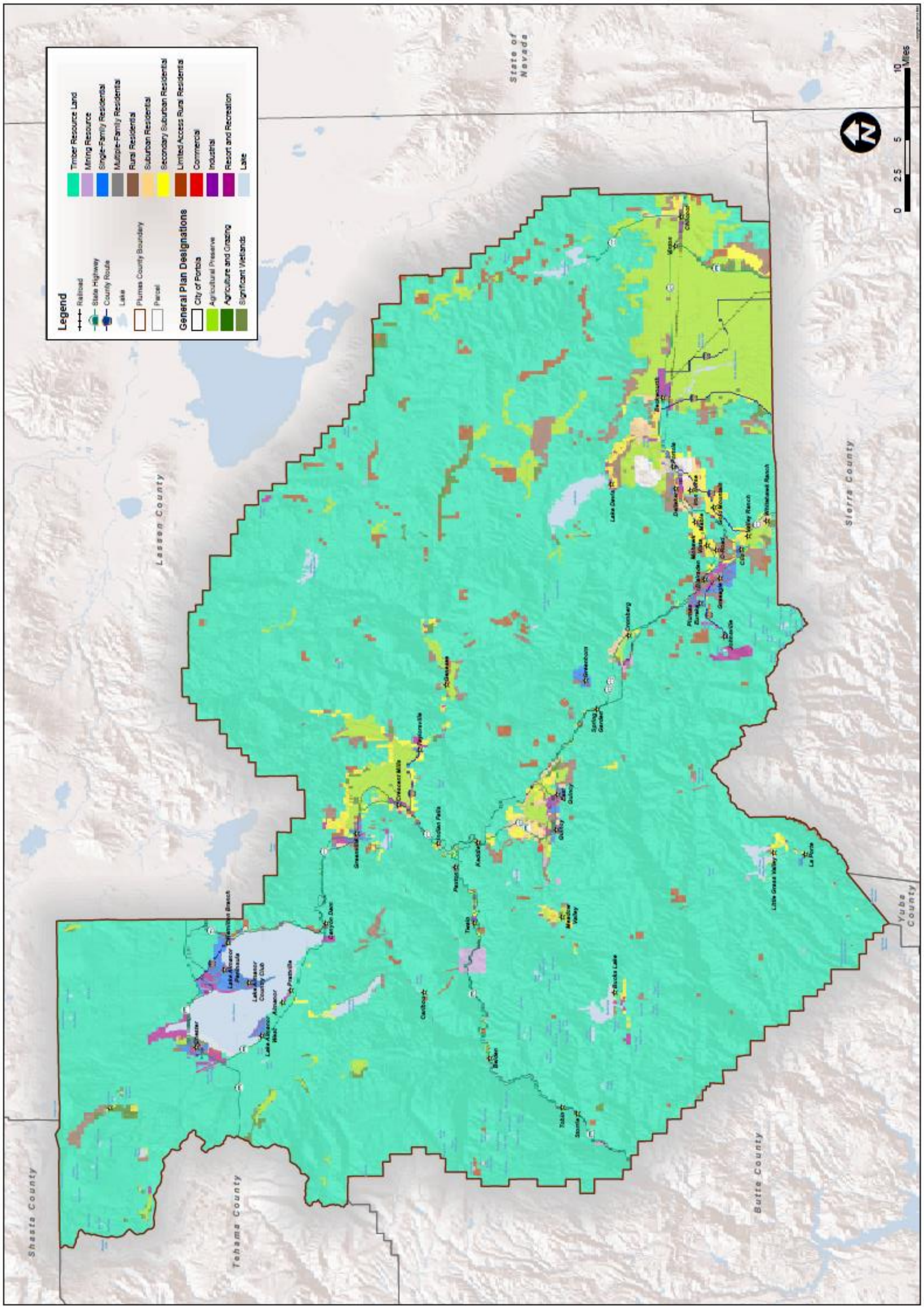
	2020	2030	2040	2050	2060
Plumas County	18,997	18,600	17,397	16,558	16,639

Source: 2019-2024 Plumas County Housing Element

Future Land Use

The future use of land in the County is fundamental to attaining the vision of a balanced, self-sustaining community. A land use pattern which balances growth between rural and urban areas, as well as providing a balance between housing, employment, natural resources, and services in the County is a key element in maintaining the quality of life and unique character of the County. Descriptions of allowed uses for each classification are detailed in the Plumas County 2035 General Plan Land Use Element. Figure 4-7 is sourced from this section.

Figure 4-7 Plumas County General Plan Land Use



Source: Plumas County 2016 General Plan Land Use Element

Future Development Area Analysis

The Plumas County Planning & Building Services noted that there are parcels being considered for future development in the County. These locations come from a variety of sources and make up the future development analysis areas:

- **3-R and 7-R** – The purpose of the Single-Family Residential Zones (2-R, 3-R, 7-R) is to provide for dwelling units in prime opportunity single-family residential areas with provisions for compatible uses.
- **AP –** The purpose of the Agricultural Preserve Zone (AP) is to provide land use regulations consistent with the intent of the Plumas County Williamson Act program for agricultural preserves.
- **C-2** – The purpose of the Periphery Commercial Zone (C-2) is to provide for major commercial uses near large population centers with provisions for adequate access and parking.
- **I-2** – The purpose of the Light Industrial Zone (I-2) is to provide for light industry where access is available to transportation routes, transportation facilities, and public service facilities and where surrounding land use and the environmental setting will permit most light industrial uses without major adverse impacts.
- **M-R** – The purpose of the Multiple-Family Residential Zone (M-R) is to provide for dwelling units in multiple-family residential areas with provisions for compatible uses.
- **R-10**– The purpose of the Rural Zone (R-10) is to provide for dwelling units at the ratio of ten (10) to twenty (20) acres per dwelling unit with provisions for compatible uses.
- **Rec-1** – The purpose of the Recreation Zones (Rec-P, Rec-1, Rec-3, Rec-10, Rec-20) is to provide for the development of prime recreation site with dwelling unit density compatible with the opportunity area in which the prime recreation site is located and to provide for multiple uses of prime recreation sites in a manner supportive of recreational uses.
- **S-3** – The purpose of the Secondary Suburban Zone (S-3) is to provide for dwelling units at the ratio of three (3) to ten (10) acres per dwelling unit with provisions for compatible uses.

Future Development GIS Analysis

The above areas were provided by Plumas County in mapped GIS format. Using GIS, the following methodology was used in determining parcel counts and values associated with future development in the Plumas County Planning Area. The February 2020 Plumas County Parcel/Assessor's data and data from the County planning department were used as the basis for the County's inventory of parcels and acres of future development areas. The Plumas County Planning Department provided a table containing the assessor parcel numbers (APNs) for the 1,075 parcels representing the different future development projects or areas. Using the GIS parcel spatial file and the APNs, the future development projects were mapped. These areas can be seen on Figure 4-8 and detailed in Table 4-18.

Figure 4-8 Plumas County Planning Area – Future Development Areas

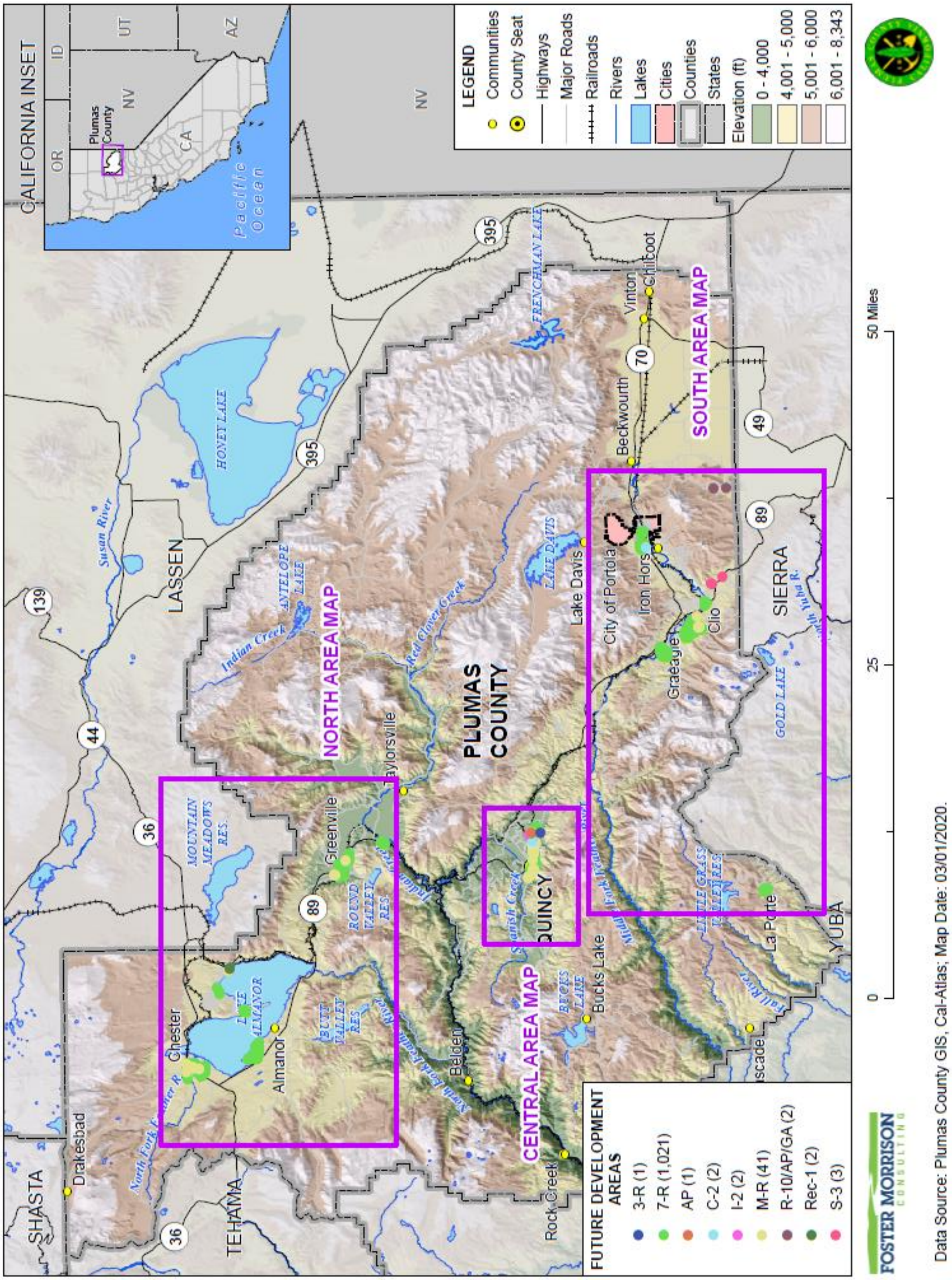


Table 4-18 Unincorporated Plumas County – Future Development Area Parcel and Acre Counts

Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
3-R	1		9.010
7-R	1021	391	504.007
AP	1		4.010
C-2	2		6.730
I-2	2	1	15.930
M-R	41	8	114.572
R-10	2	1	1,108.880
Rec-1	2	1	13.840
S-3	3	1	56.270
Grand Total	**1,075**	**403**	**1,833.249**

Source: Plumas County GIS

In order to view these sites more clearly, the County was broken up into three regions – north, central, and south. Maps and analysis were created to show future development by region. This can be seen on Figure 4-9, Figure 4-10, and Figure 4-11, as well as in Table 4-19. The analysis in the hazard vulnerability discussions in Section 4.3 below will follow this three region format.

Figure 4-9 Plumas County North – Future Development Areas

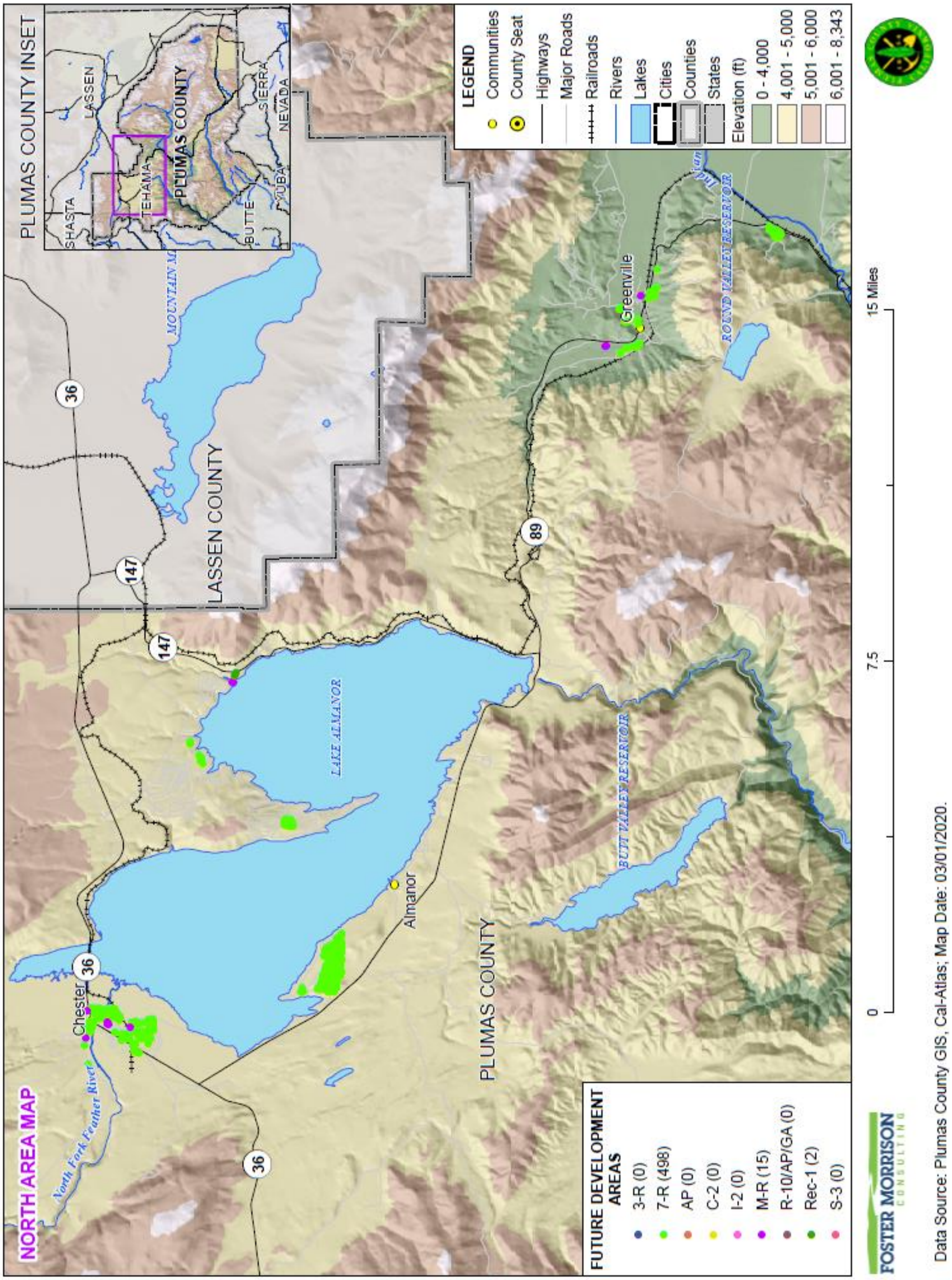


Figure 4-10 Central Plumas County – Future Development Areas

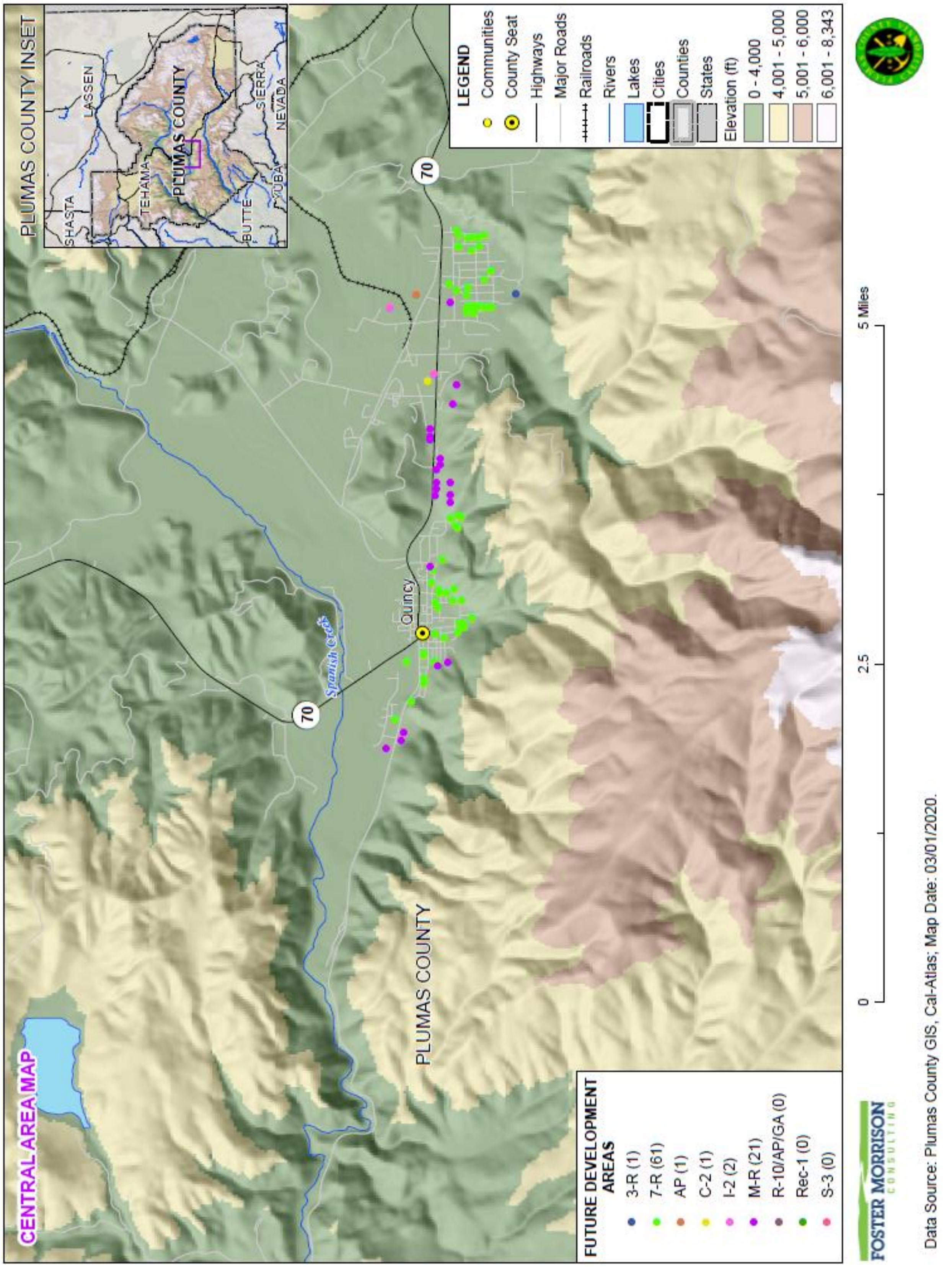


Figure 4-11 Plumas County South – Future Development Areas

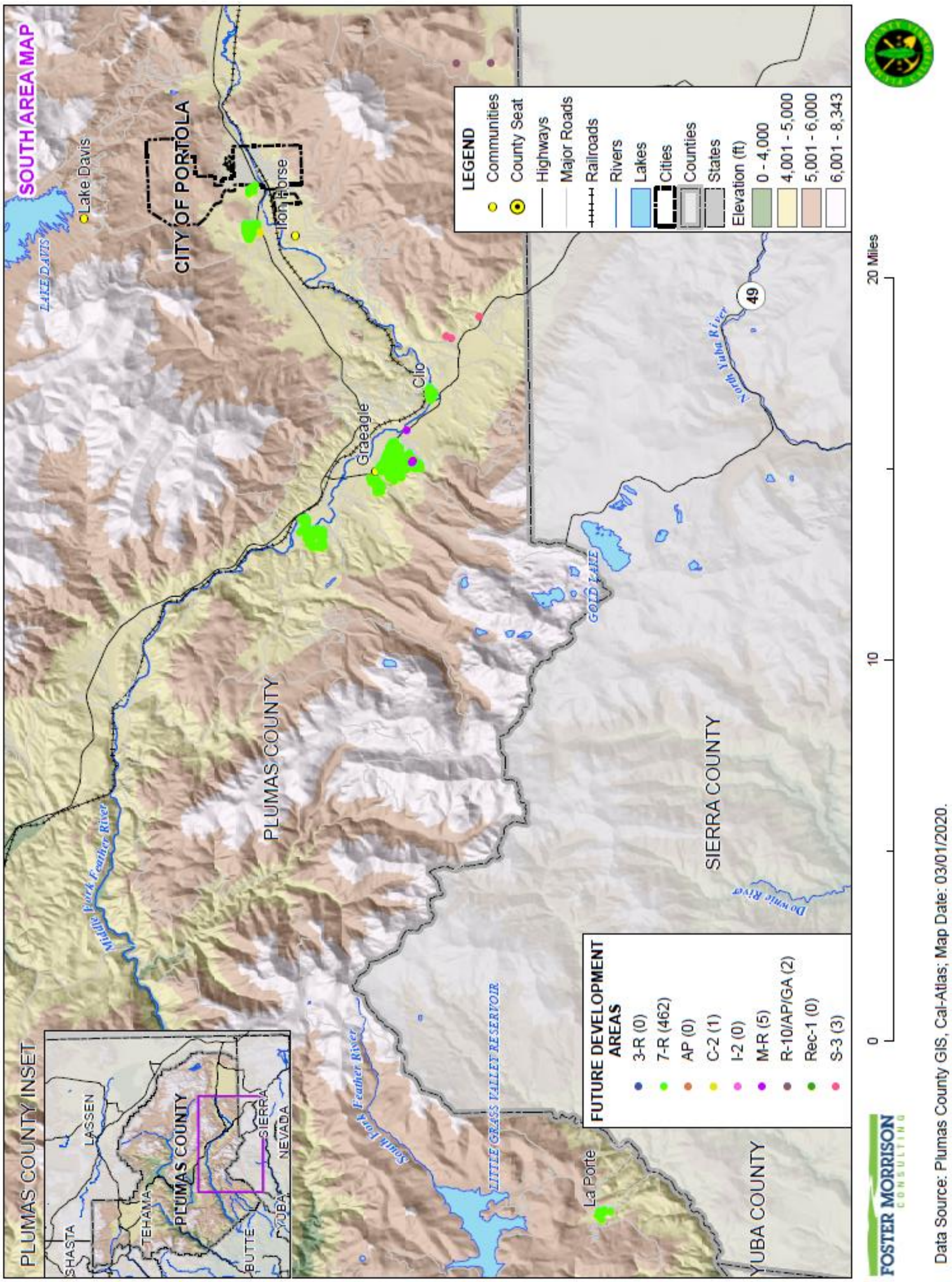


Table 4-19 Plumas County – Future Development in North, Central, and South Areas by Parcel Count and Acres

Future Development/Map Area	Total Parcel Count	Improved Parcel Count	Total Acres
North Area			
7-R	498	190	299.059
M-R	15	3	13.610
Rec-1	2	1	13.840
North Area Total	**515**	**194**	**326.509**
Central Area			
3-R	1		9.010
7-R	61	22	29.963
AP	1		4.010
C-2	1		2.870
I-2	2	1	15.930
M-R	21	4	33.320
Central Area Total	**87**	**27**	**95.103**
South Area			
7-R	462	179	174.985
C-2	1		3.860
M-R	5	1	67.642
R-10	2	1	1,108.880
S-3	3	1	56.270
South Area Total	**473**	**182**	**1,411.637**
Grand Total	**1,075**	**403**	**1,833.249**

Source: Plumas County Planning and Building Services

4.3 Hazard Profiles and Vulnerability Assessment

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

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

The hazards identified in Section 4.1 Hazard Identification, are profiled individually in this section. These hazard profiles set the stage for the Vulnerability Assessment, where the vulnerability is quantified for each of the hazards.

Hazard Profiles

Each hazard is profiled in the following format:

- **Hazard/Problem Description**—This section gives a description of the hazard and associated issues followed by details on the hazard specific to the Plumas County Planning Area. Where known, this includes information on the hazard location, extent, seasonal patterns, speed of onset/duration, and magnitude and/or any secondary effects.
- **Past Occurrences**—This section contains information on historical hazard events, including location, impacts, and damages where known. Hazard research, historical incident worksheets and other input from the HMPC were used to capture information on past occurrences.
- **Frequency/Likelihood of Future Occurrence**—The frequency of past events is used in this section to gauge the likelihood of future occurrences. Where possible, frequency was calculated based on existing data. It was determined by dividing the number of events observed by the number of years on record and multiplying by 100. This gives the percent chance of the event happening in any given year (e.g., three droughts over a 30-year period equates to a 10 percent chance of experiencing a drought in any given year). The likelihood of future occurrences is categorized into one of the following classifications:
  - ✓ **Highly Likely**—Near 100 percent chance of occurrence in next year or happens every year

- ✓ **Likely**—Between 10 and 100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less
- ✓ **Occasional**—Between 1 and 10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years
- ✓ **Unlikely**—Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

- **Climate Change**—This section contains the effects of climate change (if applicable). The possible ramifications of climate change on each hazard are discussed.

Vulnerability Assessment

With Plumas County's hazards identified and profiled, a vulnerability assessment was conducted to describe the vulnerability and impact that each hazard would have on the County. The vulnerability assessment quantifies, to the extent feasible using best available data, assets at risk to identified hazards and estimates potential losses. This section focuses on the vulnerabilities of the Plumas County Planning Areas (i.e., unincorporated Plumas County) as a whole.

An estimate of the vulnerability of the Plumas County Planning Area to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Other information can be collected in regard to the hazard area, such as the location of critical community facilities, historic structures, and valued natural resources. Together, this information conveys the impact, or vulnerability, of that area to that hazard.

The vulnerability assessment identified five hazards in the Planning Area for which specific geographical hazard areas have been defined and for which sufficient data exists to support a quantifiable vulnerability analysis. These five hazards are dam failure, earthquake, flood, landslide, and wildfire. The vulnerability of the flood (1%/0.2% annual chance), landslide, and wildfire hazards were analyzed using GIS and County parcel and assessor data.

FEMA's loss estimation software, HAZUS-MH, was used to analyze the County's vulnerability to earthquakes.

For dam failure, flood (1%/0.2% annual chance), landslide, and wildfire, the following elements were inventoried for each community, to the extent possible, to quantify vulnerability in identified hazard areas:

- General vulnerability and hazard-related impacts, including impacts to life, safety, and health
- Values at risk (i.e., types, numbers, and value of land and improvements)
- Population at risk
- Critical facilities at risk
- Overall community impact
- Future development/development trends within the identified hazard area

The vulnerability and potential impacts from priority hazards that do not have specific mapped areas nor the data to support additional vulnerability analysis are discussed in more general terms. These include:

- Avalanche
- Climate Change
- Drought and Water Shortage
- Flood: Localized/Stormwater
- Levee Failure
- Pandemic
- Tree Mortality
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rain and Storms
- Severe Weather: High Winds and Tornadoes
- Severe Weather: Winter Storm and Freeze
- Volcano

The following sections provide the hazard profile and vulnerability assessments for each of the hazards identified in Section 4.1 Hazard Identification. The severe weather hazards are discussed first to paint the picture of the County's climate and hazard environment which often lead to other hazards such as flood and wildfire. The remainder of the hazards follow alphabetically.

Data Sources

In general, information provided by the County and HMPC members is integrated into this section with information from other data sources. The data sources listed below formed the basis for this Hazard Profiles and Vulnerability section of this Plan. Where data and information from these studies, plans, reports, and other data sources were used, the source is referenced as appropriate throughout this risk assessment.

- 2018 California State Hazard Mitigation Plan
- ArkStorm at Tahoe - Stakeholder Perspectives on Vulnerabilities and Preparedness for an Extreme Storm Event in the Greater Lake Tahoe, Reno and Carson City Region. 2014.
- Bureau of Land Management
- CA DWR Best Available Maps
- CAL FIRE GIS datasets

- Cal OES
- Cal-Adapt
- Cal-Adapt – Annual Average of Acres Burned
- Cal-Adapt – Extended Drought Scenarios
- Cal-Adapt – Number of Extreme Heat Days by Year
- Cal-Adapt – Precipitation: Decadal Averages Map
- California Adaptation Planning Guide
- California Climate Adaptation Strategy (CAS) – 2014
- California Department of Water Resources
- California Department of Water Resources (CA DWR) Division of Safety of Dams
- California Department of Water Resources Best Available Maps
- California Department of Water Resources Division of Safety of Dams
- California Division of Mines and Geology
- California Geological Survey
- California Office of Emergency Services – Dam Inundation Data
- California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources.
- Chapman, K., Gold, M.B., Boatwright, J., Sipe, J., Quitoriano, V., Dreger, D., and Hardebeck, J., 2016, Faulting, damage, and intensity in the Canyondam earthquake of May 23, 2013: U.S. Geological Survey Open-File Report 2016-1145, 49 p., http://dx.doi.org/10.3133/ofr20161145.
- Climate Change and Health Profile Report – Plumas County
- County staff
- Existing plans and studies
- Feather River Bulletin, Wednesday January 29, 1997
- FEMA
- FEMA: Building Performance Assessment: Oklahoma and Kansas Tornadoes
- FEMA's HAZUS-MH 4.2 GIS-based inventory data
- Fettig, C.J. 2012. Forest health and bark beetles. In: North, M.P., ed. Managing Sierra Nevada forests. Gen. Tech. Rep. PSW-GTR-237. Albany, CA : U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 13–22
- Integrated Regional Water Management Plan
- IPCC Fifth Assessment Synthesis Report (2014)
- KCRA News Report
- Kenward, Alyson PhD, Adams-Smith, Dennis, and Raja, Urooj. Wildfires and Air Pollution – The Hidden Health Hazards of Climate Change. Climate Central. 2013.
- Levees in History: The Levee Challenge. Dr. Gerald E. Galloway, Jr., P.E., Ph.D., Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.
- Liu, J.C., Mickley, L.J., Sulprizio, M.P. et al. Climatic Change. 138: 655. doi:10.1007/s10584-016-1762-6. 2016.
- Multi-Hazard Identification and Risk Assessment, FEMA 1997
- National Drought Mitigation Center
- National Drought Mitigation Center – Drought Impact Reporter
- National Integrated Drought Information System
- National Levee Database
- National Oceanic and Atmospheric Administration's National Climatic Data Center
- National Park Service

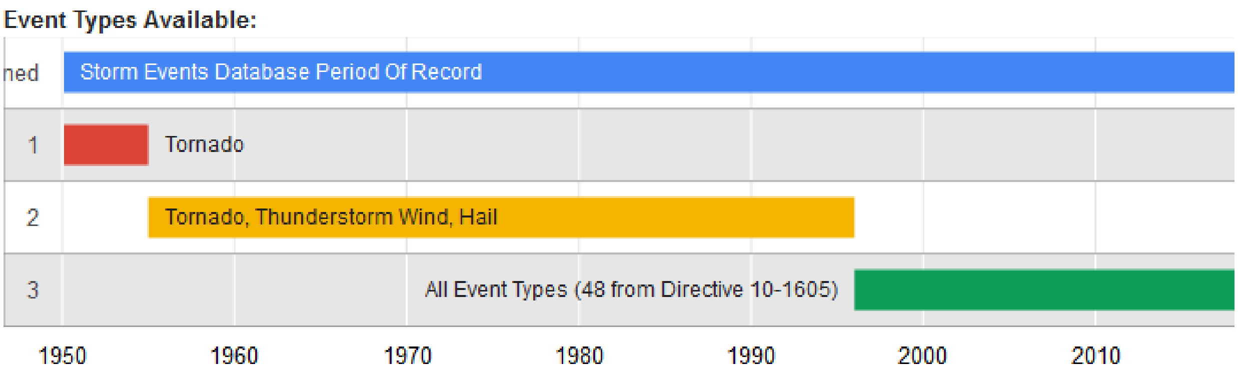
- National Park Service – Historic American Buildings Survey and Historic American Engineering Record
- National Weather Service
- Natural Resource and Conservation Service
- NOAA Storm Prediction Center
- Pacific Gas and Electric Company
- Personal interviews with planning team members and staff from the County
- Plumas County 2014 Local Hazard Mitigation Plan
- Plumas County 2019-2024 Housing Element
- Plumas County 2019 Community Wildfire Protection Plan
- Plumas County 2035 General Plan Conservation Element
- Plumas County 2035 General Plan Land Use Element
- Plumas County 2035 General Plan Public Health & Safety Element
- Plumas County 2035 General Plan Water Resources Element
- Plumas County Agriculture Commissioner
- Plumas County Assessor's Office
- Plumas County Building Department
- Plumas County Digital Flood Insurance Rate Map March 2, 2005
- Plumas County Flood Insurance Study March 2, 2005
- Plumas County GIS
- Plumas County Novel Coronavirus website
- Plumas County Road Department
- Plumas Eureka Community Services District
- Proceedings of the National Academy of Sciences
- Public Health Alliance of Southern California
- Public Policy Institute of California
- Science Magazine
- Sierra Avalanche Center
- Sierra Nevada Photos website
- Statewide GIS datasets from other agencies such as Cal OES, FEMA, USGS, CGS, Cal Atlas, and others
- Stephens, S.L., Collins, B.M., Fettig, C.J., Finney, M.A., Hoffman, C.M., Knapp, E.E., North, M.P., Safford, H. and Wayman, R.B., 2018. Drought, tree mortality, and wildfire in forests adapted to frequent fire. BioScience, 68(2), pp.77-88.
- The Storm of '86 by Robert Moon, Feather River Publishing, Quincy, CA 1986
- U.S. Census Bureau 2010 Household Population Estimates
- U.S. Fish and Wildlife Service
- U.S. Fish and Wildlife Service's National Wetlands Inventory maps
- U.S. Forest Service GIS datasets
- U.S. Geological Survey
- U.S. Geological Survey Landslide Maps
- U.S. Occupational Safety and Health Administration
- United States Geological Survey Open File Report 2015-3009
- University of California
- US Army Corps of Engineers
- US Department of Agriculture

- US Farm Service Agency
- US Fish and Wildlife Service
- US Geological Survey: Volcanic Ash: Effect & Mitigation Strategies
- USDA Forest Service Region 5
- USGS Bulletin 1847
- USGS – A Sight "Fearfully Grans" – Eruptions of Lassen Peak California, 1914 to 1917
- USGS National Earthquake Information Center
- USGS Publication 2014-3120
- Vaisala National Lightning Detection Network
- Western Regional Climate Center
- World Health Organization
- Written descriptions of inventory and risks provided by Plumas County
- Yubanet.com

4.3.1. Severe Weather: General

Severe weather is generally any destructive weather event, but usually occurs throughout the Plumas County Planning Area as localized storms that bring heavy rains and floods; severe cold, snow, and winter weather; extreme heat, and strong winds. The NOAA's NCDC has been tracking severe weather since 1950. Their Storm Events Database contains data on the following events shown on Figure 4-12.

Figure 4-12 NCDC Storm Events Database Period of Record



Event Types Available:
Add more info about event types here. Link to collections page/tab when referencing data collection source.

1. Tornado: From 1950 through 1954, only tornado events were recorded.

2. Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.

3. All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605.

Source: NCDC

The NCDC's Storm Events Database contains data on the following: all weather events from 1993 to current (except from 6/1993-7/1993); and additional data from the Storm Prediction Center, which includes tornadoes (1950-1992), thunderstorm winds (1955-1992), and hail (1955-1992). This database contains 632 severe weather events that occurred in Plumas County between January 1, 1950, and September 30, 2019. Table 4-20 summarizes these events.

*Table 4-20 NCDC Severe Weather Events for Plumas County 1950-9/30/2019**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Blizzard	1	0	0	0	0	$0	$0
Cold/Wind Chill	3	0	0	0	0	$0	$0
Debris Flows	5	0	0	0	0	$2,000	$0
Dense Fog	9	0	0	0	0	$1,000	$0
Dense Smoke	1	0	0	0	0	$0	$0
Drought	2	0	0	0	0	$50,000	$0
Flash Flood	3	0	0	0	0	$0	$0
Flood	10	0	0	1	0	$3,140,000	$0
Freezing Fog	1	0	0	0	0	$0	$0
Hail	19	0	0	0	0	$100	$5,000
Heavy Rain	47	0	0	0	0	$1,000	$0
Heavy Snow	280	1	0	0	0	$220,000	$0
High Wind	88	0	0	1	0	$2,245,500	$0
Ice Storm	1	0	0	0	0	$0	$0
Lightning	1	0	0	0	0	$0	$0
Strong Wind	2	0	0	0	0	$25,100	$0
Thunderstorm Wind	2	0	0	0	0	$675,000	$0
Wildfire	9	0	0	0	0	$22,775,000	$0
Winter Storm	117	0	0	0	0	$150,000	$0
Winter Weather	31	0	0	0	0	$0	$0
Total	**632**	**1**	**0**	**2**	**0**	**$29,284,700**	**$0**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Plumas County

The NCDC table above summarize severe weather events that occurred in Plumas County. Only a few of the events actually resulted in state and federal disaster declarations. It is further interesting to note that different data sources capture different events during the same time period, and often display different information specific to the same events. The value in this data is that it provides data depicting the County's "big picture" hazard environment.

As previously mentioned, many of Plumas County's state and federal disaster declarations have been a result of severe weather. For this plan, severe weather is discussed in the following subsections:

- Extreme Heat
- Heavy Rains and Storms
- High Winds and Tornadoes
- Winter Storm and Freeze

It was noted by the HMPC that severe weather has taken out all the communications towers, including 911 systems, during past storm events.

For purposes of this Plan, the Quincy Co-op weather station (elevation: 3,410 feet above mean sea level (msl)) was used to illustrate and inform the severe weather hazards. This station was chosen due to its length of record (1895 to 2016).

4.3.2. Severe Weather: Extreme Heat

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died. Extreme heat conditions can also compound the effects of other hazards, such as drought and wildfire and can contribute to increases in tree mortality. Extreme heat can also affect agriculture in Plumas County. During times of high heat, low humidity, and winds, PG&E can issue a Public Safety Power Shutdown (PSPS) for the County.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds a level at which the body can remove it, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise, and heat-related illness may develop. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions.

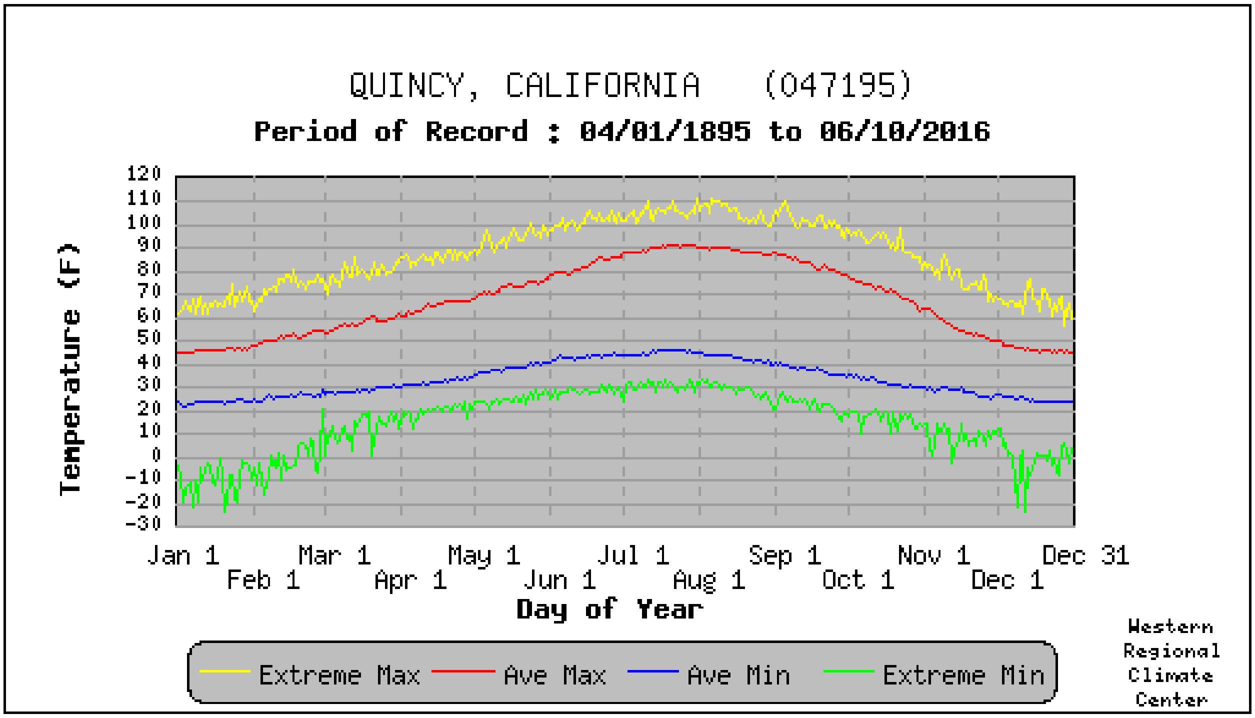
Location and Extent

Extreme heat events occur on a regional basis. Extreme heat can occur in any location of the County, though it is more prevalent in the lower elevations of the County. All portions of the County are at some risk to extreme heat. Extreme heat occurs throughout the Planning Area primarily during the summer months. The Western Regional Climate Center (WRCC) maintains data on weather normal and extremes in the western United States. Information from the representative weather station introduced in Section is summarized below.

Quincy Weather Station, Period of Record 1895 to 2016 (Elevation of 3,410 above msl)

According to the WRCC, in Plumas County, monthly average maximum temperatures in the warmest months (May through October) range from the low-70s to the upper-80s. The highest recorded daily extreme was 110°F on both August 9, 1981 and September 5, 1988. In a typical year, maximum temperatures exceed 90°F on 45.3 days. Figure 4-13 shows the average daily high temperatures and extremes for the County. Table 4-21 shows the record high temperatures by month for the County.

Figure 4-13 Plumas County—Daily Temperature Averages and Extremes



Source: Western Regional Climate Center, www.wrcc.dri.edu/

Table 4-21 Plumas County – Record High Temperatures

Month	Record High	Date	Month	Record High	Date
January	74°	1/23/1918	July	109°	7/21/1994
February	80°	2/17/1920	August	110°	8/09/1981
March	85°	3/13/1910	September	110°	9/05/1988
April	89°	4/21/2006	October	98°	10/22/1988
May	100°	5/24/1992	November	86°	11/09/1990
June	105°	6/17/1895	December	76°	12/14/1921

Source: Western Regional Climate Center

Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly take the lives of vulnerable populations. Heat waves do not generally cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios. While heat waves are obviously less dramatic, they are potentially deadlier. According to the 2018 California State Hazard Mitigation Plan, the worst single heat wave event in California occurred in Southern California in 1955, when an eight-day heat wave resulted in 946 deaths.

The National Weather Service (NWS) has in place a system or scale to initiate alert procedures (advisories or warnings) when extreme heat is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. The NWS HeatRisk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. This can be seen in Table 4-22.

Table 4-22 National Weather Service HeatRisk Categories

Category	Level	Meaning
Green	0	No Elevated Risk
Yellow	1	Low Risk for those extremely sensitive to heat, especially those without effective cooling and/or adequate hydration
Orange	2	Moderate Risk for those who are sensitive to heat, especially those without effective cooling and/or adequate hydration
Red	3	High Risk for much of the population, especially those who are heat sensitive and those without effective cooling and/or adequate hydration
Magenta	4	Very High Risk for entire population due to long duration heat, with little to no relief overnight

Source: National Weather Service

The NWS office in Sacramento can issue the following heat-related advisory as conditions warrant.

- **Heat Advisories** are issued during events where the HeatRisk is on the Orange/Red threshold (Orange will not always trigger an advisory)
- **Excessive Heat Watches/Warnings** are issued during events where the HeatRisk is in the Red/Magenta output

Past Occurrences

Disaster Declaration History

There have been no FEMA or Cal OES disasters related to extreme heat, as shown in Table 4-4.

NCDC Events

The NCDC data showed no extreme heat incidents for Plumas County since 1993.

Hazard Mitigation Planning Committee Events

Members of the HMPC recalled the following events:

A member of the HMPC from Viera Ranch searched through records kept by the ranch, and found the following extreme heat events:

- **1999** – From July 6th to 10th, high temperatures ranged from 100°F to 103°F. On October 9th, daytime highs were at 92°F.
- **2002** – Multiple days saw very high temperatures. This includes July 9th – 104°F; July 10th – 108°F; July 11th – High 109°F; 8/14/2002 – 105°F; 8/15/2002 – 104°F; 8/16/2002 – 101°F.
- **2003** – Multiple days saw very high temperatures. This includes June 28th – 102°F, July 14th to 23rd – 100°F to 108°F, and July 28th to 30th – 102°F to 105°F.
- **2006** – Multiple days saw very high temperatures. This includes June 20th to 24th – 101°F to 103°F, and July 17th to 25th – 100°F plus highs.
- **2007** – Multiple days saw very high temperatures. This includes July 4th to 6th – 101°F to 101°F.
- **2015** – Multiple days saw very high temperatures. This includes June 24th to 27th – 105°F to 108°F, and June 30th to July 2nd – 101°F to 105°F.
- **2016** – Multiple days saw very high temperatures. This includes July 14th – 102°F, July 23rd to 30th – 101°F to 108°F, and August 13th to 21st – 102°F to 107°F.
- **2017 –** Multiple days saw very high temperatures. This includes June 19th to 23rd – 101°F to 106°F, and July 30th to August 2nd – 102°F to 110°F.
- **2018 –** Multiple days saw very high temperatures. This includes July 18th – 101°F, July 19th – 103°F, July 25th – 102°F, July 26th – 104°F, and August 7th to 10th – High 10°F each day.

Likelihood of Future Occurrence

Highly Likely—Temperature extremes are likely to continue to occur annually in the Plumas County Planning Area. Temperatures at or above 90°F are common most summer days in the of the County.

Climate Change and Extreme Heat

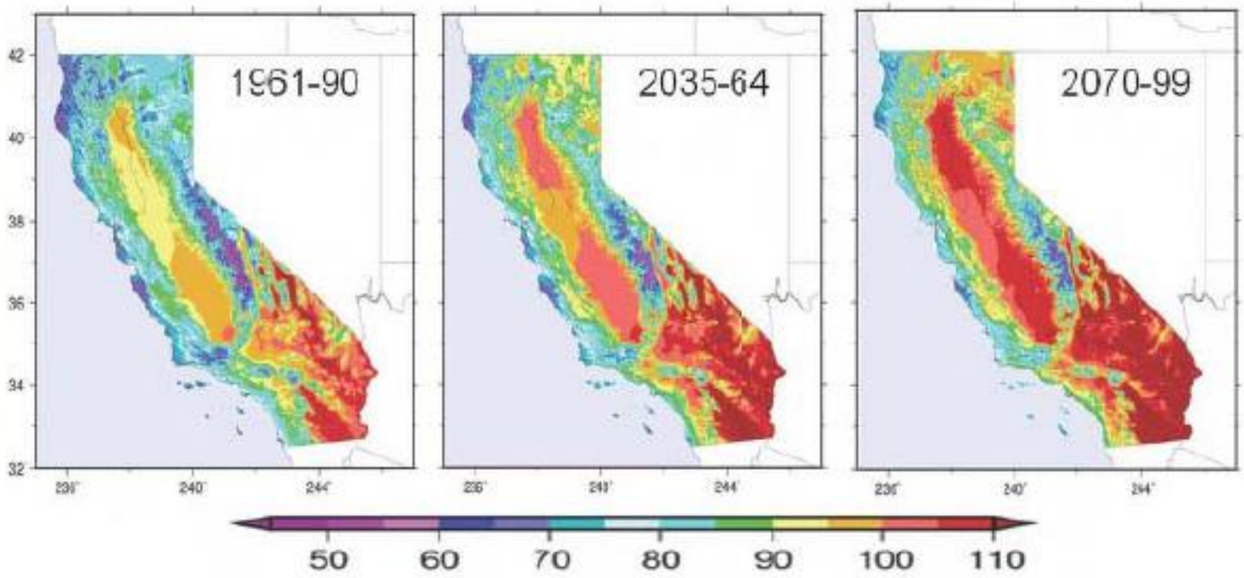
Climate change and its effect on extreme heat in the County has been discussed utilizing three sources:

- California Climate Adaptation Strategy (CAS) – 2014
- Climate Change and Health Profile Report – Plumas County
- Cal-Adapt

Climate Adaptation Strategy

The California Climate Adaptation Strategy (CAS), citing a California Energy Commission study, states that "over the past 15 years, heat waves have claimed more lives in California than all other declared disaster events combined." This study shows that California is getting warmer, leading to an increased frequency, magnitude, and duration of heat waves. These factors may lead to increased mortality from excessive heat, as shown in Figure 4-14.

Figure 4-14 California Historical and Projected Temperature Increases – 1961 to 2099



Source: Dan Cayan; California Climate Adaptation Strategy

As temperatures increase, California and Plumas County will face increased risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke and respiratory distress caused by extreme heat. According to the 2014 CAS report and the 2018 State of California Hazard Mitigation Plan, by 2100, hotter temperatures are expected throughout the state, with projected increases of 3-5.5°F (under a lower emissions scenario) to 8-10.5°F (under a higher emissions scenario). These changes could lead to an increase in deaths related to extreme heat in Plumas County.

Climate Change and Health Profile Report – Plumas County

The Climate Change and Health Profile Report (CCHPR) noted for Plumas County that increased temperatures manifested as heat waves and sustained high heat days directly harm human health through heat-related illnesses (mild heat stress to fatal heat stroke) and the exacerbation of pre-existing conditions in the medically fragile, chronically ill, and vulnerable. Increased heat also intensifies the photochemical reactions that produce smog and ground level ozone and fine particulates (PM2.5), which contribute to and exacerbate respiratory disease in children and adults. Increased heat and carbon dioxide enhance the growth of plants that produce pollen, which are associated with allergies. Increased temperatures also add to the heat load of buildings in urban areas and exacerbate existing urban heat islands adding to the risk of high ambient temperatures.

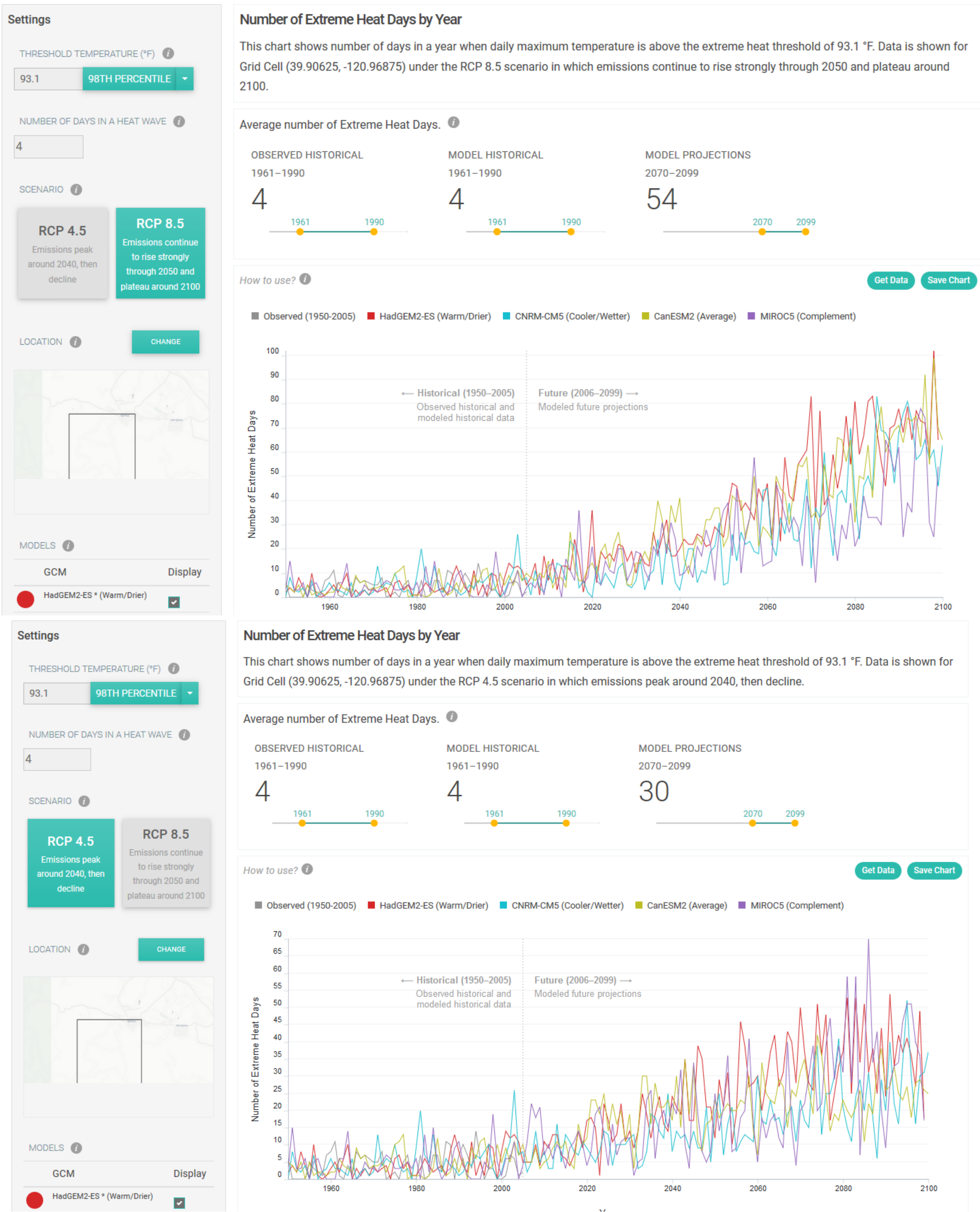
Cal-Adapt

Cal-Adapt also noted that overall temperatures are expected to rise substantially throughout this century. During the next few decades, scenarios project average temperature to rise between 1 and 2.3°F; however, the projected temperature increases begin to diverge at mid-century so that, by the end of the century, the temperature increases projected in the higher emissions scenario (Representative Concentration Pathways (RCP) 8.5) are approximately twice as high as those projected in the lower emissions scenario (RCP 4.5).

These projections also differ depending on the time of year and the type of measurement (highs vs. lows), all of which have different potential effects to the state's ecosystem health, agricultural production, water use and availability, and energy demand. Future temperature estimates from Cal-Adapt for the Plumas County Planning (using the quad that contains the Quincy) are shown in Figure 4-15. It shows the following:

- The upper chart shows number of days in a year when daily maximum temperature is above the extreme heat threshold of 90.0°F. Data is shown for Plumas County under the RCP 8.5 scenario in which emissions continue to rise strongly through 2050 and plateau around 2100.
- The lower chart shows number of days in a year when daily maximum temperature is above the extreme heat threshold of 90.0 °F. Data is shown for Plumas County under the RCP 4.5 scenario in which emissions peak around 2040, then decline.

Figure 4-15 Plumas County – Future Temperature Estimates in Low and High Emission Scenarios



Source: Cal-Adapt – Number of Extreme Heat Days by Year

Vulnerability Assessment

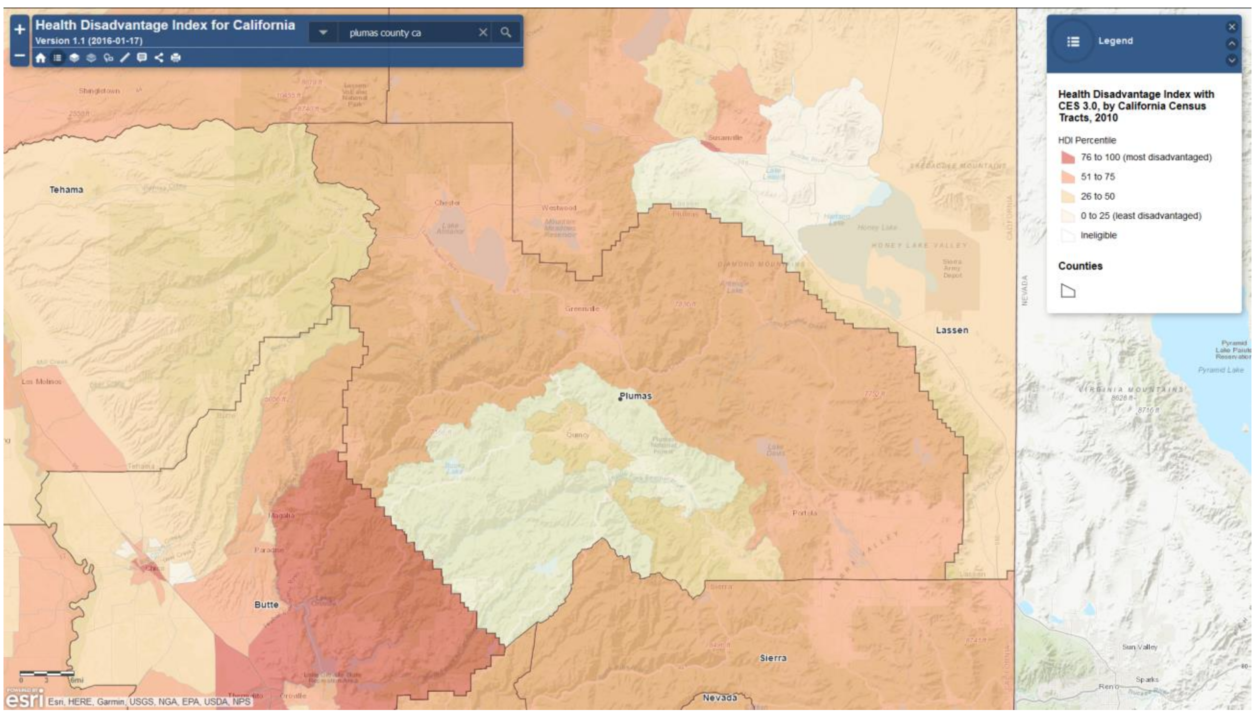
Vulnerability—Medium

Extreme heat happens in Plumas County each year. Extreme heat rarely affects buildings in the County, but affects the population inside the County. Heat can cause stress to agricultural crops and livestock in the County. Extreme heat dries out vegetation in the County, creating greater risks from wildfires. Heat, combined with low humidity and high winds, can cause PG&E or Plumas-Sierra Rural Electric Cooperative (PSREC) to issue a PSPS event for the County.

Impacts from Extreme Heat

Vulnerable populations are at the greatest risk to the effects of extreme heat. The Public Health Alliance has developed a composite index to identify cumulative health disadvantage in California. Factors such as those bulleted above were combined to show what areas are at greater risk to hazards like extreme heat. This is shown on Figure 4-16.

Figure 4-16 Health Disadvantage Index by California Census Tract



Source: Public Health Alliance of Southern California

Vulnerable populations to extreme heat include:

- Homeless
- Infants and children under age five
- Elderly (65 and older)
- Individuals with disabilities
- Individuals dependent on medical equipment

- Individuals with impaired mobility

In addition to vulnerable populations, pets and livestock are at risk to extreme heat. Extreme heat also causes greater wildfire risk, which is discussed in Section 4.3.18.

Future Development

As the County shifts in demographics, more residents will become senior citizens. The residents of nursing homes and elder care facilities are especially vulnerable to extreme temperature events. It is encouraged that such facilities have emergency plans or backup power to address power failure during times of extreme heat and in the event of a PSPS. Low income residents and homeless populations are also vulnerable. Cooling centers for these populations should be utilized when necessary. Future development may also need to consider changes to both the length of wildfire season and the increasing hazards of wildfire (discussed in more detail in 4.3.18).

4.3.3. Severe Weather: Heavy Rains and Storms

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Plumas County is located in the Sierra Nevada region of the State of California. Severe weather affects all areas of Plumas County but differs significantly by region. Throughout areas of the County there are significant variations in the average temperature and amount of precipitation received due to topography.

Storms in the lower elevations of the Plumas County Planning Area are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. In the upper elevations, these storms can drop large amounts of snow (discussed in Section 4.3.5). Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the Plumas County area falls mainly in the fall, winter, and spring months.

The severe weather hazard is broken down in the following sections into:

- Heavy Rain and Storms
- Hail
- Lightning

Heavy Rain and Storms

The NWS reports that storms and thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

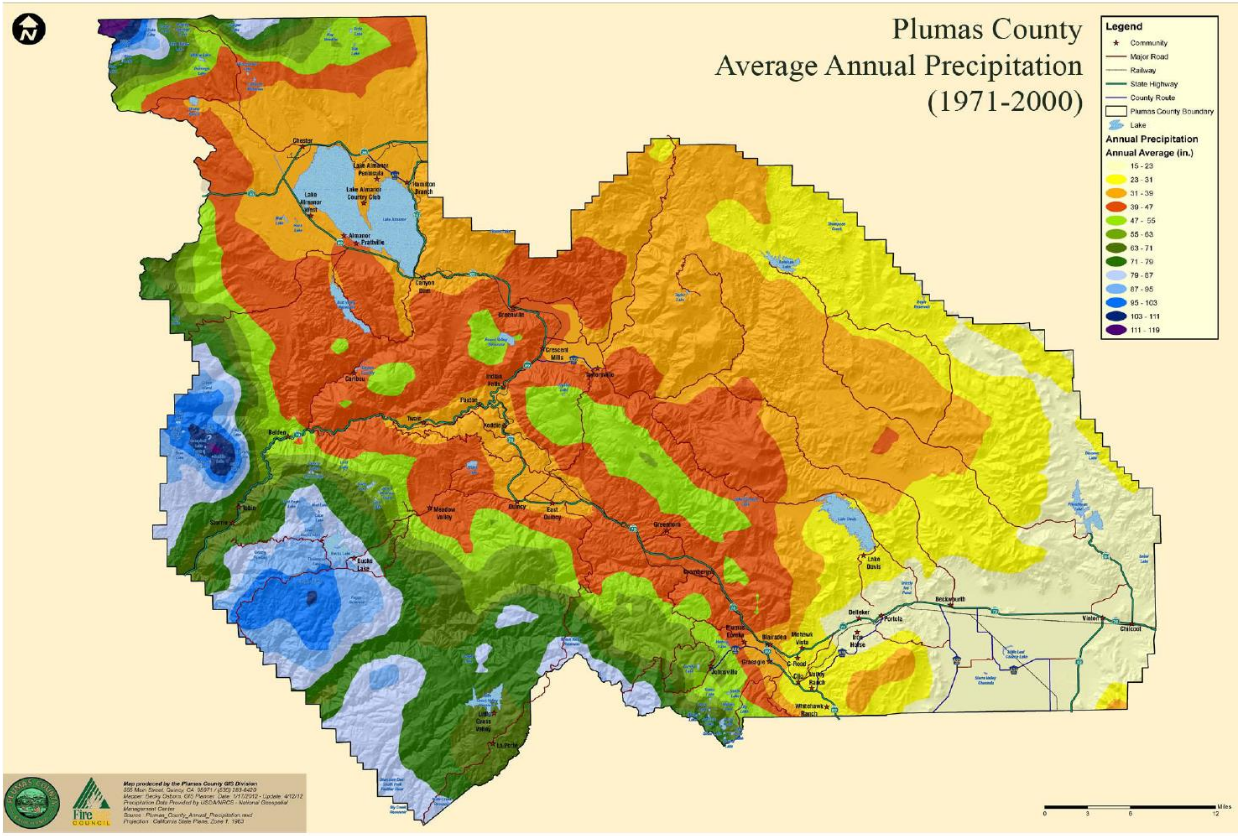
According to the HMPC, short-term, heavy storms can cause both widespread flooding as well as extensive localized drainage issues. As storms continue to increase in intensity, the limited drainage infrastructure has become an increasingly important issue. In addition to the flooding that often occurs during these storms, strong winds, when combined with saturated ground conditions, can down very mature trees.

Cloudburst storms can be expected in the spring, summer, and fall. Cloudburst storms, sometimes lasting as long as 6 hours in the study areas, are high intensity storms that can produce floods characterized by high peak flows, short-duration floodflows, and small runoff volume. In small drainage basins such as Portola Tributary, cloudbursts can produce peak flows substantially larger than those of general rainstorms.

Location and Extent

Heavy rains in Plumas County vary by season and location. Plumas County is located in the Northern portion of the Sierra Nevada region and has significant topographic variation, which causes it to experience a more severe and geographically variable winter climate (discussed in more detail in Section 4.3.5). The highest precipitation amounts are seen in the Western portion of the county where there is an orographic lift that forces air from low elevations to a higher elevation, quickly cooling down the air and raising the relative humidity to 100%. Under the right conditions orographic lifts create rain shadows where high amounts of precipitation are found on the crests of mountain ranges, but as the air descends to the leeward side of the mountain it warms and dries. In Plumas County the leeward side of the mountains represents the Eastern portion of the county where precipitation typically averages around two inches in the wettest months of the year. Areas west of the mountains, however, experience much higher precipitation levels. For example, Bucks Creek averages nearly 12 inches per month in December and January as shown on Figure 4-17. Most of these rains occur during the winter months, as discussed below.

Figure 4-17 Plumas County Average Annual Precipitation



Source: Plumas County GIS

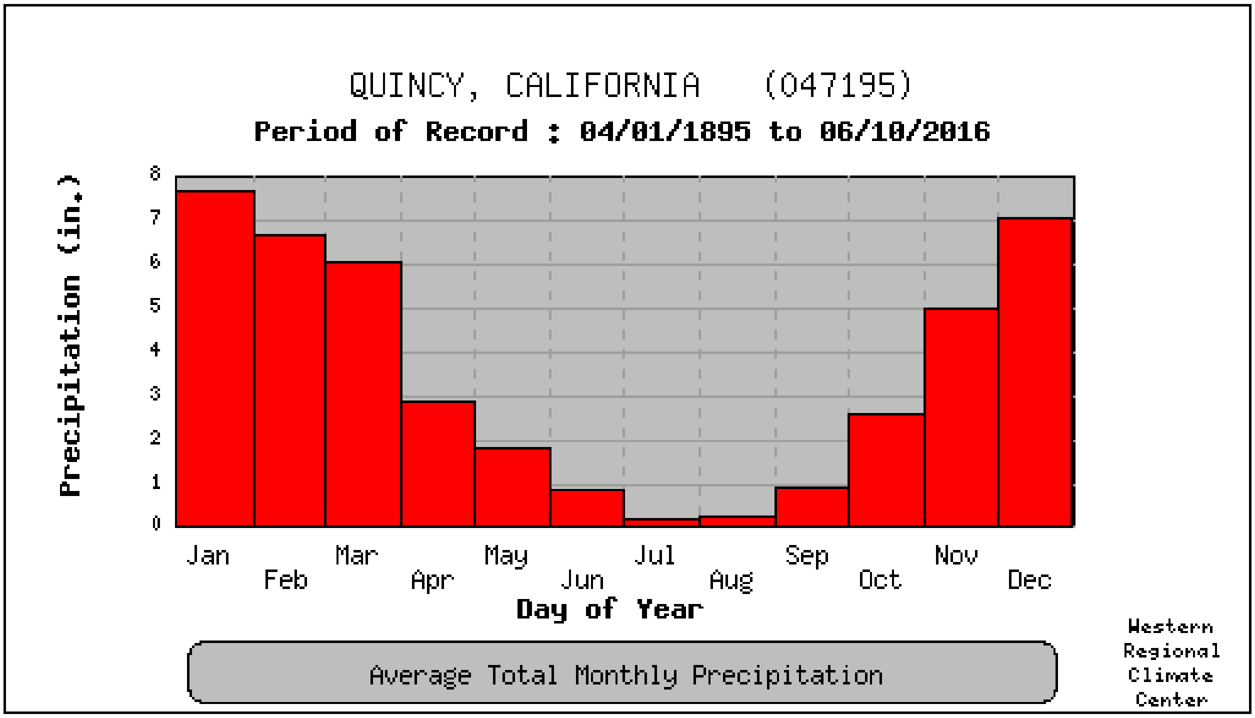
There is no scale by which heavy rains are measured – usually it is measured in terms of rainfall amounts. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms in California is often short, ranging from minutes to hours.

Information from the WRCC weather station in Plumas County previously discussed in Section □ is summarized below.

Plumas County—Quincy Station Weather Station, Period of Record 1895 to 2016

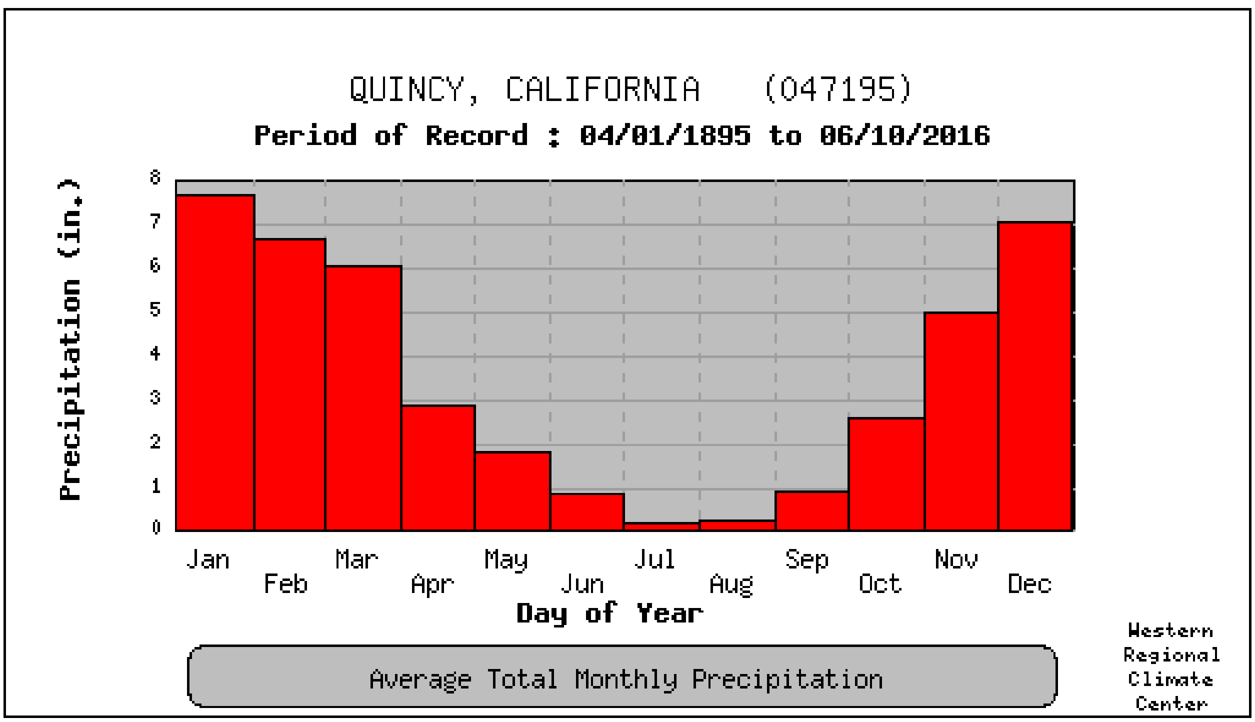
According to the WRCC, average annual precipitation in Plumas County is 40.15 inches per year. The highest recorded annual precipitation is 68.87 inches in 1909; the highest recorded precipitation for a 24-hour period is 6.50 inches on March 18, 1907. The lowest recorded annual precipitation was 22.15 inches in 1949. Average monthly precipitation for Plumas County is shown in Figure 4-18. Daily average and extreme precipitations are shown in Figure 4-19.

Figure 4-18 Plumas County—Monthly Average Total Precipitation



Source: Western Regional Climate Center, www.wrcc.dri.edu/

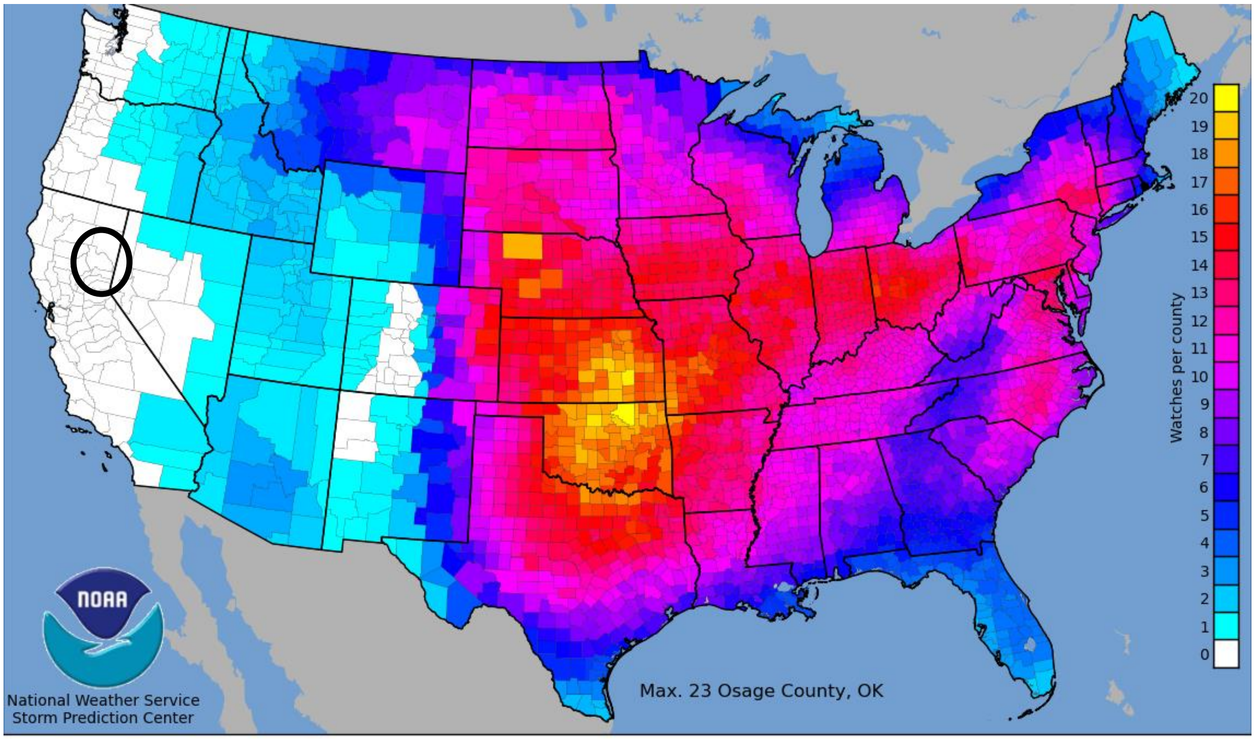
Figure 4-19 Plumas County—Daily Average and Extreme Precipitation



Source: Western Regional Climate Center, www.wrcc.dri.edu/

The NOAA Storm Prediction Center tracks thunderstorm watches on a county basis. Figure 4-20 shows thunderstorm watches in Plumas County and the United States for a 20-year period between 1993 and 2012, the most recent map available.

Figure 4-20 Plumas County – Average Thunderstorm Watches per Year (1993 to 2012)



Source: NOAA Storm Prediction Center, map retrieved 11/25/2019

Hail

Hail can occur throughout the Plumas County Planning Area during storm events, though it is rare. Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail is sometimes associated with severe storms within the Plumas County Planning Area. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 miles per hour (mph). Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops.

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4-23 indicates the hailstone measurements utilized by the National Weather Service.

Table 4-23 Hailstone Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball

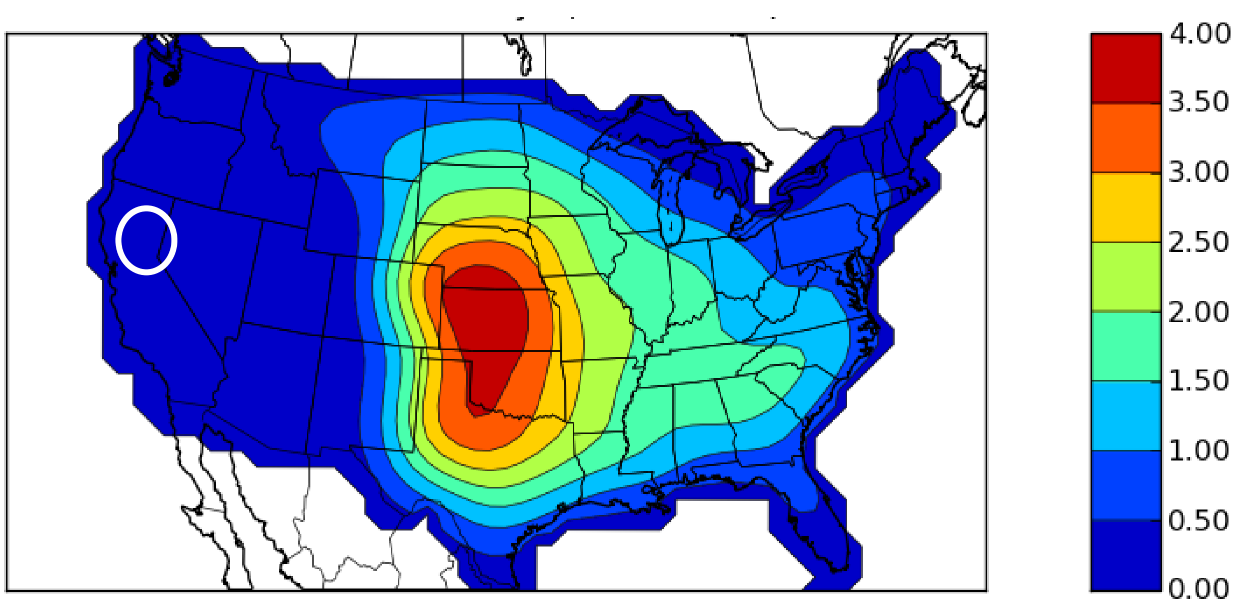
Average Diameter	Corresponding Household Object
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

Location and Extent

Hail events can occur in any location of the County. All portions of the County are at risk to hail. There is no scale in which to measure hail, other than hail stone size as detailed above. The speed of onset of hail can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms that can cause hail in California is often short, ranging from minutes to hours. Hail events last shorter than the duration of the total thunderstorm. The National Weather Service tracks hail events. Figure 4-21 shows the average days each year where hail of greater than 1" in diameter occurred during a 20-year period from 1990 to 2009. The most recent map available.

Figure 4-21 Plumas County – Average Hail Days per Year (1990 to 2009)



Source: National Weather Service, map retrieved 11/25/2019

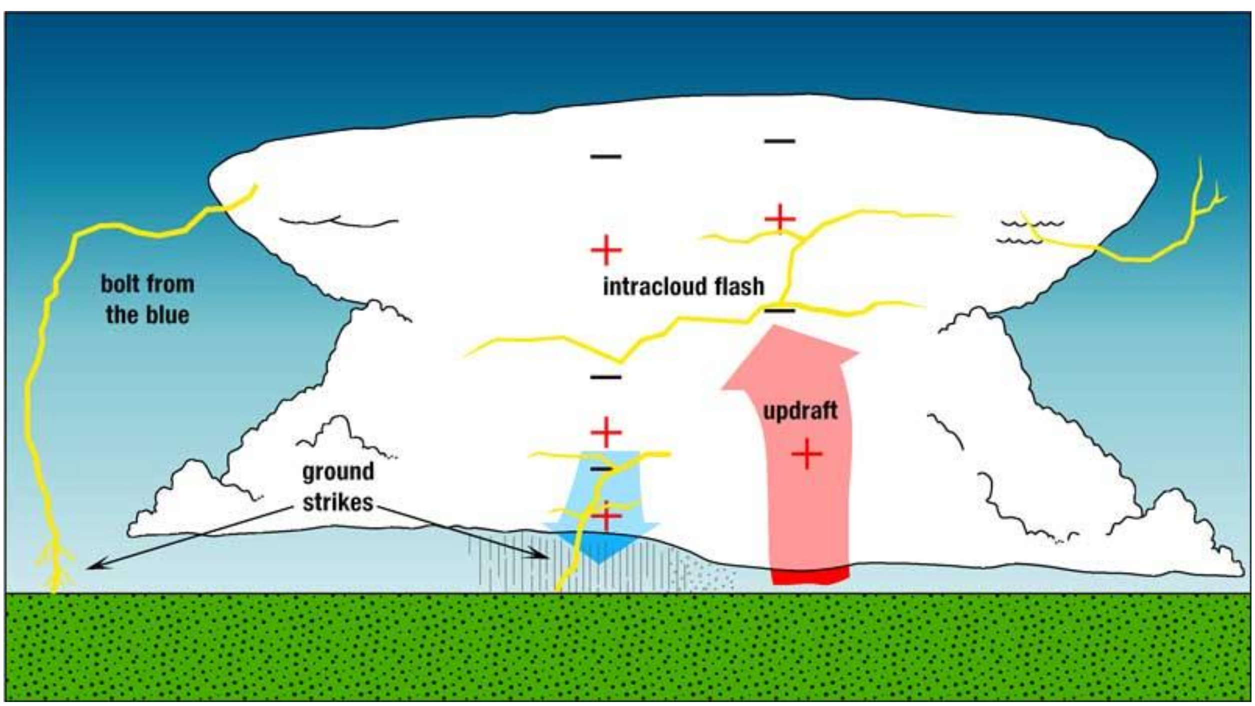
Lightning

Lightning can occur throughout the County both during and outside of storm events. Lightning is defined by the NWS as any and all of the various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or total destruction. Or, damage may be indirect, when the current passes through or near an object, which generally results in less damage.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat (see Figure 4-22). Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 4-22 Cloud to Ground Lightning



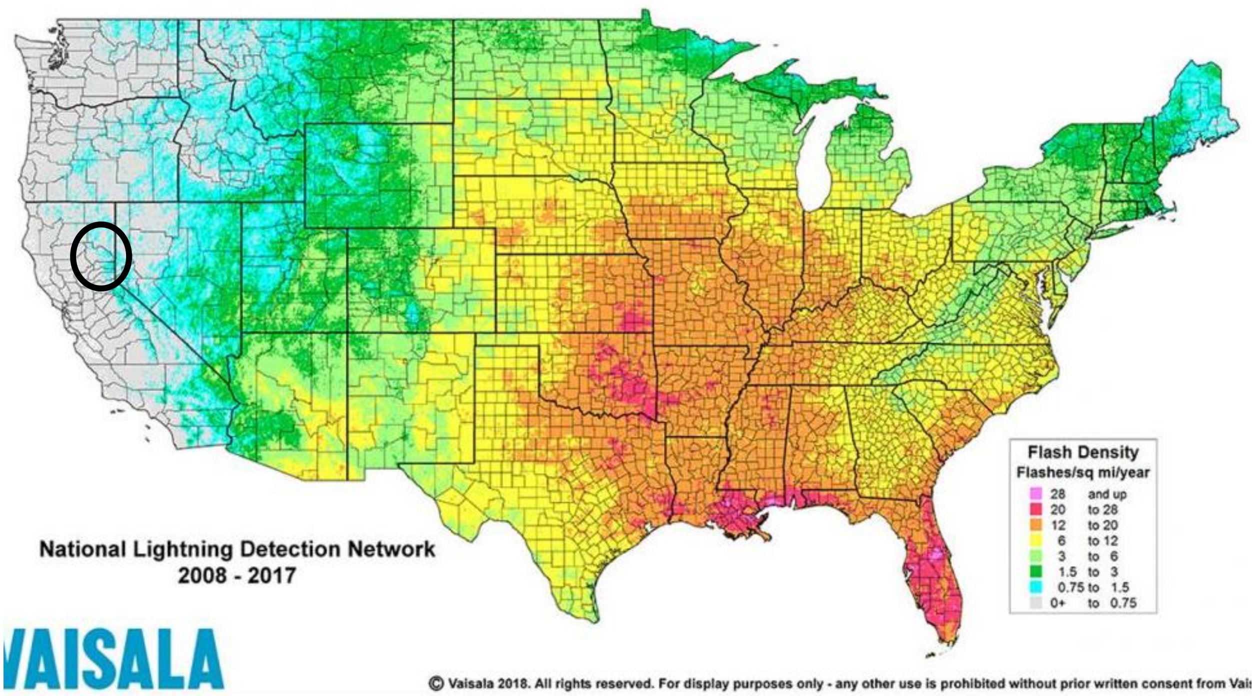
Source: National Weather Service

Lightning in the County is also a concern due to the number of fires that are started by lightning strikes. Wildfire is discussed in more detail in Section 4.3.18.

Location and Extent

Lightning events can occur in any location of the County and are often associated with thunderstorms. All portions of the County are at risk to lightning. Lightning tends to be rare in the County, as discussed in the extent section below. Lightning in the County can occur both during and outside of thunderstorms. The speed of onset of thunderstorms that can cause lightning can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms in California is often short, ranging from minutes to hours. Thunderstorms and lightning are rare in the County. Vaisala maintains the National Lightning Detection Network. It tracks cloud to ground lightning incidences in the United States. Figure 4-23 shows lightning incidences in the County and the rest of the United States from 2008 to 2017, the most recent map date available.

Figure 4-23 Plumas County – Lightning Incidence Map 2008 to 2017



Source: Vaisala National Lightning Detection Network, map retrieved 11/25/2019

Past Occurrences

Disaster Declaration History

A search of FEMA and Cal OES disaster declarations turned up multiple events. Heavy rains and storms have caused flooding in the County. Events where flooding resulted in a state or federal disaster declaration are shown in Table 4-24.

Table 4-24 Plumas County – Disaster Declarations from Heavy Rain and Storms (and Floods) 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	16	1950, 1955, 1958 (twice), 1963 (twice), 1964, 1969, 1970, 1980, 1986, 1992, 1995 (twice), 1996, 1997	15	1955, 1958, 1963, 1964, 1969, 1970, 1986, 1992, 1993, 1995 (twice), 1997, 2006, 2017 (twice)

Source: FEMA, Cal OES

NCDC Events

The NCDC data recorded 67 hail, heavy rain, and lightning incidents for Plumas County since 1950. A summary of these events is shown in Table 4-25. More detail, where available, for these events is discussed below the table. Additional events of heavy rain and storms are also discussed in the NCDC table in the flood profile in Section 4.3.11.

*Table 4-25 NCDC Severe Weather Events in Plumas County 1950–9/30/2019**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Hail	19	0	0	0	0	$100	$5,000
Heavy Rain	47	0	0	0	0	$1,000	$0
Lightning	1	0	0	0	0	$0	$0
Total	**67**	**0**	**0**	**0**	**0**	**$1,100**	**$0**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Plumas County

1991 - A member of the HMPC from Viera Ranch noted that in March of 1991, 19.5 inches of rain fell. There was .25 inch hail on July 18. On July 19 lightning strikes hit power lines in East Quincy. It knocked out electronic equipment at the Ranch. On October 26, there was 2.8 inches of rain in one day.

1992 – A member of the HMPC from Viera Ranch noted that from February 11-20, 6.3 inches of rain fell.

June 26, 2000 – Trained spotter reported 1/2 to 3/4 inch hail in Greaegle. The hail was approximately 4 inches deep and caused an estimated $100 in damage.

April 3, 2002 – One inch diameter hail was reported by two storm spotters in Portola, CA.

July 22, 2003 – The California Highway Patrol reported golf ball size hail along California State Highway 70 between Vinton and Beckwourth in eastern Plumas County. This hail also damaged alfalfa fields in the area.

October 19, 2007 – a strong cold front moved through the northern and central Sierra and western Nevada. Strong wind and locally heavy rainfall accompanied the cold front. A trained weather spotter reported a storm total of 1.25 inches of rainfall at Sloat. A total of 5.13 inches of rain fell 5 miles south of Twain.

May 28, 2009 – Strong thunderstorms occurred across the eastern Sierra and western Nevada the afternoon and evening. A trained weather spotter reported 1-inch diameter hail in Cromberg.

June 30, 2009 – The Plumas County Sheriff's Department reported that a woman was struck by lightning at her home in Portola. She was transported by helicopter to the U.C. Davis Medical Center. She never regained consciousness and died from her injuries on June 11th.

July 28, 2009 – an upper level low pressure system on the coast coupled with an unstable atmosphere brought isolated thunderstorms over the mountains of interior northern California. Hail was reported locally in western Plumas County each day. A Co-operative observer estimated hail from dime to penny sized.

July 29, 2009 – an upper level low pressure system on the coast coupled with an unstable atmosphere brought isolated thunderstorms over the mountains of interior northern California. Hail was reported locally in western Plumas County each day. Lassen Volcanic National Park rangers reported quarter sized hail.

May 5, 2013 – A thunderstorm developed over the Sierra mountains near Downieville around 1:30 pm PDT and was reported to produce hail for over 30 minutes near Bucks Lake in Plumas County (between 3:20 pm and 4:00 pm). It became severe around 3:30 pm PDT with measured hail of 1 inch. The thunderstorm weakened after 4:00 pm.

July 2, 2015 – Nickel sized hail reported just east of Sloat. Nickel sized hail was also reported 4 miles west of Portola. There was 1.43 inches of rainfall that fell over an hour.

July 7, 2015 - Penny sized hail fell, along with wind gusts estimated at 40-50 mph. About an inch of rain fell in 20 minutes.

July 21, 2015 – Accumulating nickel-sized hail was reported near the Lake Davis Dam.

December 3, 2015 – There were 1.5 inches of heavy rain in Quincy. Gusty winds damaged small limbs.

December 12, 2015 – There were 1.66 inches of rain reported over 12 hours. The observer was located in Quincy.

March 12 ,2016 – Reported total rainfall of 3.5 inches since it began the previous afternoon.

October 14, 2016 – There were 1.83 inches of rain measured, 12 hour total.

October 15, 2016 – There were 2.51 inches of rain measured, 6 hour total.

October 30, 2016 – There were 1.53 inches measured, 12 hour total.

January 3, 2017 – There were 1.99 inches of rain over 6 hours.

January 6, 2017 – There were 13.39 of rain measured at La Porte. The duration of the heavy rain event was 72 hours. There was 3.99 of rain measured, 72 hour storm total.

January 7, 2017 – There were 11.25 inches measured at Bucks Lake. The duration of the heavy rain event was 72 hours.

January 10, 2017 – There were 1.50 of rain measured over 5 hours 1 E of Quincy.

February 8, 2017 – There were 2.30 of rain measured over 24 hours, 6.16 over 72 hours.

August 2, 2017 – Golf ball hail was reported southeast of Quincy, in the vicinity of the Minerva Fire.

November 15, 2017 – There was 8.21 of rain reported at 2 NE American House over 72 hours. RAWS sensor at Denten Creek measured 2.79 inches of rain from 15 November 0715PST to 16 November 0715PST.

March 1, 2018 – The 24 hour total rainfall was 1.60. Some wet snow mixed in at times.

March 13, 2018 – Mesonet station DVSC1, Lake Davis reported 0.75 inches of rain from 13 March 1400PST to 14 March 0500PST.

March 20, 2018 – Mesonet station GRZC1, 4 miles northeast of Cromberg reported 3.02 inches of storm total rainfall from 20 March 0600PST to 23 March 0600PST. Mesonet station ANTC1 near Antelope Lake reported 3.32 inches of storm total rainfall from 20 March 0600PST to 23 March 0600PST.

April 6, 2018 – COOP observer station PRAC1, Portola reported 0.84 inches of rainfall in a 24 hour period from 6 April 0700PST to 7 April 0700PST. Mesonet station DVSC1, Lake Davis (elevation 5,768 feet) reported 1.32 inches of rainfall in a 24-hour period from 6 April 0700PST to 7 April 0700PST. Mesonet station KRKC1, 6 miles west-southwest of Antelope Lake (elevation 7,297 feet) reported 1.84 inches of rainfall in a 24-hour period from 6 April 10:00PST to 7 April 10:00PST.

May 24, 2018 – Mesonet station MWKC1, 1 mile east of Blairsden (elevation 5,149 feet) reported 1.25 inches of rainfall in a 24-hour period from 24 May 0834PST to 25 May 0834PST. COOP observer measured 0.97 inches of rainfall in a 24-hour period from 24 May 0914PST to 25 May 0914PST.

July 15, 2018 – Heavy rain from an isolated thunderstorm brought a rock slide covering the west bound lane of Highway 70. Radar estimates suggested locally 0.45 of rain within 1 hour.

July 21, 2018 - A trained weather spotter reported hail 0.75 inches in diameter and heavy rain 4 miles west-northwest of Frenchman Lake.

October 3, 2018 – Mesonet station DVSC1 near Lake Davis (elevation 5,768 feet) reported 0.94 inches of rainfall in an 18-hour period from 3 October 1100PST to 4 October 0500PST.

November 21, 2018 – CO-OP Observer PRAC1, Portola, reported 0.92 inches of heavy rain in a 24-hour period from 21 November 0800PST to 22 November 0800PST.

December 24, 2018 – There were 1.03 inches of rain over 12 hours in East Quincy. Mesonet station ANTC1 near Antelope Lake reported 1.16 inches of rainfall in a 24-hour period from 24 December 0700PST to 25 December 0700PST. Mesonet elevation 5026 feet MSL. Mesonet MWKC1 1 mile east of

Blairsden reported 0.76 inches of rainfall over a 24-hour period from 24 December 0700PST to 25 December 0700PST.

January 9, 2019 – A spotter reported a 12 hour rainfall total of 0.82.

January 16, 2019 – Mesonet DVSC1 near Lake Davis reported 2.16 inches of rainfall in a 24-hour period from 16 January 0800PST to 17 January 0800PST. Mesonet elevation 5768 feet MSL. Mesonet ANTC1 near Antelope Lake reported 2.24 inches of rainfall in a 24-hour period from 16 January 0800PST to 17 January 0800PST. Mesonet elevation 5026 feet MSL. There was a 12-hour total of 2.1 of rain. Slush from earlier snow was blocking street drains with ponding water observed.

February 25, 2019 – Heavy rain, 3.48 inches in 12 hours, 5.12 inches in 24 hours.

Hazard Mitigation Planning Committee Events

HMPC also noted the following events:

On **September 5, 2019** quarter size hail was reported near Vinton. No injuries or deaths were reported. Property damage occurred, but damage estimates were unavailable.

In **1977** and **1981** there were lightning events that caused damages in the County.

A member of the HMPC from Viera Ranch searched through records kept by the ranch, and found the following heavy rain and storm events:

- **November 6, 1994** – 4.2 inches of rain fell in the Quincy area.
- **December 2, 1994** – 3.5 inches of rain fell in the Quincy area.
- **From January 7th to 15th** of **1995**, 27.85 inches of rain fell in the Quincy area. This came after 3 inches of snow had fallen the previous two days.
- **April 26, 1995** saw 4.1 inches of rain fall in the Quincy area.
- **January 16th to 23rd 1999** – 7.85 inches of rain fell in the Quincy area. From February 6th to the 9th, another 10.3 inches of rain fell in the Quincy area.
- In early **2000**, large amounts of rain fell. Between January 10th and 24th, 14.9 inches of rain fell in the Quincy area. From February 11th to 27th, another 13.7 inches fell.
- **July 10, 2001** – Portola had 2 inches of rain in 30 minutes. 4" of 1" diameter hail fell. Flash flooding occurred.
- **December 2002 -** 49.3 inches rain and 21.5 inches snow fell in the Quincy area.
- **2003** – 5.7 inches rain fell in Quincy on March 14th and 15th. Marble size hail was seen on June 23rd. 1.25 inches of rain fell in 3 hours on August 22nd. 3.25 inches and 3.4 inches fell on the 6th and 10th of December, respectively.
- **June 8, 2004** – A thunderstorm with pea sized hail occurred in the Quincy area.
- **2006 -** 5.8 inches rain fell on the 27th and 28th of February, and 5.33 inches fell on the 3rd and 4th of April.
- **2007** – between February 8th and 12th, 7.4 inches of rain fell.
- **2015** – 3.4 inches of rain fell in the Quincy area between February 5th and 7th. Trees were blown down and power outages were reported.

- **2016** – Heavy rains fell in the Quincy area in both January and March. January saw 18.44 inches of rain, while March saw 18.24 inches of rain.
- **2017** – From January 7th to 22nd, 13.03 inches of rain fell in the Quincy area. Between February 1st and 11th, another 18.71 inches fell. April 7th say 3.72 inches of rain fall. 0.5 inch hail was reported on May 29th.
- **2018** – Between the 8th and 9th of January, 3.75 inches of rain fell.
- **2019** – 2.65 inches of rain fell in the Quincy area on January 7th. Between the 15th and 17th of January, another 8.05 inches of rain fell. February 13th and 14th saw another 5.47 inches of rain fall. February 25th to 27th, 9.5 more inches or fain fell. March 26th saw 3.52 inches of rain.

Likelihood of Future Occurrence

Highly Likely – Based on NCDC data and HMPC input, 67 heavy rain and storm incidents over a 71-year period (1950-2020) equates to a severe storm event every 1.06 years. As noted, this database likely doesn't capture all heavy rain, hail, and lightning events. Severe weather is a well-documented seasonal occurrence that will continue to occur often in the Plumas County Planning Area.

Climate Change and Heavy Rains and Storms

Climate change and its effect on flood near the City has been discussed by three sources:

- CAS – 2014
- Cal-Adapt

CAS

According to the CAS, while average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. It is unlikely that hail will become more common in the County. The amount of lightning is not projected to change.

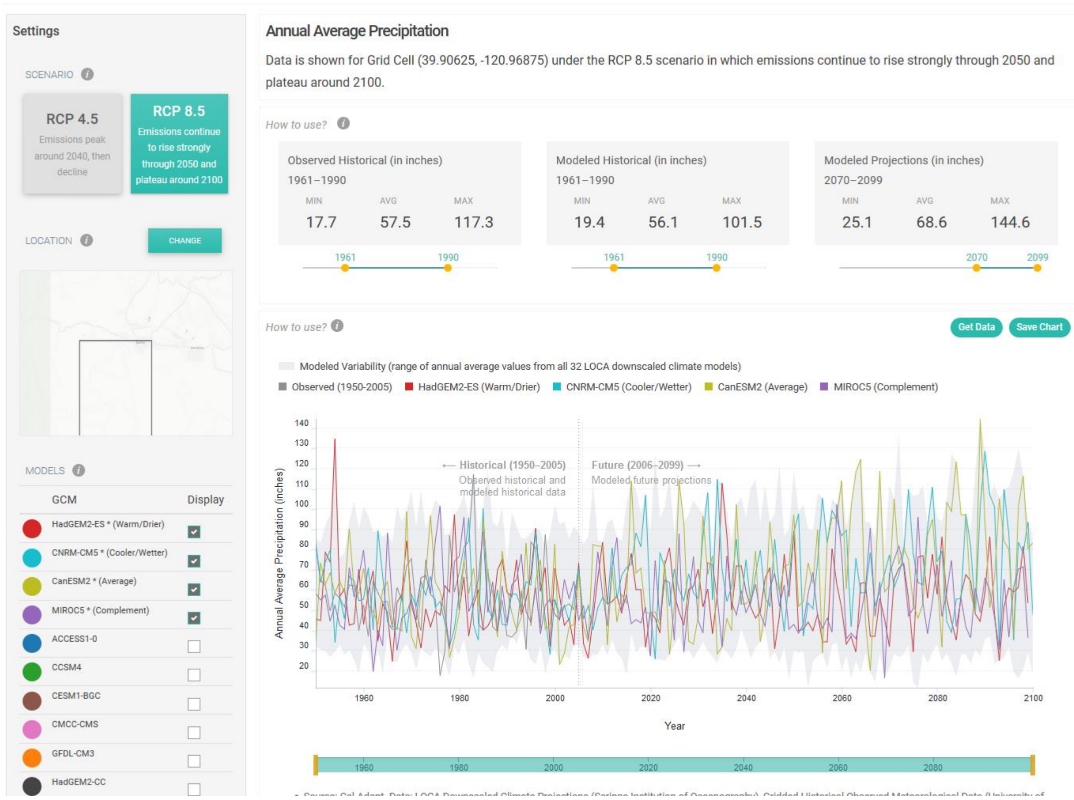
Cal-Adapt

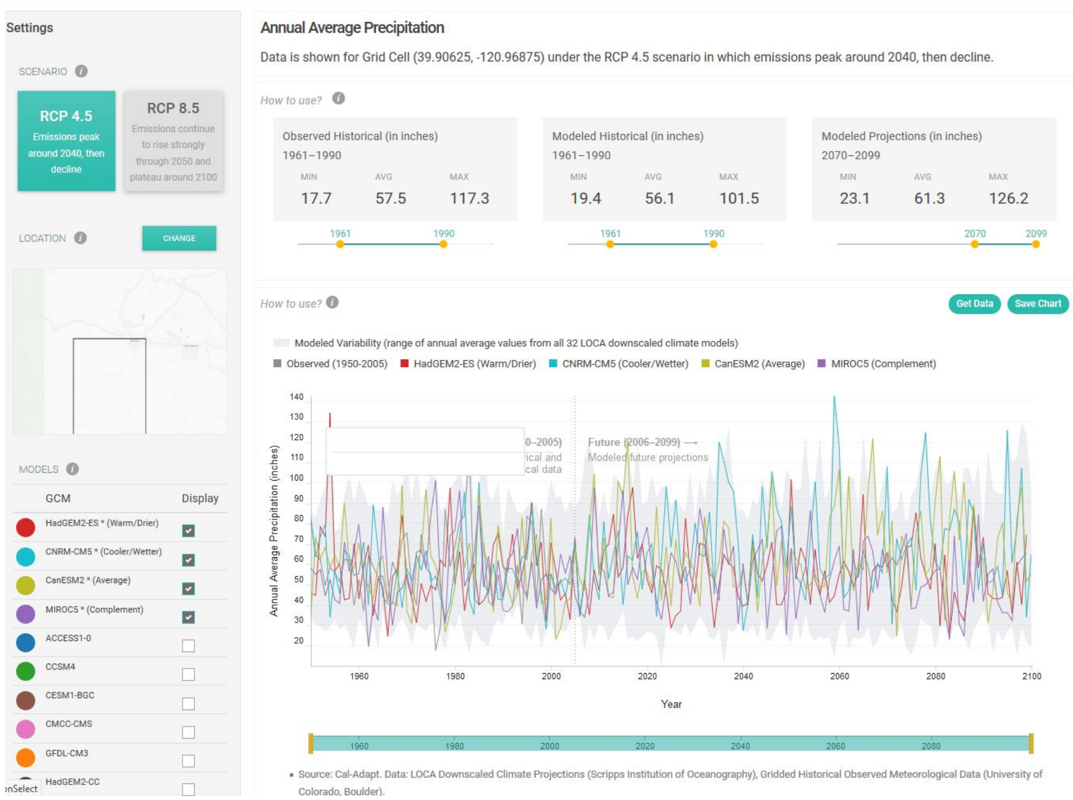
Cal-Adapt noted that, on average, the projections show little change in total annual precipitation in California. Furthermore, among several models, precipitation projections do not show a consistent trend during the next century. The Mediterranean seasonal precipitation pattern is expected to continue, with most precipitation falling during winter from North Pacific storms. One of the four climate models projects slightly wetter winters, and another projects slightly drier winters with a 10 to 20 percent decrease in total annual precipitation. However, even modest changes would have a significant impact because California ecosystems are conditioned to historical precipitation levels and water resources are nearly fully utilized.

These projections also differ depending on the time of year and the type of measurement (highs vs. lows), all of which have different potential effects to the state's ecosystem health, agricultural production, water use and availability, and energy demand. Future precipitation estimates from Cal-Adapt for the Plumas County Planning (using the quad that contains the City of Quincy) are shown in Figure 4-24.. It shows the following:

- The upper chart shows annual averages of observed and projected precipitation values for the selected area on map under the RCP 8.5 scenario in which emissions continue to rise strongly through 2050 and plateau around 2100. The gray line (1950 – 2005) is observed data. The colored lines (2006 – 2100) are projections from 10 LOCA downscaled climate models selected for California. The light gray band in the background shows the least and highest annual average values from all 32 LOCA downscaled climate models.
- The lower chart shows annual averages of observed and projected Precipitation values for the selected area on map under the RCP 4.5 scenario in which emissions peak around 2040, then decline. The gray line (1950 – 2005) is observed data. The colored lines (2006 – 2100) are projections from 10 LOCA downscaled climate models selected for California. The light gray band in the background shows the least and highest annual average values from all 32 LOCA downscaled climate models.

Figure 4-24 Plumas County– Future Precipitation Estimates: High and Low Emission Scenarios





Source: Cal-Adapt – Precipitation: Decadal Averages Map

Vulnerability Assessment

Vulnerability—Medium

According to historical hazard data, severe weather is an annual occurrence in Plumas County. Impacts can be felt by both the population of the County as well as the structures that have been built in the County. Many of the impacts from heavy rains and storms are discussed in other sections of this Plan (Section 4.3.8 Dam Failure, Section 4.3.11 Flood, Section 4.3.12 Localized Flood, Section 4.3.13 Landslide, and Section 4.3.14 Levee Failure)

Impacts

Impacts from heavy rains include damages to property and infrastructure. This includes: downed trees, damaged utility structures and infrastructures; power outages; road damages and blockages; hail damage to crops, buildings, and automobiles, and lightning damages to homes, critical infrastructure, and people. However, actual damage associated with the primary effects of severe weather have been somewhat limited. It is the secondary hazards caused by weather, such as floods, fire, and agricultural losses that have had the greatest impact on the County. The risk and vulnerability associated with these secondary hazards are discussed in other sections of this plan (Section 4.3.11 Flood: 1%/0.2% Annual Chance, Section 4.3.12 Flood: Localized Stormwater, Section 4.3.8 Dam Failure, Section 4.3.14 Levee Failure, and Section 4.3.18 Wildfire).

Future Development

Homes built in the County are built to existing building codes that generally withstand heavy rains and storms. New critical facilities such as communications towers and others should be built to withstand lightning, hail and thunderstorm winds. Backup power sources for all critical facilities should be incorporated into all new facilities. Properly located, designed, and constructed, future losses to new development should be minimal.

4.3.4. Severe Weather: High Winds and Tornadoes

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

This section includes a description and location and extent discussion for both high winds and tornadoes, respectively.

High Winds

High winds, often accompanying severe storms and thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. High winds, as defined by the NWS glossary, are sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms.

Straight-line winds may also exacerbate existing weather conditions by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snowstorms. The winds may also exacerbate fire conditions by drying out the ground cover, propelling embers around the region, and increasing the ferocity of exiting fires. These winds may damage crops, push automobiles off roads, damage roofs and structures, and cause secondary damage due to flying debris.

A special type of wind event can occur in the County. Microbursts have occurred in the County. According to the National Weather Service, a microburst is a downdraft (sinking air) in a thunderstorm that is less than 2.5 miles in scale. Some microbursts can pose a threat to life and property, but all microbursts pose a significant threat to aviation. Although microbursts are not as widely recognized as tornadoes, they can cause comparable, and in some cases, worse damage than some tornadoes produce. In fact, wind speeds as high as 150 mph are possible in extreme microburst cases.

Location and Extent

The entire Plumas County Planning Area is subject to significant, non-tornadic (straight-line), winds. Each area of the County is at risk to high winds. Magnitude of winds is measured often in speed and damages. These events are often part of a heavy rain and storm event, but can occur outside of storms. The speed of onset of winds can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of winds in California is often short, ranging from minutes to hours. The Beaufort scale is an empirical measure that relates wind speed to observed conditions at sea or on land. Its full name is the Beaufort wind force scale. Figure 4-25 shows the Beaufort wind scale.

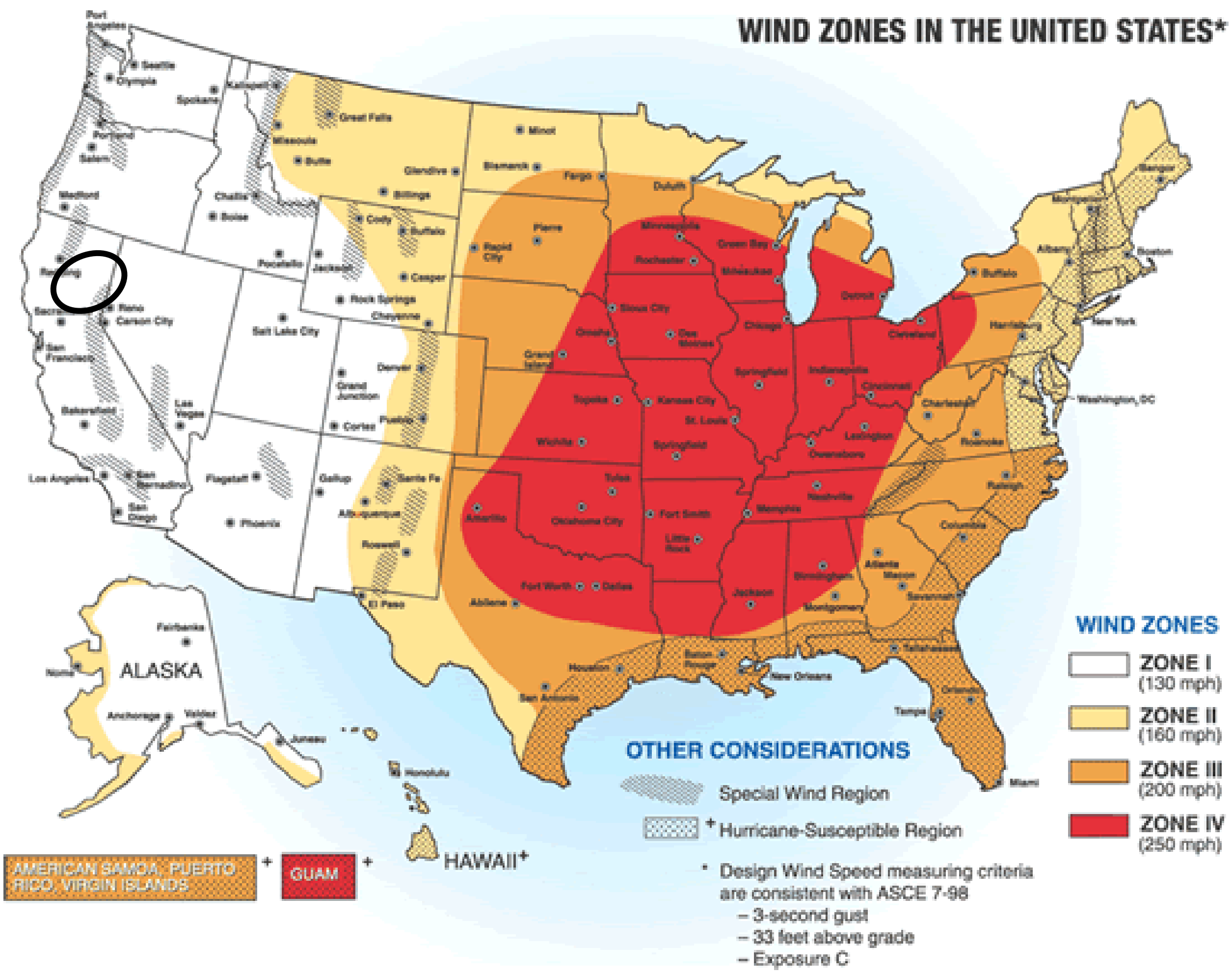
Figure 4-25 Beaufort Wind Scale

Beaufort Number	Wind Speed (miles/hour)	Wind Speed (km/hour)	Wind Speed (knots)	Description	Wind Effects on Land
0	< 1	< 1	< 1	Calm	Calm. Smoke rises vertically.
1	1-3	1-5	1-3	Light Air	Wind motion visible in smoke.
2	4-7	6-11	4-6	Light Breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	12-19	7-12	Gentle Breeze	Leaves and smaller twigs in constant motion.
4	13-18	20-28	11-16	Moderate Breeze	Dust and loose paper are raised. Small branches begin to move.
5	19-24	29-38	17-21	Fresh Breeze	Small trees begin to sway.
6	25-31	39-49	22-27	Strong Breeze	Large branches are in motion. Whistling is heard in overhead wires. Umbrella use is difficult.
7	32-38	50-61	28-33	Near Gale	Whole trees in motion. Some difficulty experienced walking into the wind.
8	39-46	62-74	34-40	Gale	Twigs and small branches break from trees. Cars veer on road.
9	47-54	75-88	41-47	Strong Gale	Larger branches break from trees. Light structural damage.
10	55-63	89-102	48-55	Storm	Trees broken and uprooted. Considerable structural damage.
11	64-72	103-117	56-63	Violent Storm	Widespread damage to structures and vegetation.
12	> 73	> 117	> 64	Hurricane	Considerable and widespread damage to structures and vegetation. Violence.

Source: National Weather Service

Figure 4-26 depicts wind zones for the United States. The map denotes that Plumas County falls into Zone I, which is characterized by high winds of up to 130 mph.

Figure 4-26 Wind Zones in the United States

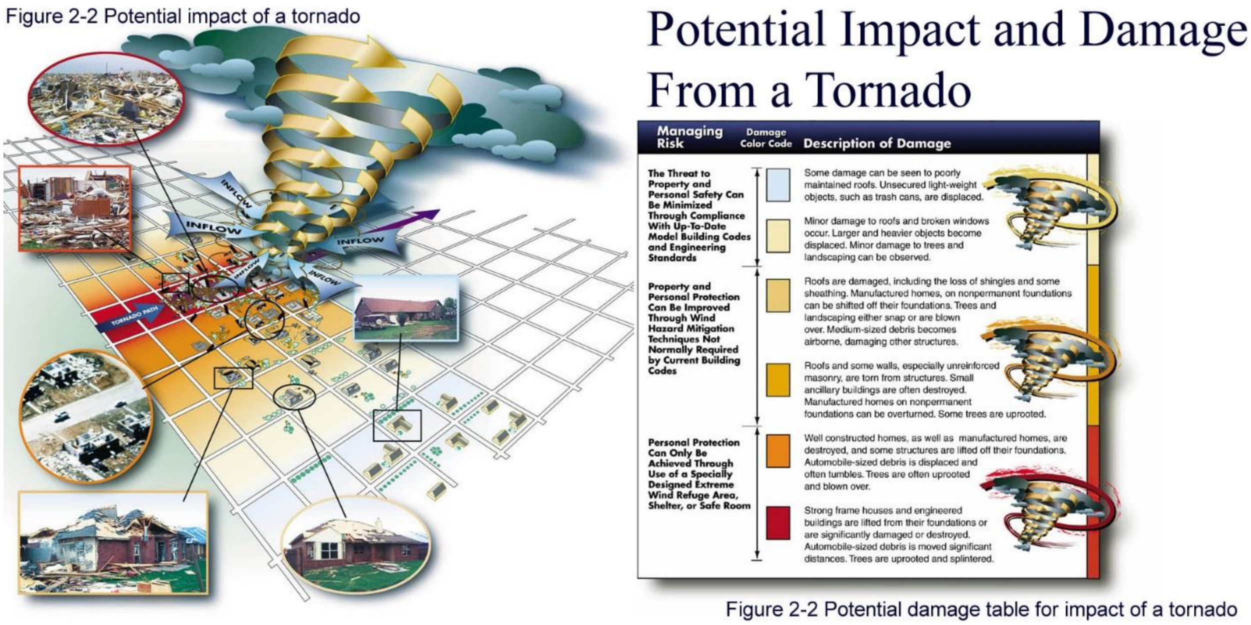


Source: FEMA

Tornadoes

Tornadoes and funnel clouds can also occur during these types of severe storms. Tornadoes are another severe weather hazard that, though rare, can affect anywhere within the Plumas County Planning Area, primarily during the rainy season in the late fall and early spring. Tornadoes form when cool, dry air sits on top of warm, moist air. Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 mph, usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist. They can have the same pressure differential across a path only 300 yards wide or less as 300-mile-wide hurricanes. Figure 4-27 illustrates the potential impact and damage from a tornado.

Figure 4-27 Potential Impact and Damage from a Tornado



Source: FEMA: Building Performance Assessment: Oklahoma and Kansas Tornadoes

Tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, the majority of injuries and deaths generally result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Agricultural crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying necessary emergency response. The HMPC also noted that tornado associated with fire conditions have now been documented in Plumas County as well.

Location and Extent

Tornadoes, while rare, can occur at locations in the lower elevations County. Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis and better correlation between damage and wind speed. It is also more precise because it considers the materials affected and the construction of structures damaged by a tornado. Table 4-26 shows the wind speeds associated with the original Fujita scale ratings and the damage that could result at different levels of intensity. Table 4-27 shows the wind speeds associated with the Enhanced Fujita Scale ratings.

Table 4-26 Original Fujita Scale

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/f-scale.html

Table 4-27 Enhanced Fujita Scale

Enhanced Fujita (EF) Scale	Enhanced Fujita Scale Wind Estimate (mph)
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	Over 200

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/ef-scale.html

It is difficult to predict a tornado or the conditions that preclude a tornado far in advance. Tornadoes can strike quickly with very little warning. In California it is rare for tornadoes to exceed EF3 magnitude. Most tornadoes that touch down are not long lived.

Past Occurrences

Disaster Declaration History

There have been no past federal or state disaster declarations due to high winds or tornadoes, according to Table 4-4.

NCDC Events

The NCDC data recorded 92 high wind incidents for Plumas County since 1955. No tornado events were recorded. A summary of these events is shown in Table 4-28. More detail on these events can be found below the table. Due to the high number of high wind events, only those events that were identified as causing damages in the County were included.

*Table 4-28 NCDC High Wind and Tornado Events in Plumas County 1955-9/30/2019**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
High Wind	88	0	0	1	0	$2,245,500	$0
Strong Wind	2	0	0	0	0	$25,100	$0
Thunderstorm Wind	2	0	0	0	0	$675,000	$0
Total	**92**	**0**	**0**	**1**	**0**	**$2,945,600**	**$0**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Plumas County

November 21, 1998 – High winds blew over tractor-semitrailer on Hwy 395 north of Reno. Winds estimated between 55-60kts. No serious injuries reported. $1,000 in damages were reported.

February 6, 1999 – Winds estimated to be over 60 mph causing roof damage to homes in Pittville. $2,000 in damages were reported.

February 18, 1999 – Semi tractor-trailer blown over on Highway 395 near Janesville, causing $5,000 in damages. No injuries reported.

November 7, 2002 – A storm spotter reported scattered property damage from strong winds estimated at over 80 mph. Most damage occurred on the west side of Sierra Valley in eastern Sierra County, CA. In addition to numerous downed trees, two barns were destroyed, one damaging a combine. Falling tree limbs damaged several parked vehicles and buildings in the towns of Sierraville and Clio. $150,000 in damages were reported.

December 26, 2006 – Wind gusts estimated at 70 knots (80 mph) knocked containers off of a train near Beckwourth, causing $50,000 in damages.

January 4, 2008 – A 75 mph wind was reported at the Pike County Lookout RAWS automated weather staion, which is 2 miles southeast of Brush Creek Reservoir. Numerous buildings were damaged due directly to the wind and/or to flying debris and falling trees and branches. Power was out to hundreds of customers for up to seven days. $114,000 in damages were reported.

March 12, 2010 – Wind brought a tree and power lines down near the intersection of Almanor Drive and Pole Line Road.

March 2, 2012 – Wind damage was focused on Lake Almanor Peninsula and Lake Almanor West with reports of trees into 3 homes, downed power lines, a propane release and other damages. Major damage was done to one home, minor damage to 2 other homes on the Peninsula. Three vehicles were damaged including a Sheriff Deputy patrol car. Many residents suffered mud and debris problems in yards and driveways. Highway 32 was closed near the causeway due to a debris flow across the roadway.

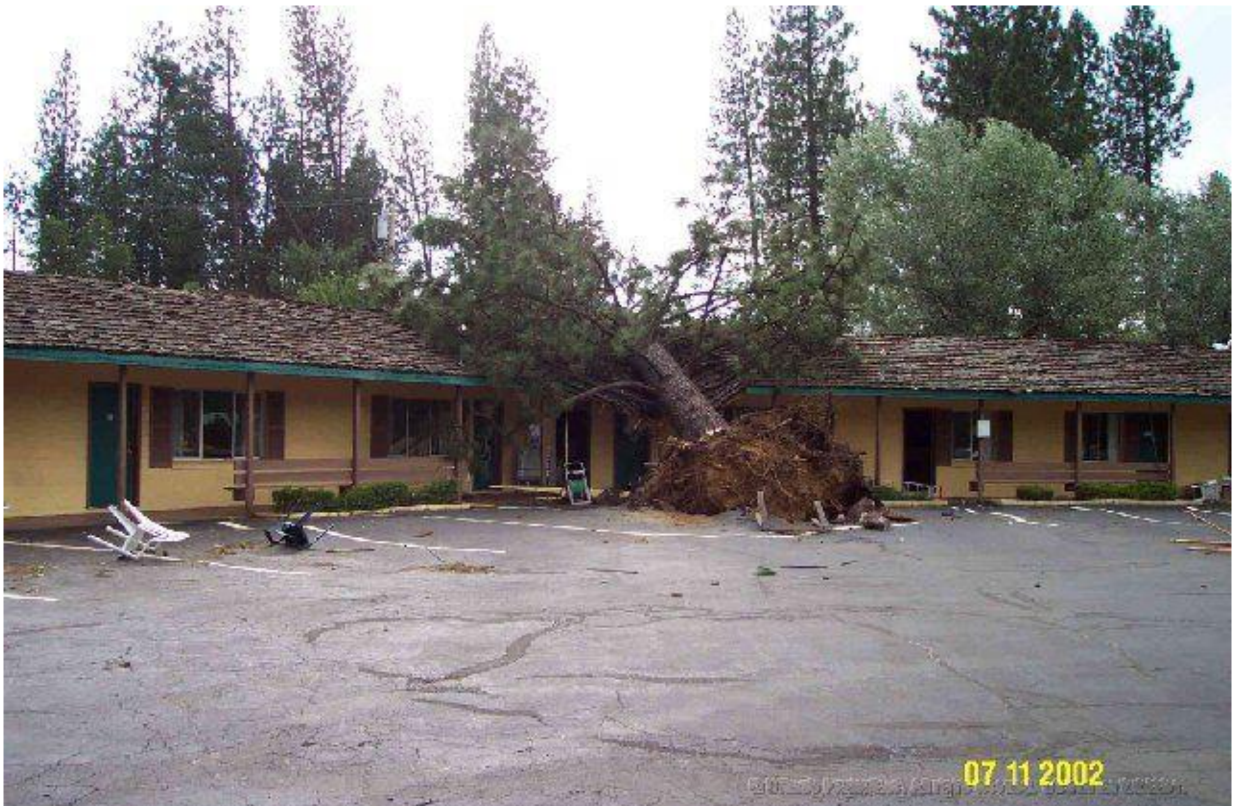
June 3, 2015 -Wind brought a tree and power lines down near the intersection of Almanor Drive and Pole Line Road. Wind damage was focused on Lake Almanor Peninsula and Lake Almanor West with reports of trees into 3 homes, downed power lines, a propane release and other damages. Major damage was done to one home, minor damage to 2 other homes on the Peninsula. Three vehicles were damaged including a Sheriff Deputy patrol car. Many residents suffered mud and debris problems in yards and driveways. Highway 32 was closed near the causeway due to a debris flow across the roadway.

HMPC Events

HMPC also noted the following events:

In **2002**, a microburst occurred in Plumas County. This caused large amounts of damage throughout the County. In all, 122 buildings were damaged. 32 had minor damage, 40 had moderate damage, and 50 had severe damage. Damages to a motel from this event can be seen in Figure 4-28. Total initial damage estimates in the County exceeded $3 million.

Figure 4-28 Damage to Motel from Tree Felled during Microburst in 2002



Source: Plumas County

December 10, 1995 – A member of the HMPC from Viera Ranch noted gale force winds. The Ranch lost parts of the well house roof. Other damages were reported in Quincy.

July 11, 2002 – After a day with 109°F highs, a microburst occurred in Quincy. Damage estimates were unavailable. No injuries or deaths were reported.

February 5th to 7th, 2015 – Heavy rains were accompanied by high winds. Gusts over 45 mph were recorded. Many trees were blown down, and power lines were downed.

July 3, 2015 – The Lake Almanor area was hit with high winds. Wind which toppled trees seemed to cause the biggest losses (in terms of cost). Figure 4-29 shows a house suffering the most damage located on the Lake Almanor peninsula. Based only on observations, this looks to be significant damage and could total $250,000 by itself. Two other houses were damaged on the west shore, but these were much less significant perhaps totaling $75,000. Three vehicles were damaged including a Sheriff Deputy patrol car. Total replacement cost could be another $100,000. Many residents suffered mud and debris problems in yards and driveways, but these were not always reported and not easy to tally for damage estimates. A few of the larger incidents may total $100,000, bringing the total for the event just over $500,000.

Figure 4-29 Plumas County – 2015 Wind Event Damage

January 7th and 8th, 2017 – Heavy rains and winds caused issues in the County. 6.12 inches rain fell and were accompanied by high winds. This knocked out power in areas of the County.

Likelihood of Future Occurrence

Highly Likely/Unlikely – Based on NCDC data and HMPC input, 99 wind incidents over a 65-year period (1955-2019) equates to a severe wind event every year. High winds are a well-documented seasonal occurrence that will continue to occur annually in the Plumas County Planning Area. Tornadoes tend to be rare in the County, and warrant a likelihood of future occurrence rating of unlikely.

Climate Change and High Winds

According to the CAS, while average annual rainfall may increase or decrease slightly, the intensity of individual thunderstorm events is likely to increase during the 21st century. This may bring stronger thunderstorm winds. The CAS does not discuss non-thunderstorm winds.

Vulnerability Assessment

Vulnerability—Medium

Plumas County is subject to potentially destructive straight-line winds and tornadoes. High winds are common throughout the area and can happen during most times of the entire year and outside of a severe storm event. Tornadoes are rare. Straight line and tornadoes winds are primarily a public safety and economic concern. Structures, agriculture (crops and livestock), and the citizens of the County are at risk to high winds and tornadoes.

Impacts

Windstorms and tornadoes can cause damage to structures and power lines which in turn can create hazardous conditions for people. Debris flying from high wind or tornado events can shatter windows in structures and vehicles and can harm people that are not adequately sheltered.

Impacts from straight line winds and tornadoes include:

- Increased wildfire risk
- Increased chance of PSPS event
- Erosion (soil loss)
- Dry land farming seed loss
- Windblown weeds
- Downed trees
- Downed crops
- Power line impacts and economic losses from power outages
- Occasional building damage, primarily to roofs

Campers, mobile homes, barns, and sheds and their occupants are particularly vulnerable as windstorm events in the region can be sufficient in magnitude to overturn these lighter structures. Livestock that may be contained in these structures may be injured or killed, causing economic harm to the rancher who owns both the structure and the livestock. Overhead power lines are vulnerable and account for the majority of historical damages. State highways can be vulnerable to high winds and dust storms, where high profile vehicles may be overturned by winds and lowered visibility can lead to multi-car accidents. The greatest threat to Plumas County from wind is not from damage from the winds themselves, but from the spread of wildfires during windy days, and now from the periodic PSPS events.

Future Development

Future development projects should consider windstorm and tornado hazards at the planning, engineering and architectural design stage with the goal of reducing vulnerability. Utilities at risk to high winds should be undergrounded as new facilities are improved or added. Whether high winds and tornadoes will occur, where, when, and of what intensity are all factors that evolve over the days and hours before they form and after they do. Improved weather forecasts coupled with new information technologies, including social media, has resulted in an increasingly large volume of risk information that is available to people when tornadoes and high winds threaten. Development trends in the County are not expected to increase vulnerability to this hazard.

4.3.5. Severe Weather: Winter Storm and Freeze

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

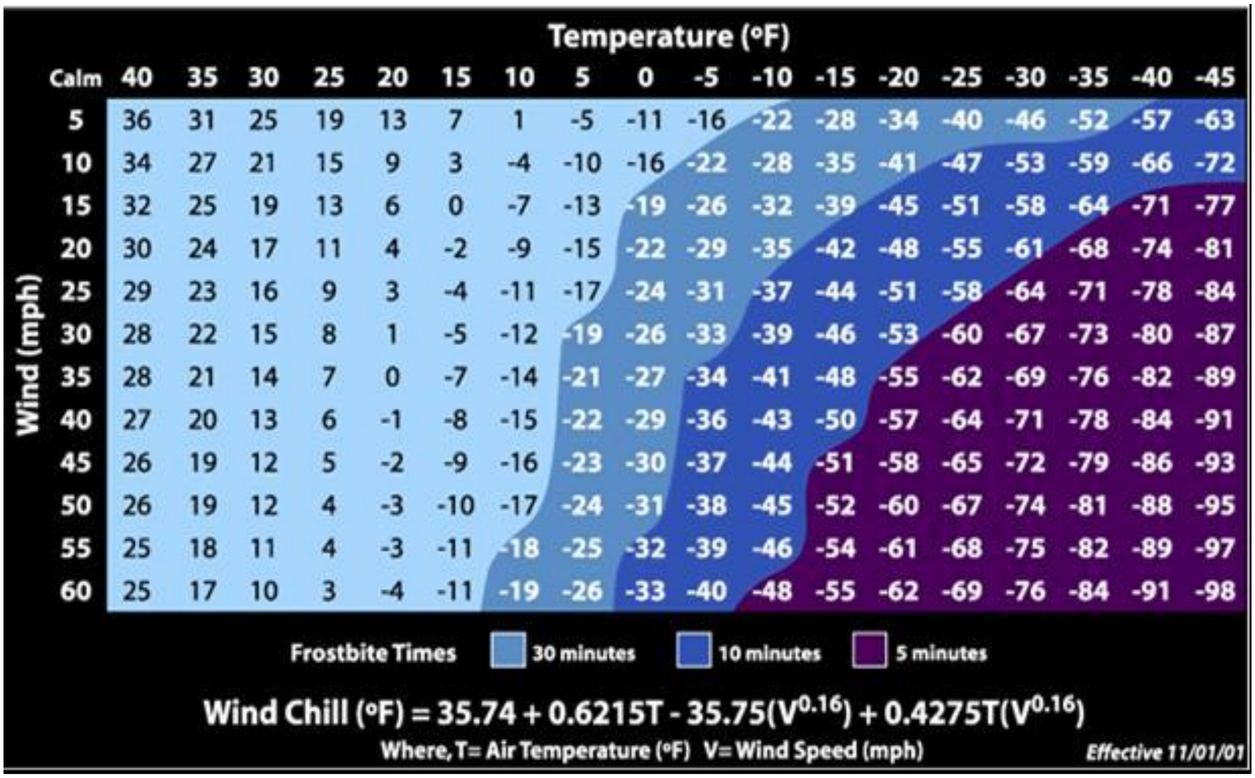
Plumas County is located in the Sierra Nevada region of the State of California. Severe weather affects all areas of Plumas County but differs significantly by region. Throughout areas of the county there are significant variations in the average temperature and amount of precipitation received due to topography.

Storms in the lower elevations of the Plumas County Planning Area are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail.

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

In 2001, the NWS implemented an updated Wind Chill Temperature index (shown in Figure 4-30), which is reproduced below. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-30 Wind Chill Temperature Chart



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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

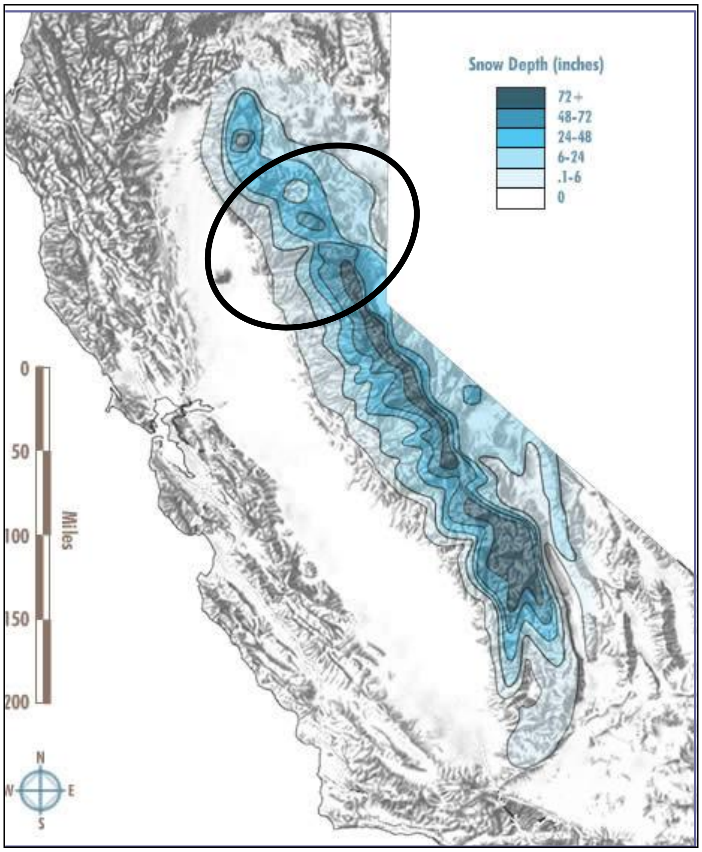
$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) *Effective 11/01/01*

Source: National Weather Service

Snowfall in the Sierras increases with elevation. The lower foothills rarely receive any measurable snow. Middle elevations receive a mix of snow and rain during the winter. Above about 6,000 ft., the majority of precipitation falls as snow. It is not unusual, in some locations, to have ten feet of snow on the ground for extended periods. Figure 4-31 shows the average maximum measured snow depth in the Sierra Nevada for the month of March (the month of greatest average snow depths).

Figure 4-31 Average Maximum Snow Depths of Sierra Nevada Mountains in March



Source: http://www.sierranevadaphotos.com/geography/snow_depth.asp. Retrieved March 2020.

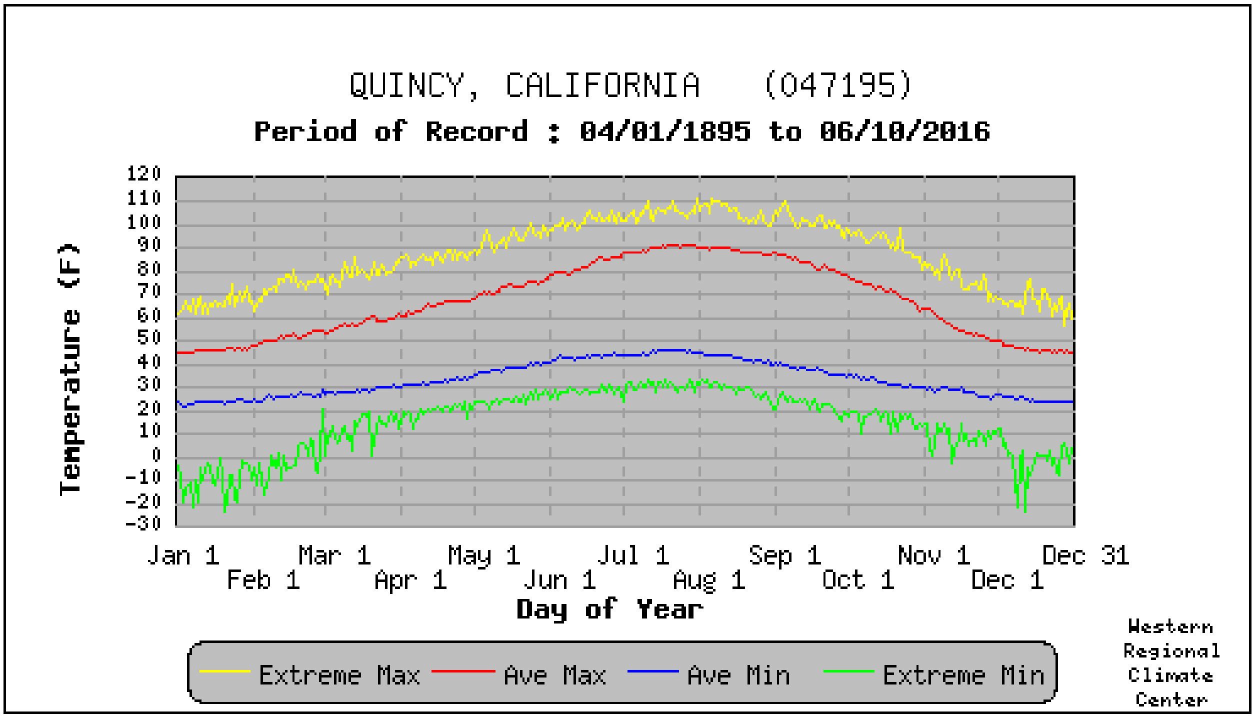
The Plumas County Planning Area does experience snowfall on a seasonal basis, and portions of the County receive an abundance of snow, mostly between the months of November through March. Winter snowstorms in the County, including strong winds and blizzard conditions, can result in localized power and phone outages and closures of streets, highways, schools, businesses, and nonessential government operations. During periods of heavy snow there is also an increase in the number and severity of traffic accidents. People can become isolated in their homes and vehicles and are unable to receive essential services. Snow removal costs can impact budgets significantly. Heavy snowfall during winter can lead to flooding or landslides during the spring if the area snowpack melts too quickly and can also create numerous challenges for emergency responders.

Information on cold and winter storms from the WRCC coop station for the County is shown below.

Plumas County— Quincy Station Weather Station, Period of Record 1895 to 2016

According to the WRCC, in Plumas County monthly average minimum temperatures from November through April range from the low-20s to upper-40s. The lowest recorded daily extreme was -28°F on January 8, 1937. In a typical year, minimum temperatures fall below 32°F on 166.9 days with 1.5 days falling below 0°F. Table 4-29 shows the record low temperatures by month for western Plumas County. Average daily temperatures for Plumas County are shown in Figure 4-32.

Figure 4-32 Plumas County— Daily Temperature Averages and Extremes



Source: Western Regional Climate Center

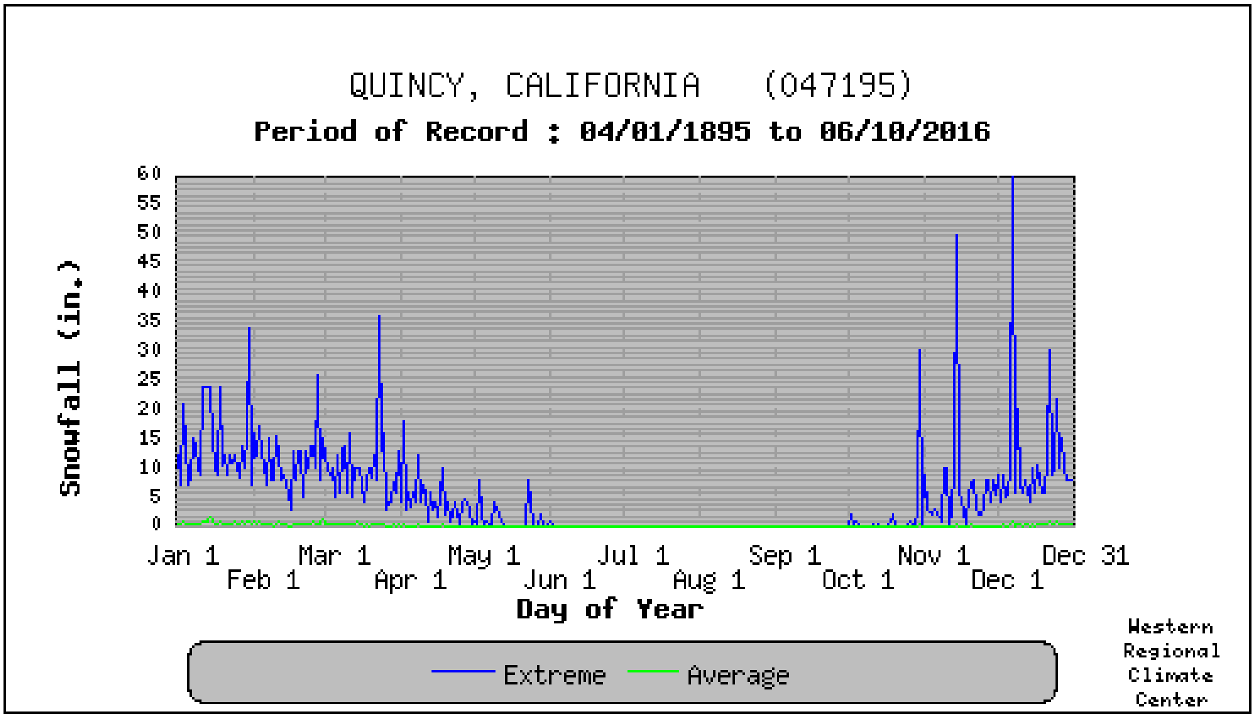
Table 4-29 Plumas County – Record Low Temperatures 1895 to 2016

Month	Record Low	Date	Month	Record Low	Date
January	-28°	1/8/1937	July	23°	7/1/1912
February	-19°	2/13/1949	August	20°	8/31/1910
March	0°	3/20/1952	September	15°	9/28/1972
April	12°	4/6/1982	October	6°	10/27/1917
May	20°	5/7/1984	November	-3°	11/12/1985
June	25°	6/4/1950	December	-24°	12/12/1972

Source: Western Regional Climate Center

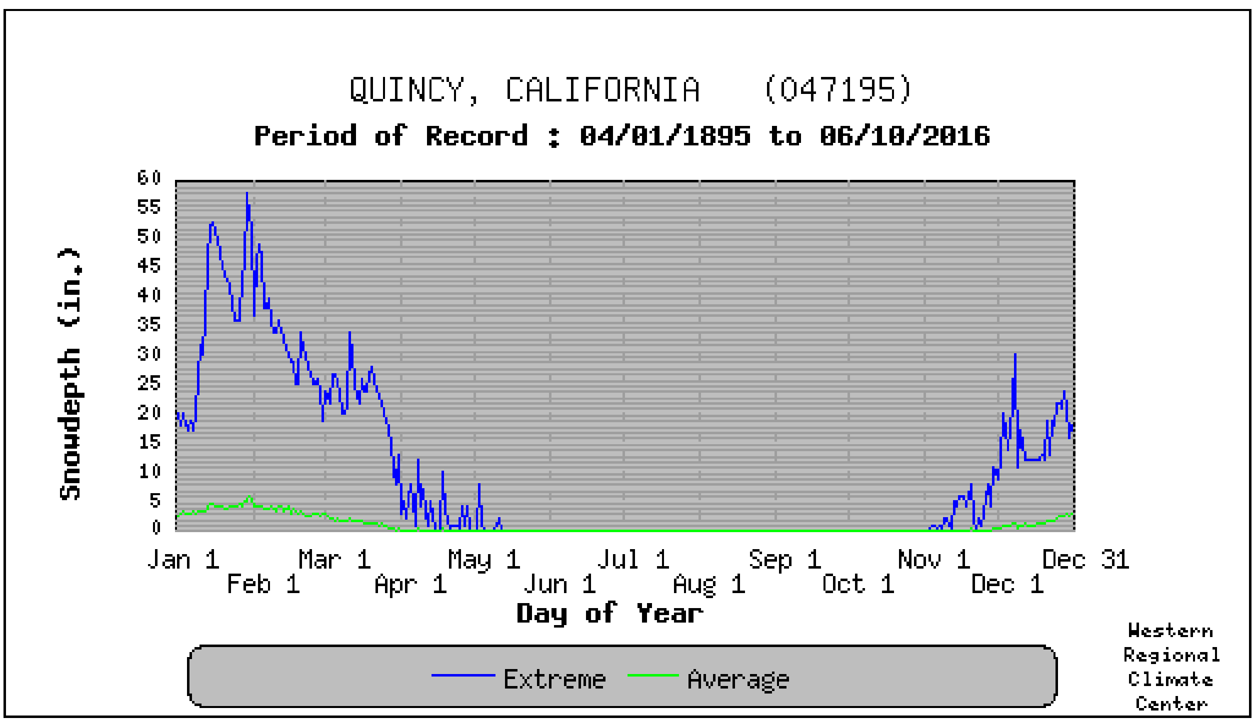
According to the WRCC, average snowfall of the County is 55.1 inches, as shown in Figure 4-33. The highest annual snowfall fell in 1952, when 167.2 inches fell. Highest monthly snowfall accumulation came in January of 1916, when 133.0 inches fell. Average snow depths in January through March can be significant. This can be seen in Figure 4-34.

Figure 4-33 Plumas County—Snowfall Averages and Extremes



Source: Western Regional Climate Center

Figure 4-34 Plumas County—Snow Depth Averages and Extremes



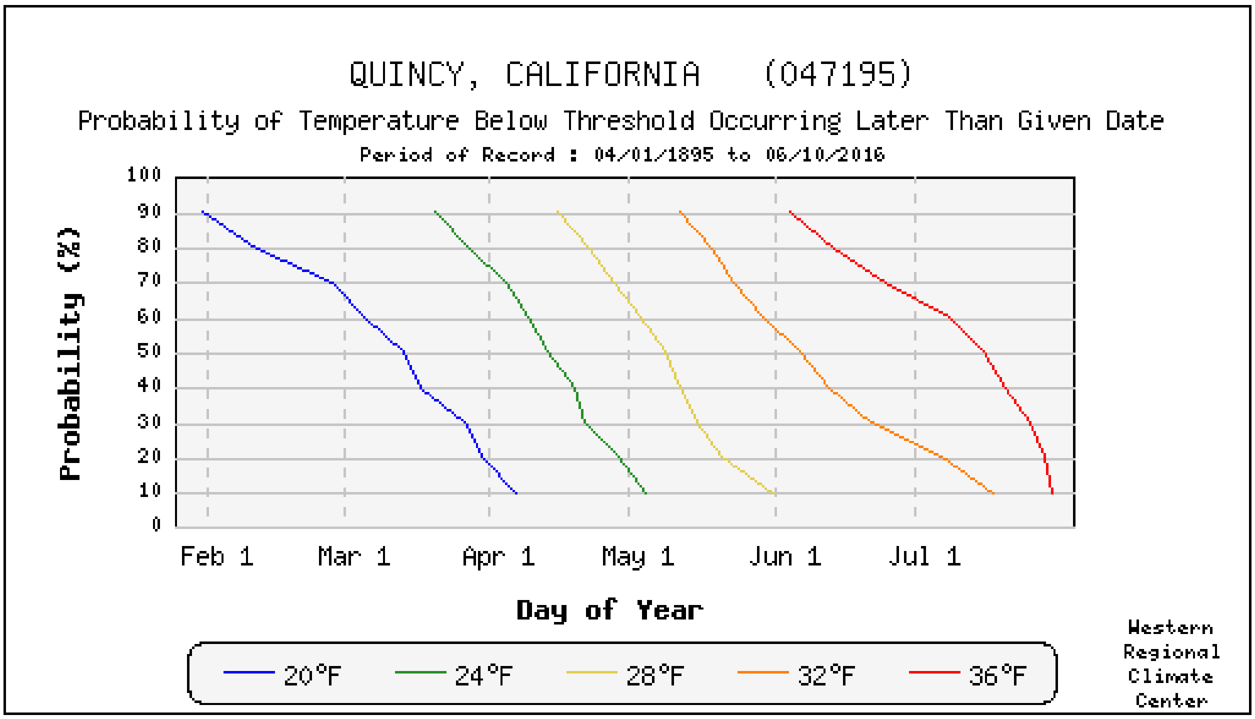
Source: Western Regional Climate Center

Location and Extent

Depending on the elevation of any given area, severe snowstorms are some of the most common extreme weather events that occur in Plumas County. Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting and dangerous wind chills. There have been many extreme snow events that have occurred in Plumas County, most notably in the high elevation regions such as Chester and La Porte. However, lower elevation areas such as Quincy are also susceptible to extreme snow events.

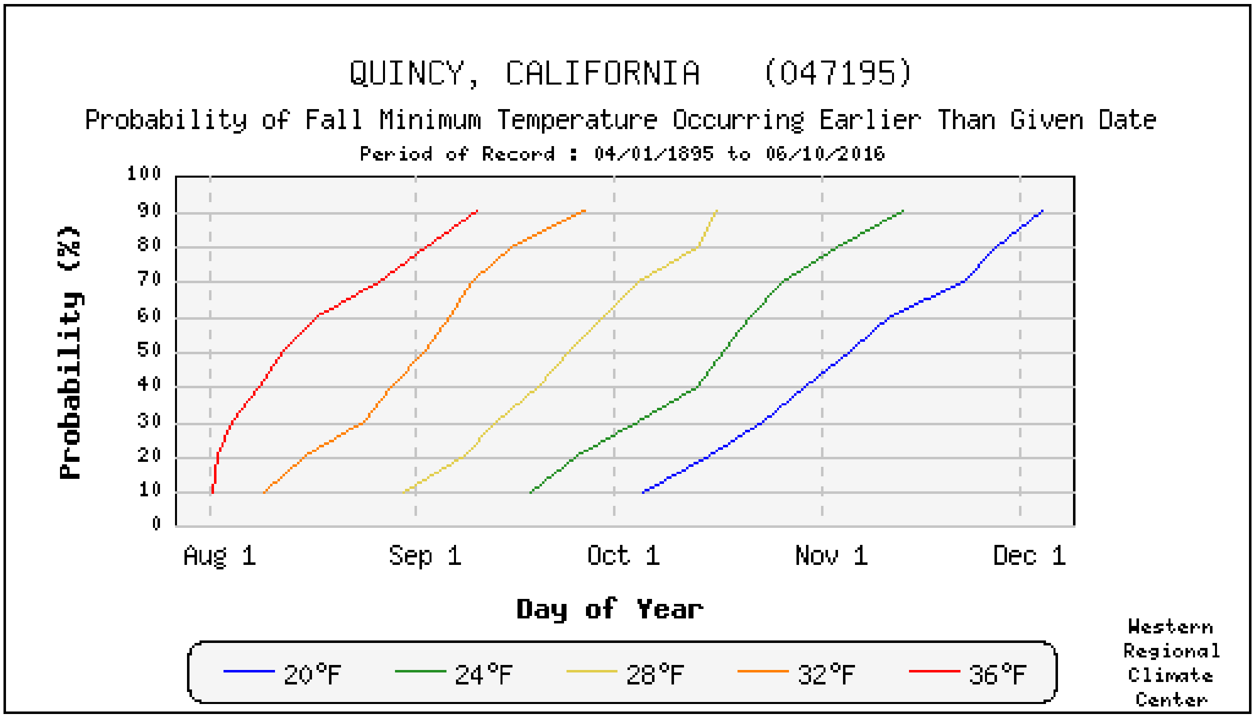
Extreme cold and freeze events occur on a regional basis. Extreme cold can occur in any location of the County. All portions of the County are at risk to extreme cold, with the upper elevations at greater risk. While there is no scale (i.e. Richter, Enhanced Fujita) to measure the effects of freeze, temperature data from the County from the WRCC indicates that there are 166.9 days that fall below 32°F. Freeze has a slow onset and can be generally be predicted in advance for the County. Freeze events can last for hours (in a cold overnight), or for days to weeks at a time. Figure 4-35 and Figure 4-36 show the probabilities in the County of freeze for both spring and fall.

Figure 4-35 Plumas County – Spring Freeze Probabilities



Source: Western Regional Climate Center

Figure 4-36 Plumas County – Fall Freeze Probabilities



Source: Western Regional Climate Center

Past Occurrences

Disaster Declaration History

The County has had no past federal or state disaster declarations for extreme cold and freeze, as shown on Table 4-4.

NCDC Events

The NCDC reports 434 events of past extreme cold and freeze for Plumas County since 1996 as shown on Table 4-30. Due to the large number of events, only events where damages were identified as occurring in the County are delineated below the table.

*Table 4-30 NCDC Winter Storm and Freeze Events for Plumas County 1996-9/30/2019**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Blizzard	1	0	0	0	0	$0	$0
Cold/Wind Chill	3	0	0	0	0	$0	$0
Freezing Fog	1	0	0	0	0	$0	$0
Heavy Snow	280	1	0	0	0	$220,000	$0
Ice Storm	1	0	0	0	0	$0	$0
Winter Storm	117	0	0	0	0	$150,000	$0

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Winter Weather	31	0	0	0	0	$0	$0
Total	**434**	**1**	**0**	**0**	**0**	**$370,000**	**$0**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Plumas County

12/20/1996 – The NCDC has no information about this storm, other than stating that 1 person died due to it.

1/22/1997 - The NCDC has no information about this storm, other than stating that $200,000 in damages occurred.

March 2, 2009 – A cold winter storm brought one to five feet of storm total snow accumulation to the higher mountains of the southern Cascades and to the northern Sierra Nevada. Snow levels dropped to near 4,000 feet during the latter part of the storm. Gusty winds brought reduced visibilities and broad drifting of snow. This system also generated thunderstorms in the Central Valley bringing heavy rain, flash flooding, and other severe effects. Large amounts of hail were reported over Shasta and Glenn Counties, larger than quarter size and more than 6 inches deep in some areas. Flash flooding and slides closed Highway 70 with minor flooding over a number of rural roads. Numerous car accidents from wet roads were reported across the area, as well as trees falling from a combination of wet ground and wind. CHP closed the west bound lane of Highway 70 in the Rich Bar area due to a rockslide resulting from heavy rainfall on a burn area. Storm total snowfall reports: 5 miles WSW of Beckwourth - 24 inches;|5 miles west of Portola, 20 inches; 3 miles northwest of Janesville - 19 inches; 2 miles WNW of Cromberg - 15 inches; and 2 miles northwest of Blairsden - 12 inches. |Passes across the northern Sierra were nearly impassible with many accidents reported. $20,000 in damages were reported from this event.

February 25, 2019 – Heavy snow fell, impacting travel on mountain roads with chain controls and delays. There was 7 inches of new snow at Quincy.

HMPC Events

HMPC also noted the following events:

- Extreme snow events have included up to 60 inches of snow in Quincy and 45 inches of snow in Chester in one month. Two notable snow seasons occurred in 1951-1952, and 1992-1993. During these years the Chester area received a total of 362 inches of snow in 1951-52 and 295 inches in 1992-93.

Figure 4-37 City of Chester 1951-1952 Snow Event

Source: Plumas County

Figure 4-38 1993 Storm Damage of Store in Quincy

Source: KCRA News Report

Figure 4-39 City of Chester 2001 Snow Event

Source: Plumas County

- The winter of **1990** also featured many cold weather incidents and heavy snows. A member of the HMPC from Viera Ranch noted that from February 15 to 18 46 inches of snow fell. Lows in Quincy from December 21 and 22 were -5°F and -8°F, respectively.
- On **June 12 to 14 of 1981**, there were freezes each day in Quincy. A member of the HMPC from Viera Ranch noted that the freeze killed their garden.
- Between **March 28 and April 7 of 1982**, there was high snowfall in the Quincy area. A member of the HMPC from Viera Ranch noted that power was out by March 31, with roads and schools closed in the area.
- The winter of **1989** featured many cold weather incidents and heavy snows. A member of the HMPC from Viera Ranch noted that from January 1 to 3, 46 inches of snow fell. Lows in Quincy from February 5 to February 8 were -8°F, -15°F, -14°F, and -18°F, respectively.
- On **June 15, of 1992**, a late freeze hit. It killed gardens and crops in the area.
- A member of the HMPC from Viera Ranch noted from **December 28 of 1992 to January 9 of 1993** over six feet of snow fell in Quincy.
- A member of the HMPC from Viera Ranch noted on **February 20 and 21 of 1994**, 23 inches of snow fell near Quincy. June 20-24 of that yar also saw lows around 32°F.
- A member of the HMPC from Viera Ranch noted the from **January 4-6 of 1995**, 13 inches of snow fell. Between the 7th and the 15th, 27.85 inches of rain fell as well. This caused flooding in Quincy. Snow fell again in March, and on the 22nd and 23rd, 41 inches of snow fell, cancelling schools and knocking out power. June 16th of 1995 of that year also saw 2.5 inches of snow!
- A member of the HMPC from Viera Ranch noted 19 inches of snow fell between **April 5th and 8th of 1999**.

- A low of 8°F was ween on **February 15th of 2001**.
- A member of the HMPC from Viera Ranch noted heavy snows between January 7th and 11th of 2005. Power was out in the Quincy area on January 11th. Events of frost were noted between **June 3rd and 6th of 2005**.
- June **7th of 2007** saw frost, with damages to gardens and crops in the area reporte.
- Frost was noted on **June 18th, 2014**.

Likelihood of Future Occurrence

Highly Likely—Extreme cold and freeze are likely to continue to occur annually in the Plumas County Planning Area. In a typical year, minimum temperatures fall below 32°F on 166.9 days in the County. This equates to a likelihood of future occurrences being considered highly likely.

Climate Change and Freeze and Snow

According to the CAS, freezing spells are likely to become less frequent in California as climate temperatures increase; if emissions increase, freezing events could occur only once per decade in large portion of the State by the second half of the 21st century. According to a California Natural Resources Report in 2014, it was determined that while fewer freezing spells would decrease cold related health effects, too few freezes could lead to increased incidence of disease as vectors and pathogens do not die off.

Vulnerability Assessment

Vulnerability—Medium

Extreme cold and freeze events happen in Plumas County each year. It can impact both structures and populations in Plumas County. Like most weather events, periods of heavy snow occur on an annual basis in the higher elevations of the County. Snow removal is an ongoing issue in the upcountry areas of the upper elevations of the County. Snow removal is constant.

Impacts

Extreme cold and freeze events happen in Plumas County each year. Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to cold can cause frostbite or hypothermia and can be life-threatening. Vulnerable populations to cold and freeze include:

- Homeless
- Infants and children under age five
- Elderly (65 and older)
- Individuals with disabilities
- Individuals dependent on medical equipment
- Individuals with impaired mobility

Of significant concern is the impact to populations with special needs such as the elderly and those requiring the use of medical equipment. The residents of nursing homes and elder care facilities are especially vulnerable to extreme temperature events. It is encouraged that such facilities have emergency plans or backup power to address power failure during times of extreme cold and freeze. In addition to vulnerable populations, pets and livestock are at risk to freeze and cold.

Impacts to the County as a result of winter snowstorms include damage to infrastructure, utility outages, road closures, traffic accidents, and interruption in business and school activities. Strong winds combined with intense snowstorms can knock down trees, utility poles and power lines. Blowing snow can reduce visibility to only a few feet in areas where there are no trees or buildings, significantly increasing the likeliness of serious vehicle accidents. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Freezing temperatures and ice can cause accidents and road closures and can cause significant damage to the agricultural industry. Also of concern as described above is the impact to populations with special needs such as the elderly and those requiring the use of medical equipment. Delays in emergency response services can be of significant concern. Further, there are economic impacts associated with areas prone to heavy snow. Extreme cold can affect agricultural products and cattle in the County. Freeze damages reduce the values of agricultural crops.

Future Development

Future development built to code should be able to withstand extreme cold and freeze. Pipes at risk of freezing should be mitigated be either burying or insulating them from freeze as new facilities are improved or added. Current County codes provide such provisions for new construction. Vulnerability to extreme cold will increase as the average age of the population in the County shifts resulting in a larger number of senior citizens in the Planning Area. Many of the residents of Plumas County are self-sufficient and accustomed to rural living.

4.3.6. Avalanche

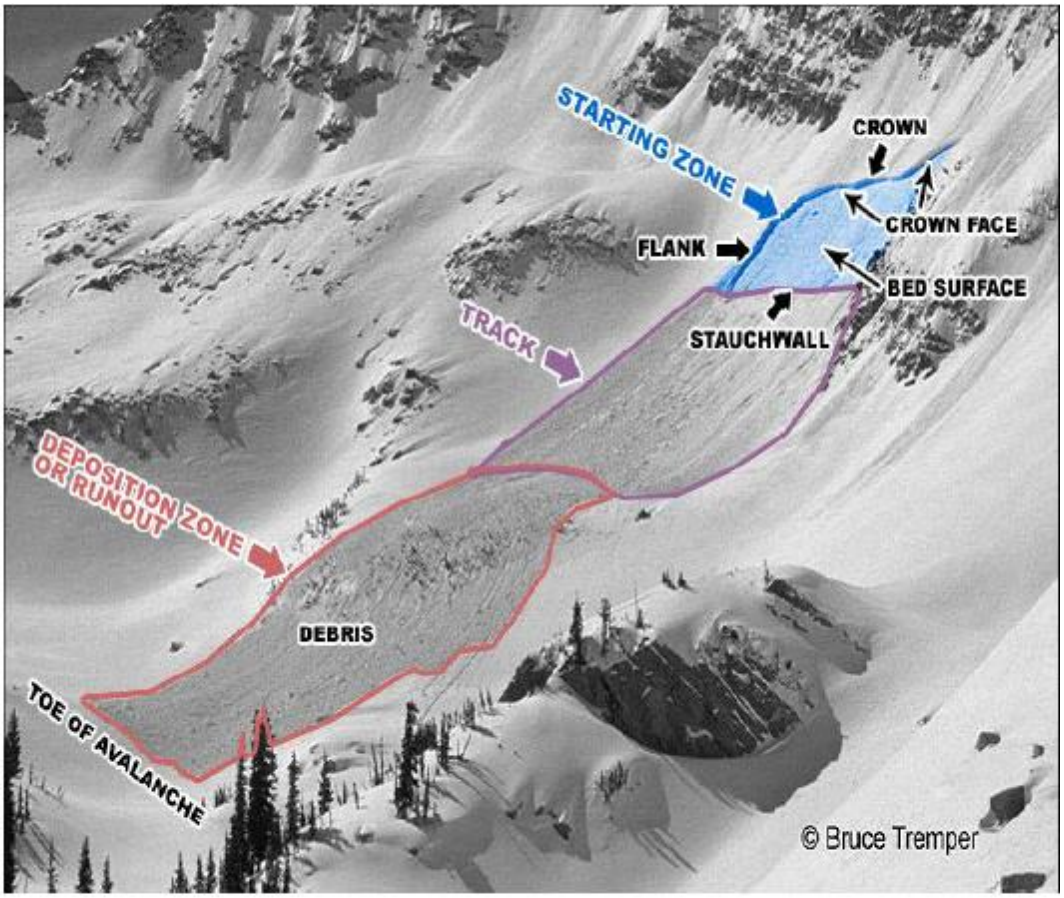
Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

According to the Sierra Avalanche Center, avalanches occur when loading of new snow increases stress at a rate faster than strength develops, and the slope fails. Avalanches are a rapid down-slope movement of snow, ice and debris triggered by ground shaking, sound, or human or animal movement. Avalanches consist of a starting zone where the ice or snow breaks loose, a track which is the grade or channel the debris slides down and a run-out zone where the snow is deposited. This can be seen in Figure 4-40.

Figure 4-40 Avalanche Zones



Source: Sierra Avalanche Center

Critical stresses develop more quickly on steeper slopes and where deposition of wind-transported snow is common. The vast majority of avalanches occur during and shortly after storms. This hazard generally affects a small number of people, such as snowboarders, skiers, and hikers who venture into backcountry areas during or after winter storms. Roads and highway closures, damaged structures, and destruction of forests are also a direct result of avalanches.

Location and Extent

The combination of steep slopes, abundant snow, weather, snowpack, and an impetus to cause movement to create an avalanching episode. Avalanche hazards exist in many of the steeply sloped areas of Plumas County, where combinations of the above criteria occur. The two primary factors impacting avalanche activity are weather and terrain. Large, frequent storms deposit snow on steep slopes to create avalanche hazards. Additional factors that contribute to slope stability are the amount of snow, rate of accumulation, moisture content, wind speed and direction and type of snow crystals. Topography also plays a vital role in avalanche dynamics. Slope angles between 30 to 45 degrees are optimal for avalanches. The risk of avalanches decreases on slope angles below 30 degrees. At 50 or more degrees they tend to produce sluff or loose snow avalanches that account for only a small percentage of avalanche deaths and property damage annually. The HMPC noted that Genesee (and approximately 20 homes) are in an area affected by avalanche.

Speed of onset of avalanche is short, as is the duration of each event. Most avalanches occur during and shortly after storms between January and March. A scale of avalanche danger has been created for North America. This can be found in Table 4-31.

Table 4-31 North American Public Avalanche Danger Scale

Danger Level	Travel Advice	Likelihood of Avalanche	Avalanche Size or Distribution.
5 – Extreme	Avoid all avalanche terrain	Natural and human-triggered avalanches certain	Large to very large avalanches in many areas
4 – High	Very dangerous avalanche conditions. Travel in avalanche terrain not recommended	Natural avalanches likely; human-triggered avalanches very likely	Large avalanches in many areas; or very large avalanches in specific areas
3 – Considerable	Dangerous avalanche conditions. Careful snowpack evaluation, cautious route-finding and conservative decision making essential	Natural avalanches possible; human-triggered avalanches likely	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas
2 – Moderate	Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully; identify features of concern	Natural avalanches unlikely; human-triggered avalanches possible	Small avalanches in specific areas; or large avalanches in isolated areas
1 – Low	Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features	Natural and human-triggered avalanches unlikely	Small avalanches in isolated areas or extreme terrain

Source: National Avalanche Center

Past Occurrences

Disaster Declaration History

There have been no federal or state disaster declarations related to avalanche in Plumas County, as shown in Table 4-4.

NCDC Events

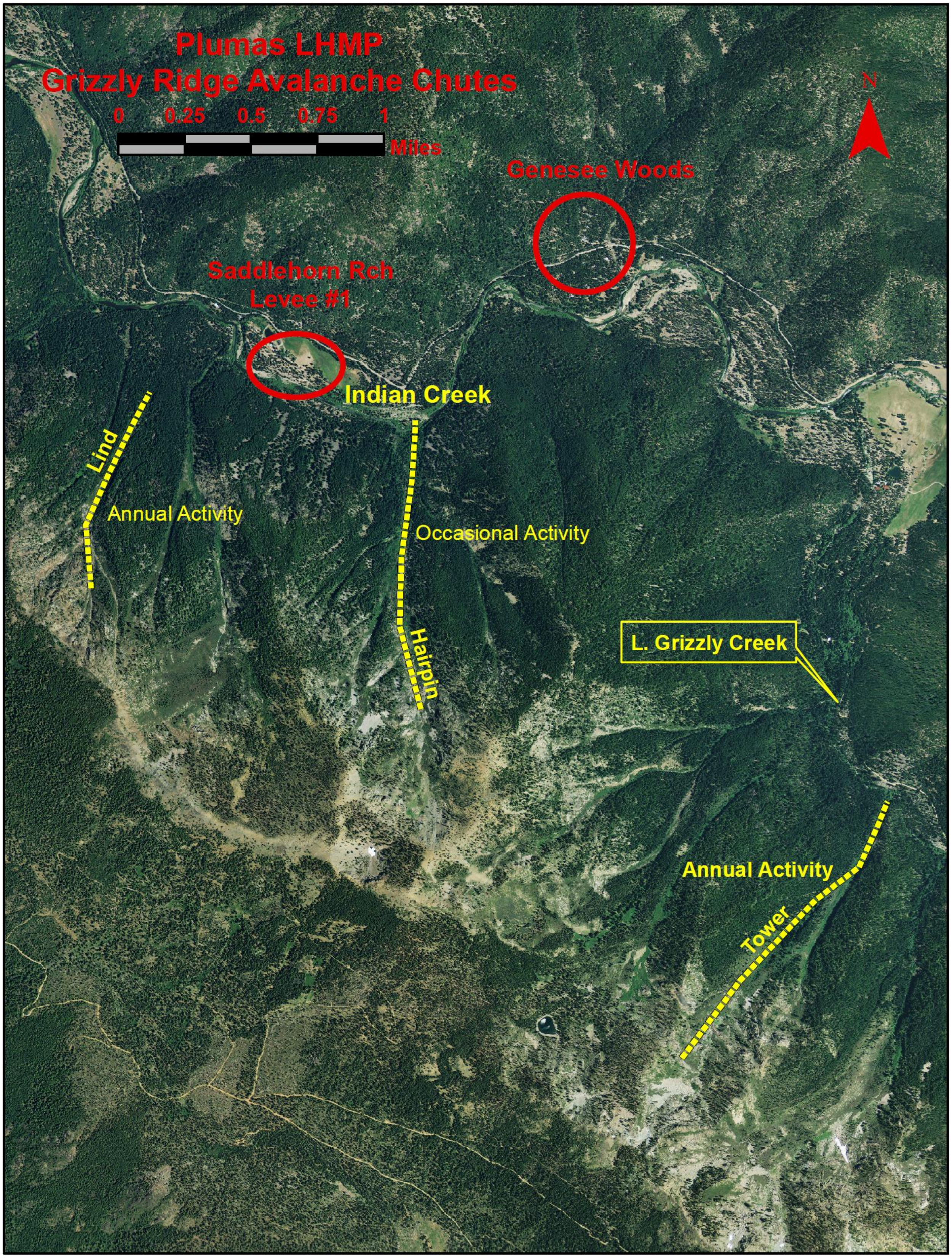
The NCDC database shows no avalanche events in Plumas County since 1993.

HMPC Events

Historically, avalanches occur within the steeply sloped portion of the County between the months of January and March, following snowstorms. Past occurrences of avalanche in the County include:

- The HMPC noted that near Grizzly Ridge in Genessee, avalanches occur with regularity. These have blocked Indian Creek and Little Grizzly Creek and/or Grizzly Creek. There are 4 homes in the area that have their ingress and egress routes blocked. There are numerous avalanche chutes on the northeast and north faces of Grizzly Ridge in the Genesee Valley area. These can be seen in Figure 4-41. The Tower & Lind chutes are active annually, with multiple small to moderate falls per year. The Tower does deliver stream-blocking falls to Little Grizzly Creek (observed by a member of the HMPC in 1983 and 1993). The Lind chute, while very active, does not extend to Indian Creek. The Hairpin chute reportedly blocked Indian Creek in 1952 and 1963 (as reported by members of the HMPC). It last sent snow to Indian Creek in 1995, without blocking the creek. The less active chutes are becoming more overgrown with vegetation with overall reductions in last 30 years in snowfall/avalanches to keep clear.

Figure 4-41 Plumas County – Grizzly Ridge Avalanche Chutes



- An avalanche occurred in the winter of 2012 near Sloat. No injuries or deaths were reported. Timber stock in the avalanche area was damaged, though no damage estimates were available.

Likelihood of Future Occurrence

Highly Likely – Given the topography and amount of snow falling on an annual basis in Plumas County, avalanches will continue to occur. The loss of life due to an avalanche is usually due to people recreating in remote areas at the wrong time. Avalanche warnings are posted after winter storms; therefore, information is available to reduce the risk to those in avalanche prone areas.

Climate Change and Avalanche

According to the CAS, climate change may exacerbate the avalanche hazard in the County. Avalanches stemming from a weather pattern of heavy snowfalls followed by thawing may increase – a dangerous combination that can be expected with climate change.

Vulnerability Assessment

Vulnerability—Low

Avalanches occur when the weight of new snow increases stress faster than strength of the snowpack develops, causing the slope to fail. Avalanche conditions develop more quickly on steeper slopes (located throughout the County) and where wind-blown snow is common. The combination of steep slopes, abundant snow, weather, snowpack, and a trigger to cause movement create avalanches. In Plumas County, there is not significant development in these areas.

Impacts

Avalanche impacts vary, but include risk to property, injury, or death. Avalanches generally affect a few snowboarders, skiers, and hikers who venture into backcountry areas during or after winter storms. Avalanches cause road closures, and can damage structures and forests.

Future Development

The County noted that future development is unlikely to occur in avalanche prone areas.

4.3.7. Climate Change

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate – until recently.

This LHMP Update is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began in the 19th century, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

In Plumas County, the HMPC noted that each year it seems to get a bit warmer. California's Adaptation Planning Guide (APG): Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Plumas County falls within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the majority of water used by the state. Table 4-32 provides a summary of Cal-Adapt Climate Projections for the North Central Valley Region.

Table 4-32 North Sierra Region and Plumas County – Cal-Adapt Climate Projections

Effect	Ranges
Temperature Change, 1990-2100	January increase in average temperatures: 2.5 °F to 4°F by 2050 and 6°F to 7°F by 2100. The largest changes are observed in the southern part of the region. July increase in average temperatures: 4 °F to 5°F by 2050 and 10°F by the end of the century, with the greatest change in the northern part of the region. (Modeled average temperatures; high emissions scenario)
Precipitation	Precipitation decline is projected throughout the region. The amount of decrease varies from 3 to 5 inches by 2050 and 6 inches to more than 10 inches by 2100, with the larger rainfall reductions projected for the southern portions of the region. (Community Climate System Model Version 3 (CCSM3) climate model; high carbon emissions scenario)
Heat wave	Heat waves are defined as five consecutive days over 83 °F to 97°F depending on location. By 2050, the number of heat waves per year is expected to increase by two. A dramatic increase in annual heat waves is expected by 2100, eight to 10 more per year.
Snowpack	Snowpack levels are projected to decline dramatically in many portions of the region. In southern portions of the region, a decline of nearly 15 inches in snowpack levels - a more than 60 percent drop - is projected by 2090. (CCSM3 climate model; high carbon emissions scenario)
Wildfire	Wildfire risk is projected to increase in a range of 1.1 to 10.5 times throughout the region, with the highest risks expected in the northern and southern parts of the region. (Geophysical Fluid Dynamics Laboratory (GFDL) climate model; high carbon emissions scenario)

Source: Cal-Adapt

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the County. There is no scale to measure the extent of climate change. Climate change exacerbates other hazard, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Disaster Declaration History

Climate change has never been directly linked to any declared disasters, as shown in Table 4-4.

NCDC Events

The NCDC does not track climate change events.

Hazard Mitigation Planning Committee Events

While the HMPC noted that climate change is of concern, no specific impacts of climate change could be recalled. HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter. The HMPC also noted that snow levels seem to be higher each year, and the winter rains of 2018 were more intense.

Likelihood of Future Occurrence

Likely – Climate change is virtually certain to continue without immediate and effective global action. According to NASA, 2017 and 2019 were two of the hottest years on record. Without significant global action to reduce greenhouse gas (GHG) emissions, the IPCC concludes in its Fifth Assessment Synthesis Report (2014) that average global temperatures are likely to exceed 1.5°C by the end of the 21st century, with consequences for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges.

Climate Scenarios

The United Nations IPCC developed several GHG emissions scenarios based on differing sets of assumptions about future economic growth, population growth, fossil fuel use, and other factors. The emissions scenarios range from "business-as-usual" (i.e., minimal change in the current emissions trends) to more progressive (i.e., international leaders implement aggressive emissions reductions policies). Each of these scenarios leads to a corresponding GHG concentration, which is then used in climate models to examine how the climate may react to varying levels of GHGs. Climate researchers use many global climate models to assess the potential changes in climate due to increased GHGs.

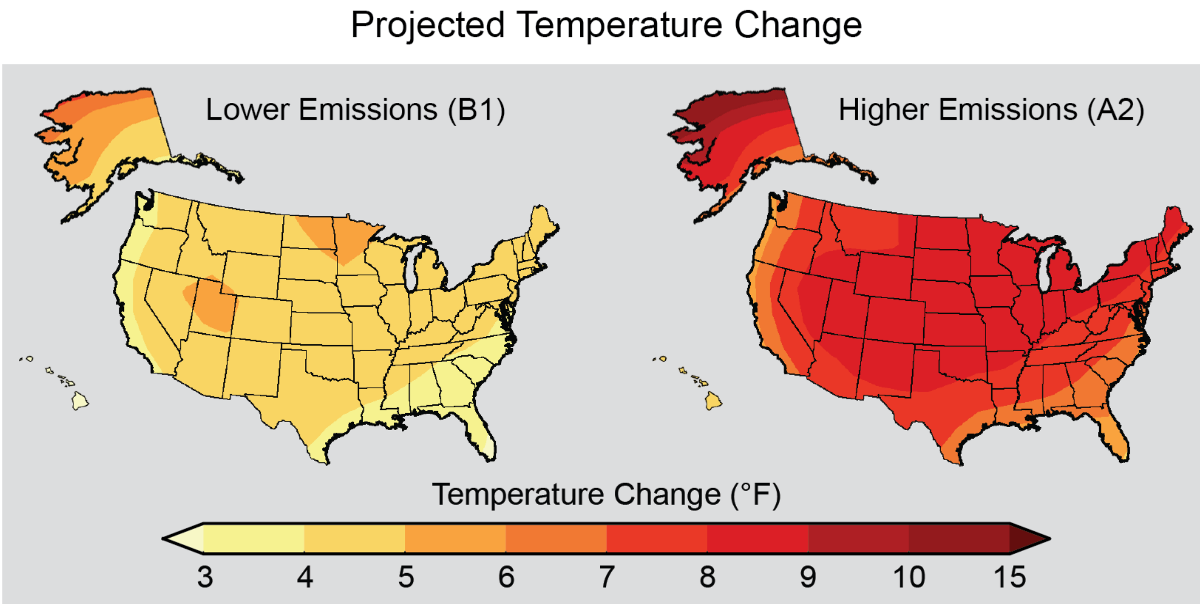
Key Uncertainties Associated with Climate Projections

- Climate projections and impacts, like other types of research about future conditions, are characterized by uncertainty. Climate projection uncertainties include but are not limited to:
  - ✓ Levels of future greenhouse gas concentrations and other radiatively important gases and aerosols,
  - ✓ Sensitivity of the climate system to greenhouse gas concentrations and other radiatively important gases and aerosols,
  - ✓ Inherent climate variability, and
  - ✓ Changes in local physical processes (such as afternoon sea breezes) that are not captured by global climate models.

Even though precise quantitative climate projections at the local scale are characterized by uncertainties, the information provided can help identify the potential risks associated with climate variability/climate change and support long term mitigation and adaptation planning.

Maps show projected change in average surface air temperature in the later part of this century (2071-2099) relative to the later part of the last century (1970-1999) under a scenario that assumes substantial reductions in heat trapping gases and a higher emissions scenario that assumes continued increases in global emissions. These are shown in Figure 4-42.

Figure 4-42 Projected Temperature Change – Lower and Higher Emissions Scenario



Source: National Climate Assessment

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts can result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services.

The CNRA's 2014 CAS delineated how climate change may impact and exacerbate natural hazards in the future, including wildfires, extreme heat, floods, and drought:

- Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in Plumas County and the rest of California, which are likely to increase the risk of mortality and morbidity due to heat-related illness and exacerbation of existing chronic health conditions. Those most at risk and vulnerable to climate-related illness are the elderly, individuals with chronic conditions such as heart and lung disease, diabetes, and mental illnesses, infants, the socially or economically disadvantaged, and those who work outdoors.
- Higher temperatures will melt the Sierra snowpack earlier and drive the snowline higher, resulting in less snowpack to supply water to California users.
- Droughts are likely to become more frequent and persistent in the 21st century.
- Intense rainfall events, periodically ones with larger than historical runoff, will continue to affect California with more frequent and/or more extensive flooding.
- Storms and snowmelt may coincide and produce higher winter runoff from the landward side, while accelerating sea-level rise will produce higher storm surges during coastal storms. Together, these

changes may increase the probability of floods and levee and dam failures, along with creating issues related to saltwater intrusion.

- Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire through fuel hazards and ignition risks. These changes can also increase plant moisture stress and insect populations, both of which affect forest health and reduce forest resilience to wildfires. An increase in wildfire intensity and extent will increase public safety risks, property damage, fire suppression and emergency response costs to government, watershed and water quality impacts, vegetation conversions and habitat fragmentation.

Vulnerability Assessment

Vulnerability—Medium

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. The APG prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change.

The APG: Defining Local and Regional Impacts focuses on understanding the ways in which climate change can affect a community. According to this APG, climate change impacts (temperature, precipitation, sea level rise, ocean acidification, and wind) affect a wide range of community structures, functions and populations. These impacts further defined by regional and local characteristics are discussed by secondary impacts and seven sectors found in local communities: Public Health, Socioeconomic, and equity impacts; Ocean and Coastal Resources; Water Management; Forest and Rangeland; Biodiversity and Habitat; Agriculture; and Infrastructure.

Plumas County Climate Change Impacts

The APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Plumas County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack
- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire

California's APG: Understanding Regional Characteristics provides input on adaptation considerations for the North Sierra Region. As detailed in this guide, climate change has the potential to disrupt many features that characterize the region, including ecosystems health, snowpack, and the tourist economy. Specific regional impacts include the following:

Ecosystems and Biodiversity. Exacerbated by new development in the region, climate change can cause habitats to shift, creating conditions that stress ecosystems and endemic species. Timber practices, also compounded by climate change, has resulted in forests with trees of similar age, lacking snags and underbrush, further reducing the diversity of the habitat. The Sierra's aquatic and riparian systems are one of the most altered habitats in the region through past development and water diversion activities. Continued changes in hydrologic flow regimes and increased temperatures will further stress these systems regional habitats supporting many special-status species.

Snowpack and Flooding. Climate-related decrease in snowpack can have significant consequences on the areas that depend on this water. In addition, a decrease in snowpack can increase impacts from flooding, landslide, and loss of economic base related to a drop in tourism. Recreation and tourism are likely to suffer due to lower water levels in waterways and reservoirs and declining snowpack. This can result in fewer ski days and impacts to hotels, restaurants, and second home development. Increases in flood events can further stress the region and increase flood related impacts and damages.

Wildfire. The North Sierra Region is already challenged through past fire suppression combined with the large number of structures that have been built throughout the WUI areas. Climate change is projected to result in large increases in wildfire frequency and size which will further compound the wildfire problem. In addition, potential impacts following fires, such as heavy rains causing landslide and erosion in post-burn areas can have significant consequences on waterways and entire watersheds.

Public Health, Socioeconomic, and Equity Impact. The foothills of the North Sierra Region show higher ozone levels and increased temperatures causing vulnerable populations to be at greater risk to these issues. In addition to the elderly population found in this region, people who work and play outdoors are also vulnerable.

In addition to the APG, a report from the Proceedings of the National Academy of Sciences (PNAS) states that some of the recent fire impacts may have been attributed to climate change. The PNAS report posits that climate influences wildfire potential primarily by modulating fuel abundance in fuel-limited environments, and by modulating fuel aridity in flammability-limited environments. Increased forest fire activity across the western United States in recent decades has contributed to widespread forest mortality, carbon emissions, periods of degraded air quality, and substantial fire suppression expenditures. Those most vulnerable to high levels of ozone and particulate matter include people who work or spend a lot of time outdoors, such as residents of this region who are employees of the tourist industry. Households eligible for energy utility financial assistance programs are an indicator of potential impacts. These households may be more at risk of not using cooling appliances, such as air conditioning, due to associated energy costs.

Future Development

Plumas County in general could see population fluctuations as a result of climate impacts relative to those experienced in other regions, and these fluctuations could be expected to impact demand for housing and other development. For example, sea level rise may disrupt economic activity and housing in coastal communities, resulting in migration to inland urban areas. Other interior western states may experience an exodus of population due to challenges in adapting to heat even more extreme than that which is projected to occur here. While there are currently no formal studies of specific migration patterns expected to impact the Plumas County region, climate-induced migration was recognized within the UNFCCC Conference of Parties Paris Agreement of 2015 and is expected to be the focus of future studies.

Climate change, coupled with shifting demographics and market conditions, could impact both the location of desired developments and the nature of development. Demand may increase for smaller dwellings that are less resource intensive, more energy efficient, easier to maintain and can be more readily adapted or even moved in response to changing conditions. Compact, mixed-use and infill developments that can help residents avoid long commutes and vulnerabilities associated with the transportation system will likely continue to grow in popularity. The value of open space and pressure to preserve it will likely increase, due in part to its restorative, recreational, environmental and habitat benefits but also for its ability to sequester carbon, help mitigate the accumulation of greenhouse gas in the atmosphere and slow down the global warming trend. Higher flood risks, especially if coupled with increased federal flood insurance rates, may decrease market demand for housing and other types of development in floodplains, while increased risk of wildfires may do the same for new developments in the urban-wildland interface. Flood risks may also inspire new development and building codes that elevate structures while maintaining streetscapes and neighborhood characteristics.

Climate change will stress water resources. Water is an issue in every region, but the nature of the potential impacts varies. Drought, related to reduced precipitation, increased evaporation, and increased water loss from plants, is an important issue in many U.S. regions, especially in the West. Floods, water quality problems, and impacts on aquatic ecosystems and species are likely to be amplified by climate change. Declines in mountain snowpack are important in Plumas County the Sierra Nevada Mountains and across the state, where snowpack provides vital natural water storage and supply. The ability to secure and provide water for new development requires on-going monitoring and assurances. It is recommended that the ability to provide a reliable water supply from the appropriate water purveyor, continue to be in the conditions for project approval, and such assurances shall be verified and in place prior to issuing building permits.

Similarly, protecting and enhancing water supply will also need to be addressed. California's Sustainable Groundwater Management Act (SGMA) will contribute to addressing groundwater and aquifer recharge needs. Good groundwater management will provide a buffer against drought and climate change, and contribute to reliable water supplies regardless of weather patterns. California depends on groundwater for a major portion of its annual water supply, and sustainable groundwater management is essential to a reliable and resilient water system. Protection of critical recharge areas should be addressed across the County in the respective Groundwater Management Plans. Further, these plans should include provisions that guide development or curtail development in areas that would harm or compromise recharge areas.

Climate change will affect transportation. The transportation network is vital to the County and the region's economy, safety, and quality of life. While it is widely recognized that emissions from transportation have impacts on climate change, climate will also likely have significant impacts on transportation infrastructure and operations Examples of specific types of impacts include softening of asphalt roads and warping of railroad rails; damage to roads; flooding of roadways, rail routes, and airports from extreme events; and interruptions to flight plans due to severe weather. Climate change impacts considered in the plan include: extreme temperatures; increased precipitation, runoff and flooding;

increased wildfires; and landslides. Although landslides are not a direct result of climate change, these events are expected to increase in frequency due to increased rainfall, runoff, and wildfire. These events have the potential to cause injuries or fatalities, environmental damage, property damage, infrastructure damage, and interruption of operations. During flood events, these trails serve as secondary transportation facilities when roadways are blocked or otherwise impassible. During Hurricane Sandy, bicycles were one of the primary modes used to deliver food and water to residents stranded in their homes due to flood. Including dual or multi-purpose facilities and amenities as part of all new development provides not just desirable community amenities but critical infrastructure for climate resiliency.

Climate change will affect land uses and planning. Climate change coupled with shifting demographics and market conditions, could impact both the location of desired developments and the nature of development. Demand may increase for smaller dwellings that are less resource intensive, more energy efficient, easier to maintain and can be more readily adapted or even moved in response to changing conditions. Compact, mixed-use and infill developments that can help residents avoid long commutes and vulnerabilities associated with the transportation system will likely continue to grow in popularity. The value of open space, urban greening, green infrastructure, tree canopy expansion and pressure to preserve it will likely increase, due in part to its restorative, recreational, environmental, and habitat, and physical and mental health benefits but also for its ability to sequester carbon and cool the surrounding environment.

Climate change will affect Utilities. California is already experiencing impacts from climate change such as an increased number of wildfires, sea level rise and severe drought. Utility efforts to deal with these impacts range from emergency and risk management protocols to new standards for infrastructure design and new resource management techniques. Utilities are just beginning to build additional resilience and redundancy into their infrastructure investments from a climate adaptation perspective, but have been doing so from an overall safety and reliability perspective for decades. Significant efforts are also being made in those areas that overlap with climate change mitigation such as diversification of resources, specifically the addition of more renewables to the portfolio mix, as well as implementation of demand response efforts to curb peak demand. Efforts are also under way to upgrade the distribution grid infrastructure, which should add significant resilience to the grid as well. Next, they will issue a guidance document that expands upon the vulnerability assessments phase and includes plans for resilience solutions including cost/benefit analysis methodologies. The outcomes of this work will help to inform next steps on how infrastructure, the grid and other related operations will be modified to address climate change. New development will have to adapt and incorporate these new approaches as they evolve. Existing and new development will be affected from impacts that includes not only diminished capacity from all of the utility assets from generation to transmission and distribution, but also the cost consequences resulting from prevention, replacement, outage, and energy loss. These have the potential for greatly impacting not just residential development but commercial and industrial and all utility users.

Addressing Urban Heat Islands and Heat Events. New development will contribute to urban heat island (UHI) impacts and will need to incorporate urban greening methods into all aspects of development; interior and exterior of buildings, surrounding environment and beyond. New development will need to reduce its impacts to the overall UHI impacts affecting the county and surrounding region. On-going and expanding heat wave awareness and assistance will also affect new development. During heat waves in Plumas County, a heat alert is issued and news organizations are provided with tips on how vulnerable people can protect themselves. Programs used by health departments to engage with thousands of block captains to check on elderly and other vulnerable residents, along with public cooling places extending their hours, or local businesses welcoming residents into their businesses for purposes of staying cool are examples of programs and services that will be necessary. Other programs to consider that could further involve hospitals and clinics are operating a "heatline" with nurses or other healthcare professionals ready to assist callers with heat-related health problems. In addition, continued funding for weatherization, reduced utility rates and similar programs that offers assistance to elderly, low-income residents to install roof insulation, solar, trees and cool surfaces to save energy and lower indoor temperatures.

4.3.8. Dam Failure

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

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

Dam failures can also result from any one or a combination of the following causes:

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

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

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

Dams and reservoirs have been built throughout California to supply water for agriculture and domestic use, to allow for flood control, as a source of hydroelectric power, and to serve as recreational facilities. The storage capacities of these reservoirs range from a few thousand acre feet to five million acre-feet. The water from these reservoirs eventually makes its way to the Pacific Ocean by way of several river systems.

The California Department of Water Resources (CA DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. CA DWR, DOSD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property:

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

Location and Extent

According to data provided by Plumas County, CA DWR, and Cal OES, there are 22 dams in Plumas County that were constructed for flood control, storage, treatment impoundments, electrical generation, and recreational purposes that fall under the jurisdiction of the DSOD (jurisdictional dams described above). Of these 22 jurisdictional dams in the County, 2 were rated as extremely high, 14 is rated as High Hazard, 4 as Significant Hazard, and 2 as Low Hazard. Figure 4-43 identifies the dams located in the Plumas County Planning Area. Table 4-33 gives information on each of the dams in the County that fall under DOSD jurisdiction. Table 4-34 shows the dam outside of Plumas County that could affect areas inside Plumas County.

Figure 4-43 Plumas County Dam Inventory

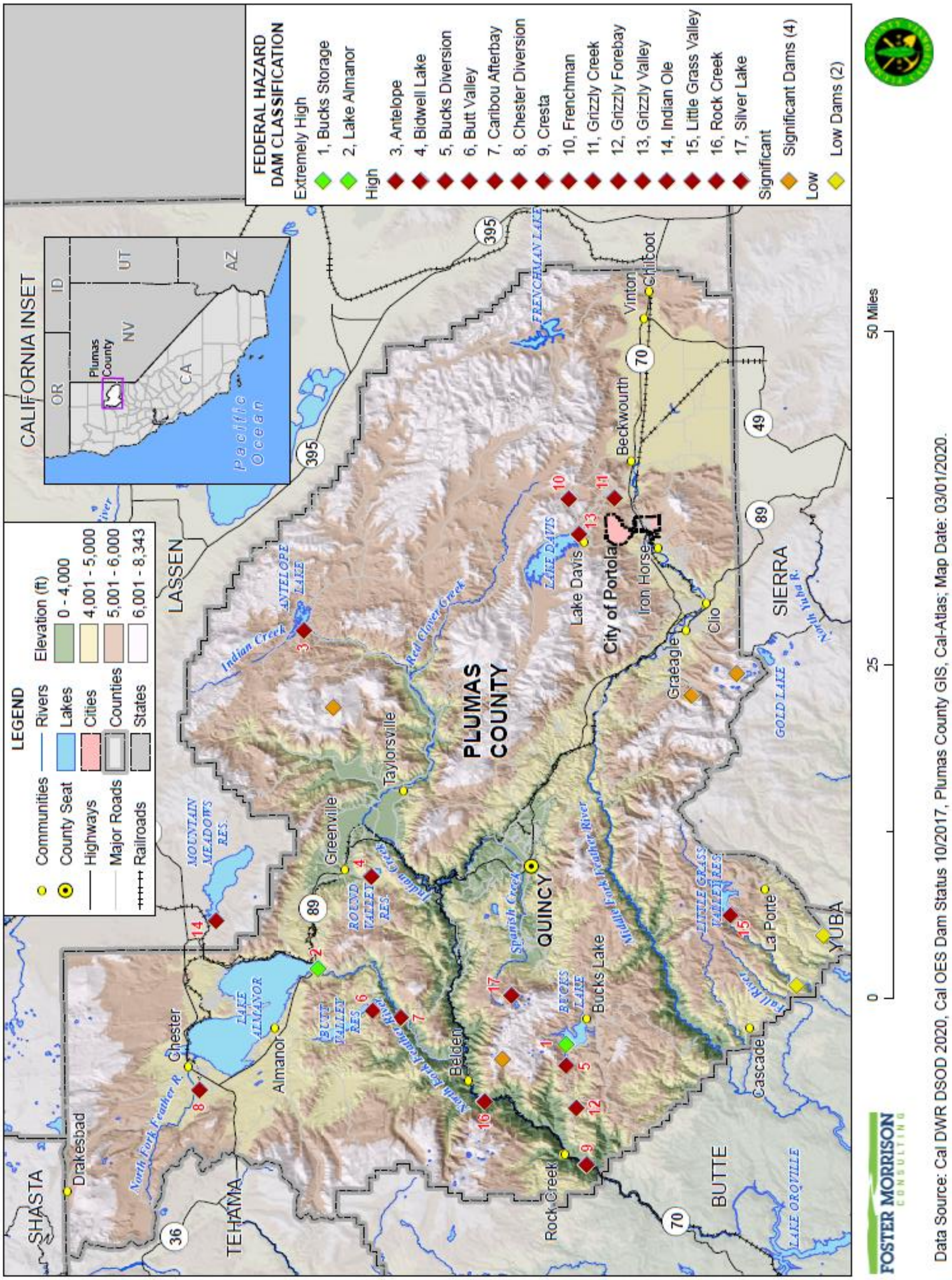


Table 4-33 Plumas County – Inventory of Dams under DSOD Jurisdiction

Name	River/Stream	Hazard Classification	Owner	Dam Type	Capacity (acre-ft_	Structural Height (ft)	Year Built
Antelope	Indian Creek	High	CA DWR	Earth	22,566	113	1964
Bidwell Lake	Canyon Creek	High	Indian Valley Community Services District	Earth and Rock	5,200	35	1865
Bucks Diversion	Brush Creek	High	PG&E	Earth	5,843	99	1928
Bucks Storage	Brush Creek	Extremely High	PG&E	Rockfill	103,000	122	1928
Butt Valley	Butt Creek	High	PG&E	Earth	49,800	106	1924
Caribou Afterbay	North Fork Feather River	High	PG&E	Earth and Rock	2,400	164	1959
Chester Diversion	North Fork Feather River	High	Central Valley Flood Protection Board	Earth	75	47	1975
Cresta	North Fork Feather River	High	PG&E	Gravity	4,400	103	1949
Eureka	Eureka Creek	Significant	Californa Dept. of Parks and Recreation	Earth	220	29	1866
Frenchman	Last Chance Creek	High	CA DWR	Earth	55,477	139	1961
Grizzly Creek	Big Grizzly Creek	High	Private	Gravity	140	39	1915
Grizzly Forebay	Grizzly Creek	High	PG&E	Arch	1,112	92	1928
Grizzly Valley	Big Grizzly Creek	High	CA DWR	Earth and Rock	83,000	115	1966
Lake Almanor	North Fork Feather River	Extremely High	PG&E	Earth	1,308,000	130	1927
Little Grass Valley	South Fork Feather River	High	South Feather Water and Power Agency	Rockfill	74,730	210	1961
Long Lake	Gray Eagle Creek	Significant	Graeagle Water Company	Rockfill	1,478	12	1938
Lower Three Lakes	Feather River	Significant	PG&E	Rockfill	525	32	1928
Rock Creek	North Fork Feather River	High	PG&E	Gravity	4,660	120	1950

Name	River/Stream	Hazard Classification	Owner	Dam Type	Capacity (acre-ft_	Structural Height (ft)	Year Built
Silver Lake	Silver Creek	High	Soper Wheeler Company	Earth and Rock	650	21	1906
Slate Creek Diversion	Slate Creek	Low	South Feather Water and Power Agency	Arch	643	72	1961
South Fork Diversion	South Fork Feather River	Low	South Feather Water and Power Agency	Earth	88	70	1961
Taylor Lake	Tributary of Indian Creek	Significant	Nature Conservancy	Earth	380	14	1929

Source: Cal OES and the National Performance of Dams Program
*One Acre Foot=326,000 gallons

Table 4-34 Dams of Concern Outside Plumas County

Name	River/Stream	Hazard Classification	Owner	Dam Type	Capacity (acre-ft_	Structural Height (ft)	Year Built
Indian Ole (Lassen County)	Hamilton Creek	High	PG&E	Flashboard and Buttress	24,800	26	1924

Source: Cal OES and the National Performance of Dams Program
*One Acre Foot=326,000 gallons

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, dam failure would most probably happen in consequence of the natural disaster triggering the event. However, DOSD assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail: Low, Significant, High, and Extremely High. There is no scale with which to measure dam failure. While a dam may fill slowly with runoff from winter storms, a dam break can have a very quick speed of onset. The duration of dam failure is not long – only as long as it takes to empty the reservoir of water the dam held back. Dam inundation flood geographic extents are discussed in Table 4-39 (for extremely high hazard dams) and Table 4-40 (for high hazard dams) in the flooded acres analysis in the vulnerability assessment of this section.

Past Occurrences

Disaster Declaration History

There have been no disasters declarations related to dam failure in Plumas County, as shown in Table 4-4.

NCDC Events

There have been no NCDC dam failure events in Plumas County.

National Performance of Dams Program Events

The National Performance of Dams Program at Stanford University tracks dam failures. A search of the National Performance of Dams Program database showed no past dam failure events in Plumas County.

Hazard Mitigation Planning Committee Events

The HMPC noted no events of dam failure that have affected the County. There was an event in 2017 where the Bidwell Dam lost some bedrock on the spillway when heavy rains filled the reservoir. It has since been fixed, at a cost of approximately $10,000.

Likelihood of Future Occurrence

Unlikely—No dam failure events have occurred in the County. Thus, based on historical data and input from the HMPC, it is unlikely that major dam failure event will occur in Plumas County.

Climate Change and Dam Failure

Increases in both precipitation and heat causing snow melt in areas upstream of dams could increase the potential for dam failure and uncontrolled releases in Plumas County.

Vulnerability Assessment

Vulnerability—High

Dam failure flooding can occur as the result of partial or complete collapse of an impoundment. Dam failures often result from prolonged rainfall and flooding. The primary danger associated with dam failure is the high velocity flooding of those properties downstream of the dam. A dam failure can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to dam failures is confined to the areas subject to inundation downstream of the facility. Secondary losses would include loss of the multi-use functions of the facility and associated revenues that accompany those functions. Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding.

Impacts

Based on the risk assessment, it is apparent that a major dam failure could have a devastating impact on the Planning Area. Dam failure flooding presents a threat to life and property, including buildings, their contents, and their use. Large flood events can affect crops and livestock as well as lifeline critical utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, and the local and regional economies.

Dams of Concern

As detailed in Table 4-33, the County is most vulnerable to the following 17 dams:

Extremely High Hazard

- Bucks Storage
- Lake Almanor

High Hazard

- Antelope
- Bidwell Lake
- Bucks Diversion
- Butt Valley
- Caribou Afterbay
- Chester Diversion
- Cresta
- Frenchman
- Grizzly Creek
- Grizzly Forebay
- Grizzly Valley
- Indian Ole (Lassen County)
- Little Grass Valley*
- Rock Creek
- Silver Lake

*This dam did not have mapped dam inundation areas

Available dam inundation maps show areas that lie within the potential dam failure inundation areas, as shown in Figure 4-44.

Values at Risk

Dam inundation areas were available for 16 of the 17 dams of concern, as obtained from CA DWR, DSOD and OES, were used as the basis of this dam inundation analysis. Dams were grouped by hazard rating in order to perform analysis. The depth of flooding due to the failure of these dams is unknown.

Methodology and Results

The same methodology was used for both the extremely high hazard and high hazard dam analysis. Plumas County's February 2020 Parcel/Assessor Data, obtained from Plumas County, were used for the County inventory of parcels and values. GIS was used to for analysis on the parcel layer.. The dam inundation areas, obtained from Cal OES and DSOD, were then overlaid on the parcel layer. For the purposes of this analysis, if the dam inundation layer intersected any part of the parcel, the entire parcel was considered to be in the dam inundation area. The parcels were segregated and analyzed in this fashion for the entirety of

Plumas County. Once completed, the parcel boundary layer was joined to the centroid layer and values were transferred based on the identification number in the Assessors database and the GIS parcel layer.

Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the dam inundation areas due primarily to Proposition 13 and to a lesser extent properties falling under the Williamson Act.

Extremely High Hazard Dams

Dam analysis was performed for the mapped extremely high hazard dams in the County with available inundation data. This includes Lake Almanor and Bucks Storage. Figure 4-44 shows the extremely high dam inundation areas of these dams of concern for the County. Figure 4-45 zooms into the Lake Almanor dam inundation area. Figure 4-46 zooms into the Bucks Storage dam inundation area. The depth of flooding due to the failure of a dam is unknown. Table 4-35 the total parcel counts, improved parcel counts, their improved structure and land values in each extremely high hazard dam inundation areas. Table 4-36 breaks down Table 4-35 to show the property uses affected by each dam inundation area. For these tables it should be noted that:

- All dam/inundations originate within Plumas County
- Inundation cannot be summed as the inundations intersect in similar area coverage. By summing, duplication would occur.

Figure 4-44 Plumas County – Extremely High Hazard Dam Inundation Areas

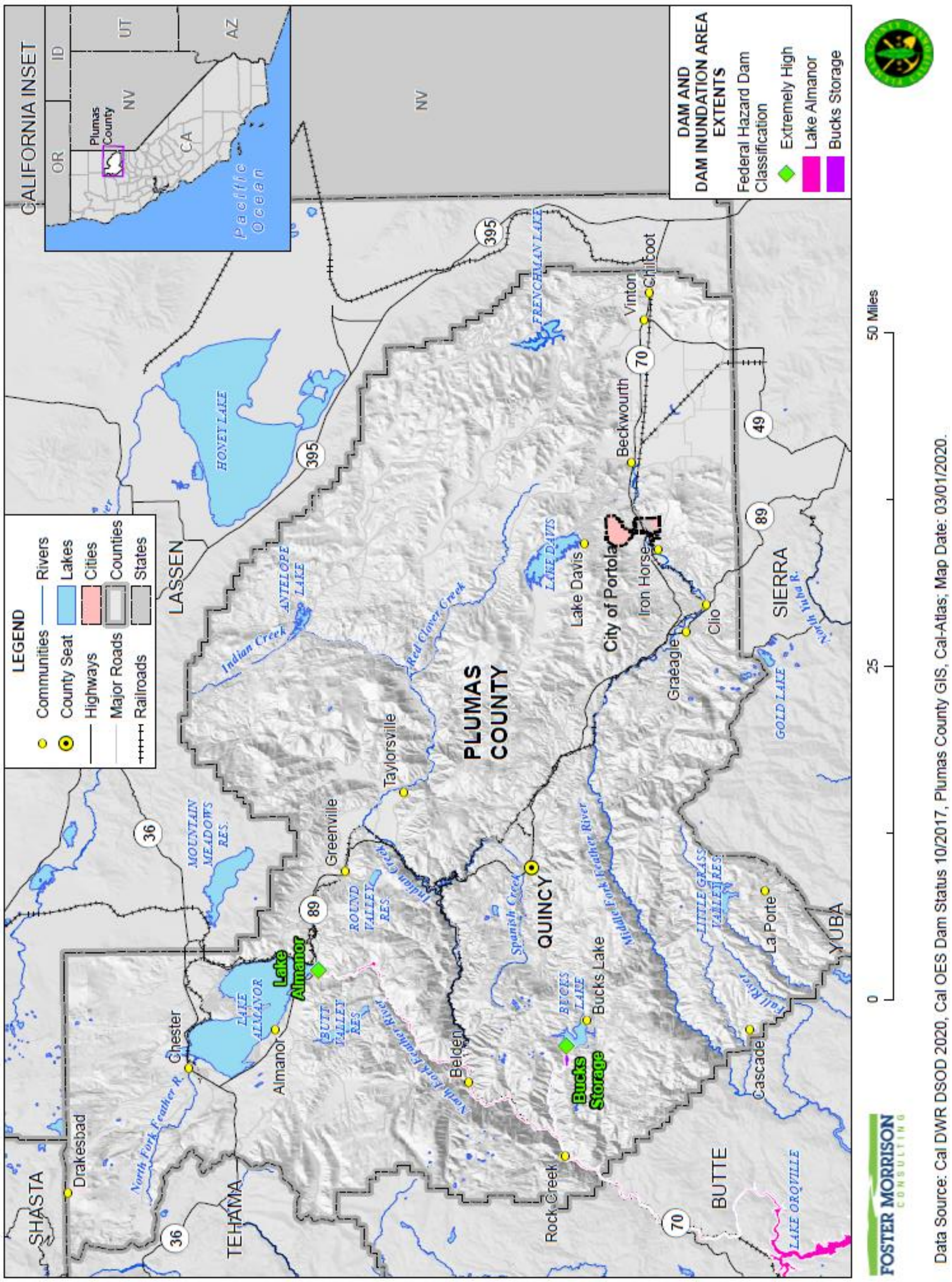


Figure 4-45 Plumas County – Lake Almanor Dam Inundation Areas

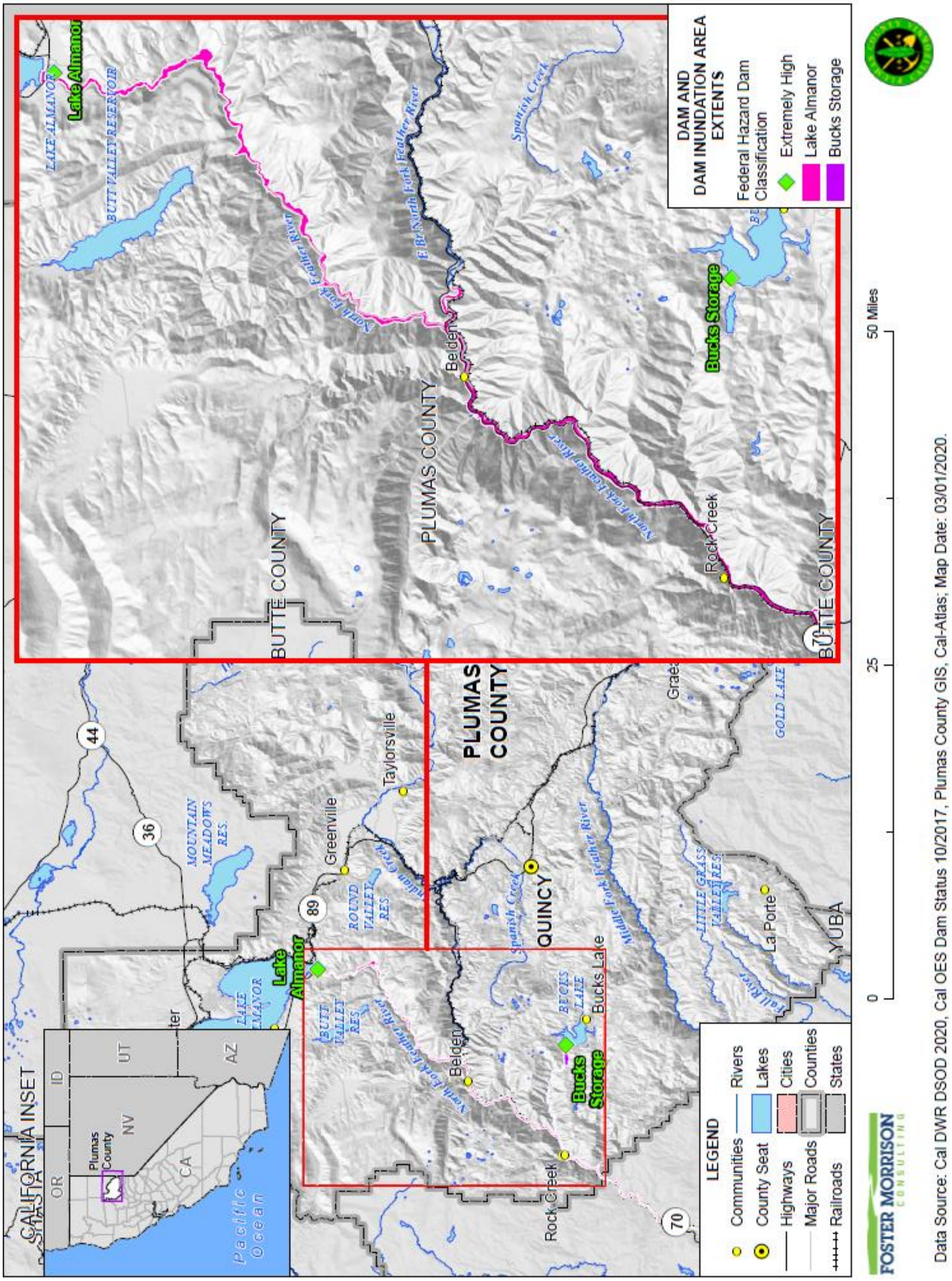


Figure 4-46 Plumas County – Bucks Storage Dam Inundation Areas

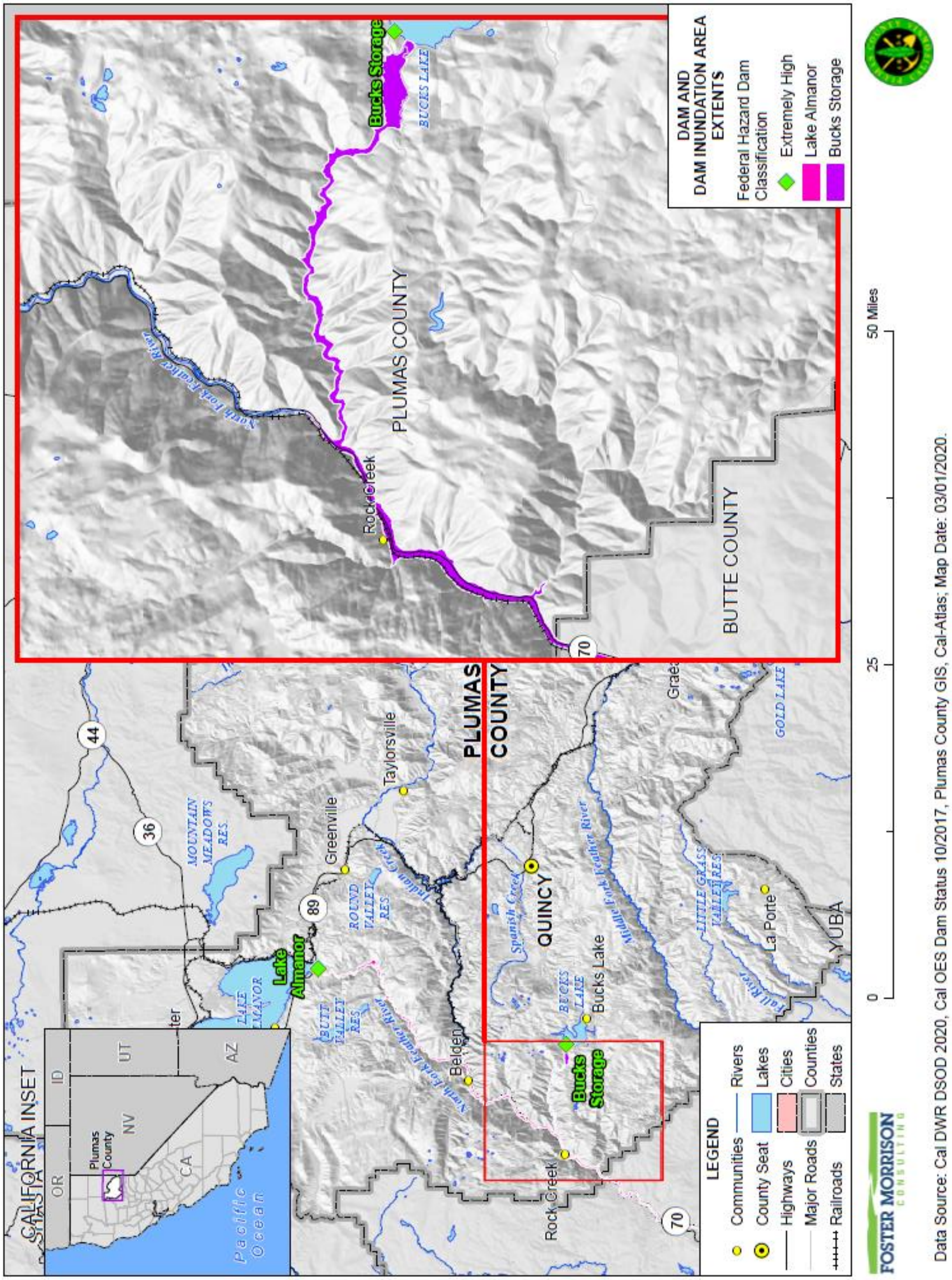


Table 4-35 Plumas County – Summary Count and Value of Parcels in the Extremely High Hazard Dam Inundation Areas

Extremely High Dam Inundation Areas	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Lake Almanor	49	19	$1,444,281	$2,490,148	$43,603	$2,100,702	$6,078,734
Bucks Storage	8	1	$53,508	$29,166	$0	$29,166	$111,840

Source: Plumas County February 2020 Parcel/Assessor's Data, Cal OES

Table 4-36 Plumas County – Count and Value of Parcels in the Extremely High Hazard Dam Inundation Areas by Property Use

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Lake Almanor Dam Inundation Area							
Agricultural	6	0	$185,343	$0	$0	$0	$185,343
Commercial	4	3	$71,064	$1,628,278	$38,296	$1,628,278	$3,365,916
Federal Lands	9	0	$0	$0	$0	$0	$0
Government	2	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	1	0	$3,400	$0	$0	$0	$3,400
Recreational	1	1	$103,358	$82,977	$590	$82,977	$269,902
Residential	22	15	$1,081,116	$778,893	$4,717	$389,447	$2,254,173
ROW/Utilities	4	0	$0	$0	$0	$0	$0
Total	**49**	**19**	**$1,444,281**	**$2,490,148**	**$43,603**	**$2,100,702**	**$6,078,734**
Bucks Storage Dam Inundation Area							
Agricultural	3	0	$52,369	$0	$0	$0	$52,369
Commercial	1	1	$1,139	$29,166	$0	$29,166	$59,471
Federal Lands	2	0	$0	$0	$0	$0	$0
Government	1	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	1	0	$0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0	$0

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
ROW/Utilities	0	0	$0	$0	$0	$0	$0
Total	**8**	**1**	**$53,508**	**$29,166**	**$0**	**$29,166**	**$111,840**

Source: Plumas County 12/31/2018 Parcel/Assessor's Data, Cal OES

High Hazard Dams

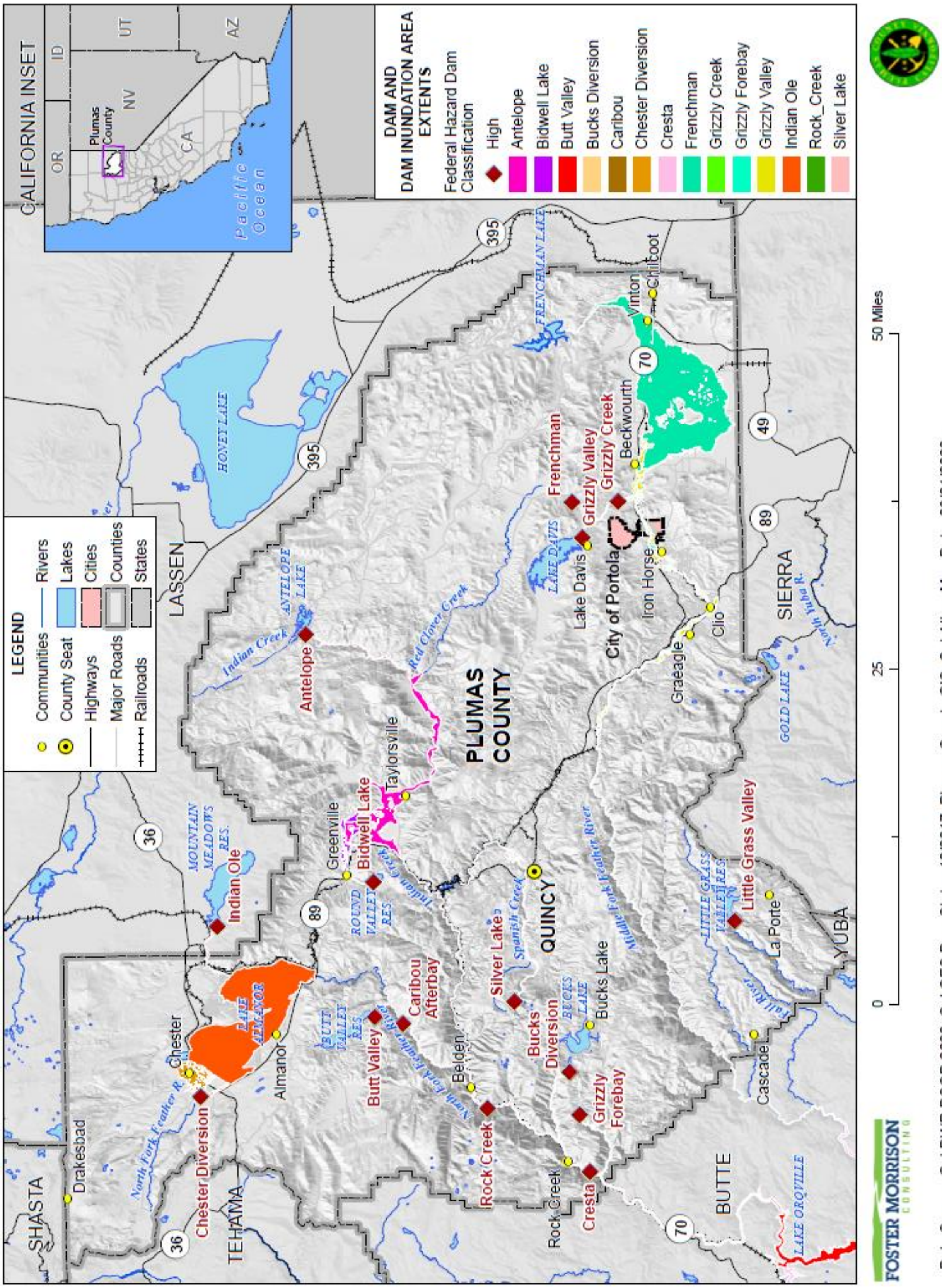
Dam analysis was performed for the mapped high hazard dams in the County with available inundation data. This includes Antelope, Bidwell Lake, Bucks Diversion, Butt Valley, Caribou Afterbay, Chester Diversion, Frenchman, Grizzly Creek, Grizzly Valley, Indian Ole (Lassen County), and Silver Lake. Figure 4-47 shows the dam inundation areas of these dams of concern for the County. Four maps were created to zoom into the areas affected by dam inundation in the County:

- Figure 4-48 show the Bidwell Lake, Butt Valley, Chester Diversion Caribou Afterbay, and Indian Ole dam inundation areas.
- Figure 4-49 show the Antelope and Bidwell Lake dam inundation areas.
- Figure 4-50 show the Butt Valley, Caribou Afterbay, Cresta, Grizzly Forebay, Rock Creek, and Silver Lake dam inundation areas.
- Figure 4-51 show the Bucks Diversion, Frenchman, Grizzly Valley, Lake Davis, and Grizzly Creek dam inundation areas. The depth of flooding due to the failure of a dam is unknown.

Table 4-37 the total parcel counts, improved parcel counts, their improved structure and land values in each high hazard dam inundation areas. Table 4-38 breaks down Table 4-37 to show the property uses affected by each dam inundation area. For these tables it should be noted that:

- Indian Ole is the only dam/inundation that originates outside of Plumas County in Lassen County.
- There are 15 dams classified as High and 14 are analyzed.
  - ✓ Little Grass Valley was not analyzed as no inundation dataset was available.
- Inundation cannot be summed as the inundations intersect in similar area coverage. By summing, duplication would occur.

Figure 4-47 Plumas County – High Hazard Dam Inundation Areas



Data Source: Cal DWR DSOD 2020, Cal OES Dam Status 10/2017, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Figure 4-48 Plumas County – High Hazard Dam Inundation Areas Map 1

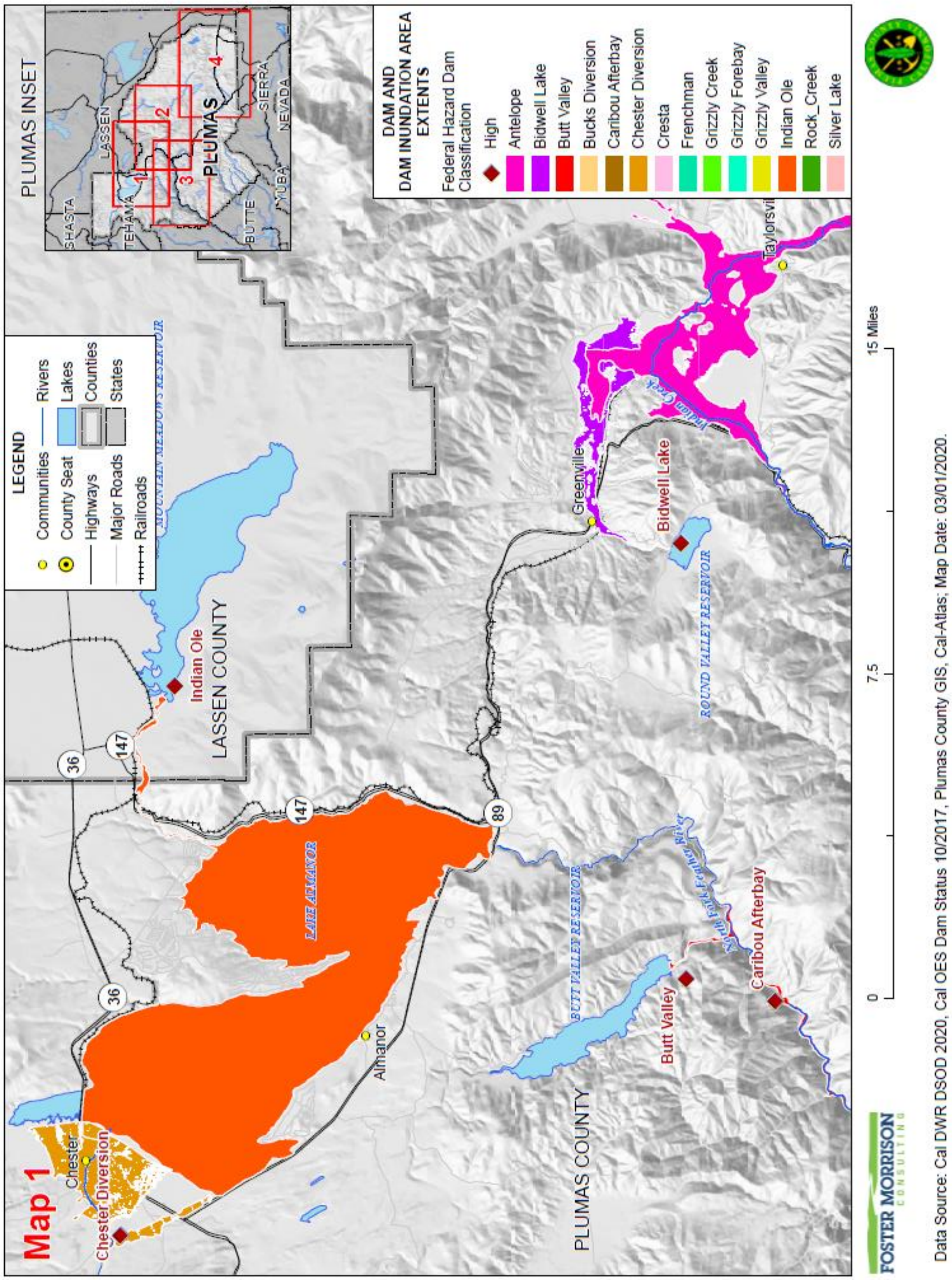


Figure 4-49 Plumas County – High Hazard Dam Inundation Areas Map 2

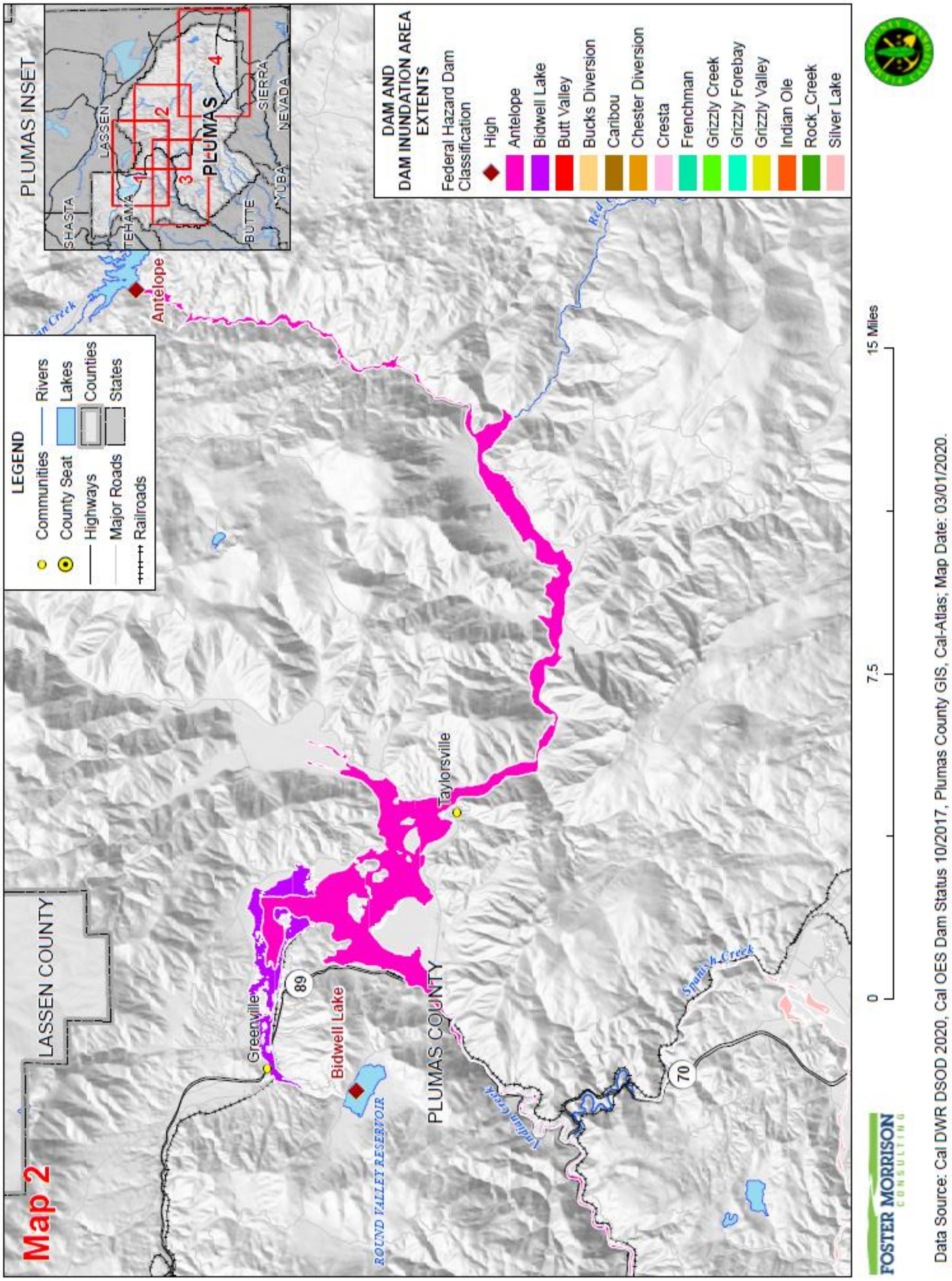


Figure 4-50 Plumas County – High Hazard Dam Inundation Areas Map 3

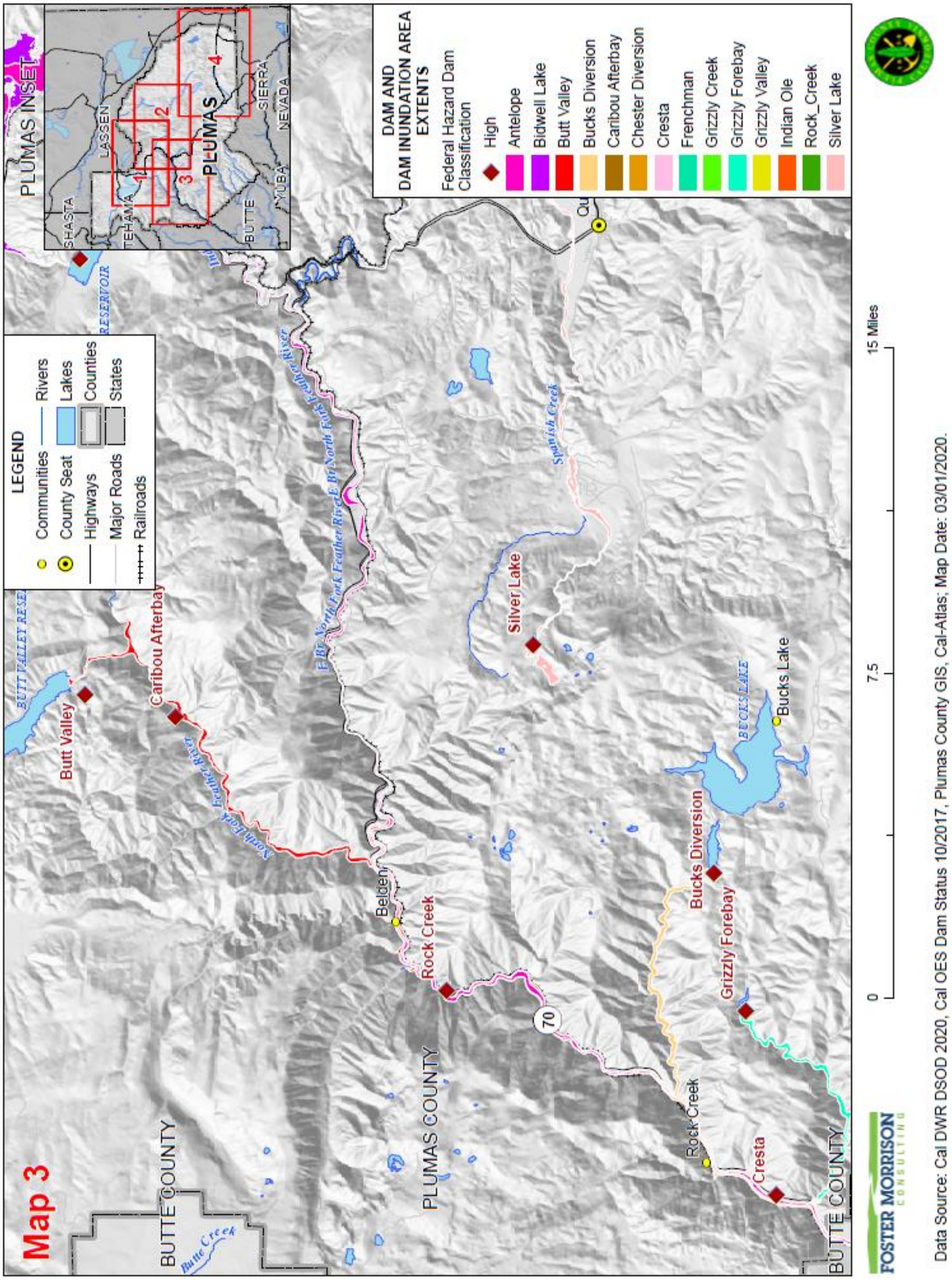


Figure 4-51 Plumas County – High Hazard Dam Inundation Areas Map 4

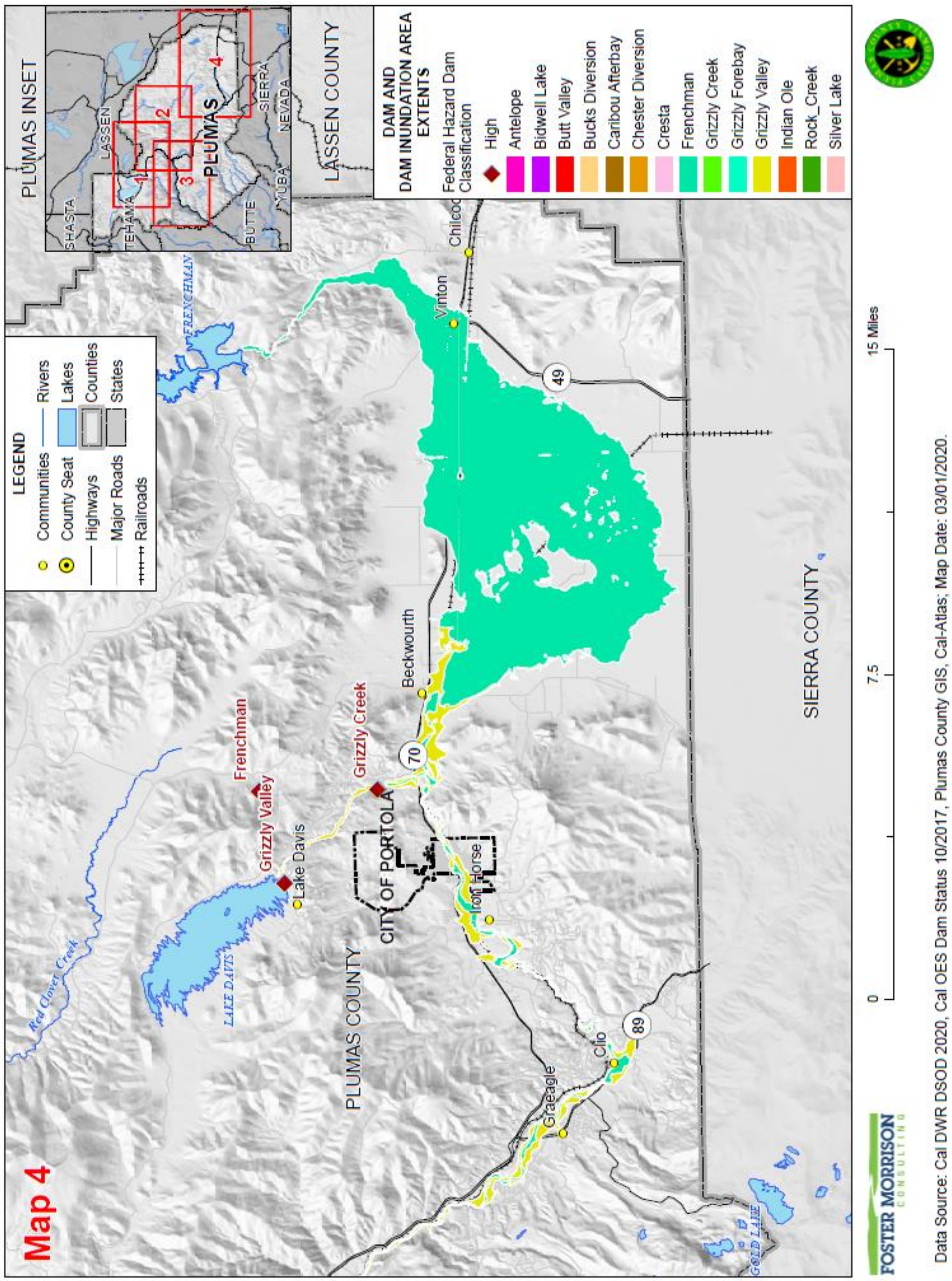


Table 4-37 Plumas County – Summary Count and Value of Parcels in the High Hazard Dam Inundation Areas

High Dam Inundation Areas	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Antelope	466	205	$29,056,684	$34,621,413	$311,684	$21,070,644	$85,060,425
Bidwell Lake	292	145	$13,729,580	$15,471,505	$359,040	$10,583,505	$40,143,630
Butt Valley	31	8	$495,793	$1,907,115	$38,296	$1,767,697	$4,208,901
Bucks Diversion	8	1	$53,508	$29,166	$0	$29,166	$111,840
Caribou Afterbay	19	4	$140,034	$1,725,096	$36,580	$1,662,104	$3,563,814
Chester Diversion	1,527	1,149	$60,999,682	$163,245,377	$1,121,040	$107,645,203	$333,011,302
Cresta	1	0	$0	$0	$0	$0	$0
Frenchman	443	162	$30,220,463	$30,296,743	$2,272,689	$20,868,427	$83,658,322
Grizzly Creek	128	38	$7,077,882	$10,427,936	$193,630	$7,511,248	$25,210,696
Grizzly Forebay	11	0	$83,360	$0	$0	$0	$83,360
Grizzly Valley	949	499	$53,201,272	$85,238,691	$408,406	$54,352,681	$193,201,050
Indian Ole	190	139	$56,836,825	$55,140,862	$4,818	$27,570,431	$139,552,936
Rock Creek	7	0	$52,369	$0	$	$0	$52,369
Silver Lake	126	62	$6,247,994	$7,707,567	$47,120	$4,150,341	$18,153,022

Source: Plumas County 12/31/2018 Parcel/Assessor's Data, Cal OES

Table 4-38 Plumas County – Count and Value of Parcels in the High Hazard Dam Inundation Areas by Property Use

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Antelope Dam Inundation Area							
Agricultural	116	29	$12,479,498	$3,252,387	$118,354	$3,252,387	$19,102,626
Commercial	10	8	$1,003,347	$3,570,734	$53,070	$3,570,734	$8,197,885
Federal Lands	17	0	$0	$0	$0	$0	$0
Government	17	0	$0	$0	$0	$0	$0
Industrial	6	2	$406,816	$215,299	$0	$322,949	$945,064
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	8	0	$0	$0	$0	$0	$0

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Recreational	3	2	$75,411	$266,156	$40,690	$266,156	$648,413
Residential	237	164	$15,091,612	$27,316,837	$99,570	$13,658,419	$56,166,438
ROW/Utilities	52	0	$0	$0	$0	$0	$0
Total	**466**	**205**	**$29,056,684**	**$34,621,413**	**$311,684**	**$21,070,644**	**$85,060,425**
Bidwell Lake Dam Inundation Area							
Agricultural	43	9	$6,438,219	$1,263,951	$20,144	$1,263,951	$8,986,265
Commercial	23	17	$1,139,108	$4,009,337	$223,000	$4,009,337	$9,380,782
Federal Lands	2	0	$0	$0	$0	$0	$0
Government	14	0	$0	$0	$0	$0	$0
Industrial	9	1	$412,047	$1,530	$0	$2,295	$415,872
Institutional	1	1	$25,500	$153,000	$0	$153,000	$331,500
Miscellaneous	3	0	$0	$0	$0	$0	$0
Recreational	4	2	$90,550	$266,156	$40,690	$266,156	$663,552
Residential	154	115	$5,624,156	$9,777,531	$75,206	$4,888,766	$20,365,659
ROW/Utilities	39	0	$0	$0	$0	$0	$0
Total	**292**	**145**	**$13,729,580**	**$15,471,505**	**$359,040**	**$10,583,505**	**$40,143,630**
Bucks Diversion Dam Inundation Area							
Agricultural	1	1	$1,139	$29,166	$0	$29,166	$59,471
Commercial	3	0	$0	$0	$0	$0	$0
Federal Lands	1	0	$0	$0	$0	$0	$0
Government	0	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0	$0
ROW/Utilities	8	1	$53,508	$29,166	$0	$29,166	$111,840
Total	**1**	**1**	**$1,139**	**$29,166**	**$0**	**$29,166**	**$59,471**
Butt Valley Dam Inundation Area							
Agricultural	5	0	$150,218	$0	$0	$0	$150,218
Commercial	4	3	$71,064	$1,628,278	$38,296	$1,628,278	$3,365,916
Federal Lands	9	0	$0	$0	$0	$0	$0
Government	1	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0	$0
Residential	8	5	$274,511	$278,837	$0	$139,419	$692,767
ROW/Utilities	4	0	$0	$0	$0	$0	$0
Total	**31**	**8**	**$495,793**	**$1,907,115**	**$38,296**	**$1,767,697**	**$4,208,901**
Caribou Afterbay Dam Inundation Area							
Agricultural	3	0	$52,369	$0	$0	$0	$52,369
Commercial	2	2	$56,275	$1,599,112	$36,580	$1,599,112	$3,291,079
Federal Lands	6	0	$0	$0	$0	$0	$0
Government	1	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0	$0
Residential	4	2	$31,390	$125,984	$0	$62,992	$220,366
ROW/Utilities	3	0	$0	$0	$0	$0	$0
Total	**19**	**4**	**$140,034**	**$1,725,096**	**$36,580**	**$1,662,104**	**$3,563,814**
Chester Diversion Dam Inundation Area							
Agricultural	16	1	$622,682	$286,000	$0	$286,000	$1,194,682
Commercial	160	121	$14,965,009	$45,588,078	$871,429	$45,588,078	$107,012,594
Federal Lands	3	0	$0	$0	$0	$0	$0
Government	32	0	$0	$0	$0	$0	$0
Industrial	20	13	$1,337,211	$2,377,952	$8,644	$3,566,928	$7,290,735
Institutional	16	9	$280,923	$1,291,836	$9,195	$1,291,836	$2,873,790
Miscellaneous	1	0	$0	$0	$0	$0	$0
Recreational	1	1	$135,089	$123,211	$0	$123,211	$381,511
Residential	1,189	1,004	$43,658,768	$113,578,300	$231,772	$56,789,150	$214,257,990
ROW/Utilities	89	0	$0	$0	$0	$0	$0
Total	**1,527**	**1,149**	**$60,999,682**	**$163,245,377**	**$1,121,040**	**$107,645,203**	**$333,011,302**
Cresta Dam Inundation Area							
Agricultural	0	0	$0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0	$0
Federal Lands	0	0	$0	$0	$0	$0	$0

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Government	1	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0	$0
ROW/Utilities	0	0	$0	$0	$0	$0	$0
Total	1	0	**$0**	**$0**	**$0**	**$0**	**$0**
Frenchman Dam Inundation Area							
Agricultural	87	36	$14,085,044	$5,474,554	$1,908,704	$5,474,554	$26,942,856
Commercial	23	16	$1,767,500	$4,392,476	$57,910	$4,392,476	$10,610,362
Federal Lands	16	0	$0	$0	$0	$0	$0
Government	32	0	$0	$0	$0	$0	$0
Industrial	1	0	$76,467	$0	$0	$0	$76,467
Institutional	1	0	$0	$0	$0	$0	$0
Miscellaneous	15	0	$0	$0	$0	$0	$0
Recreational	7	5	$717,953	$1,573,080	$0	$1,573,080	$3,864,113
Residential	192	105	$13,573,499	$18,856,633	$306,075	$9,428,317	$42,164,524
ROW/Utilities	69	0	$0	$0	$0	$0	$0
Total	**443**	**162**	**$30,220,463**	**$30,296,743**	**$2,272,689**	**$20,868,427**	**$83,658,322**
Grizzly Creek Dam Inundation Area							
Agricultural	4		$216,582	$0	$0	$0	$216,582
Commercial	15	9	$1,674,214	$3,400,742	$159,430	$3,400,742	$8,635,128
Federal Lands	4	0	$0	$0	$0	$0	$0
Government	13	0	$0	$0	$0	$0	$0
Industrial	1	0	$76,467	$0	$0	$0	$76,467
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	4	0	$0	$0	$0	$0	$0
Recreational	2	2	$127,052	$1,193,817	$0	$1,193,817	$2,514,686
Residential	64	27	$4,983,567	$5,833,377	$34,200	$2,916,689	$13,767,833
ROW/Utilities	21	0	$0	$0	$0	$0	$0
Total	**128**	**38**	**$7,077,882**	**$10,427,936**	**$193,630**	**$7,511,248**	**$25,210,696**
Grizzly Forebay Dam Inundation Area							
Agricultural	3	**0**	$83,360	$0	$0	$0	$83,360

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Commercial	**0**	**0**	$0	$0	$0	$0	$0
Federal Lands	7	**0**	$0	$0	$0	$0	$0
Government	1	**0**	$0	$0	$0	$0	$0
Industrial	**0**	**0**	$0	$0	$0	$0	$0
Institutional	**0**	**0**	$0	$0	$0	$0	$0
Miscellaneous	**0**	**0**	$0	$0	$0	$0	$0
Recreational	**0**	**0**	$0	$0	$0	$0	$0
Residential	**0**	**0**	$0	$0	$0	$0	$0
ROW/Utilities	**0**	**0**	$0	$0	$0	$0	$0
Total	**11**	**0**	**$83,360**	**$0**	**$0**	**$0**	**$83,360**
Grizzly Valley Dam Inundation Area							
Agricultural	68	21	$9,724,805	$1,226,940	$0	$1,226,940	$12,178,685
Commercial	64	43	$5,621,633	$13,544,877	$301,341	$13,544,877	$33,012,728
Federal Lands	16	0	$0	$0	$0	$0	$0
Government	52	0	$0	$0	$0	$0	$0
Industrial	24	17	$1,801,587	$1,936,748	$1,040	$2,905,122	$6,644,497
Institutional	1	1	$8,597	$160,816	$0	$160,816	$330,229
Miscellaneous	9	0	$0	$0	$0	$0	$0
Recreational	53	34	$2,170,291	$4,660,542	$0	$4,660,542	$11,491,375
Residential	568	383	$33,874,359	$63,708,768	$106,025	$31,854,384	$129,543,536
ROW/Utilities	94	0	$0	$0	$0	$0	$0
Total	949	499	$53,201,272	$85,238,691	$408,406	$54,352,681	$193,201,050
Indian Ole Dam Inundation Area							
Agricultural	5	0	$185,805	$0	$0	$0	$185,805
Commercial	4	0	$335,539	$0	$0	$0	$335,539
Federal Lands	5	0	$0	$0	$0	$0	$0
Government	1	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	3	0	$0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0	$0
Residential	157	139	$56,315,481	$55,140,862	$4,818	$27,570,431	$139,031,592
ROW/Utilities	15	0	$0	$0	$0	$0	$0
Total	**190**	**139**	**$56,836,825**	**$55,140,862**	**$4,818**	**$27,570,431**	**$139,552,936**

Extremely High Dam Inundation Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Rock Creek Dam Inundation Area							
Agricultural	3	0	$52,369	$0	$0	$0	$52,369
Commercial		0	$0	$0	$0	$0	$0
Federal Lands	3	0	$0	$0	$0	$0	$0
Government	1	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0	$0
ROW/Utilities	0	0	$0	$0	$0	$0	$0
Total	**7**	**0**	**$52,369**	**$0**	**$0**	**$0**	**$52,369**
Silver Lake Dam Inundation Area							
Agricultural	15	5	$1,497,563	$577,782	$47,120	$577,782	$2,700,247
Commercial	4	1	$169,890	$15,333	$0	$15,333	$200,556
Federal Lands	8	0	$0	$0	$0	$0	$0
Government	4	0	$0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0	$0
Residential	83	56	$4,580,541	$7,114,452	$0	$3,557,226	$15,252,219
ROW/Utilities	12	0	$0	$0	$0	$0	$0
Total	**126**	**62**	**$6,247,994**	**$7,707,567**	**$47,120**	**$4,150,341**	**$18,153,022**

Source: Plumas County 12/31/2018 Parcel/Assessor's Data, Cal OES

Dam Inundation - Flooded Acres

In addition to the centroid analysis used to obtain numbers of parcels and values at risk to the dam failure hazard, parcel boundary analysis was performed to obtain total acres and flooded acres by dam inundation area. The following is an analysis of inundated or flooded acres associated with dam failures and inundation areas in the County.

Methodology

GIS was used to calculate acres flooded by each Cal OES dam inundation area. The parcel layer was intersected with the Cal OES and CA DWR DSOD dam inundation area data to obtain the acres inundated by dam. The Plumas County parcel layer and inundation areas were intersected, and each segment divided by the intersection of inundation area and parcels was calculated for acres.

Limitations

One limitation created by this type of analysis is that with respect to the improved acres analysis, improvements are uniformly found throughout the parcel, while in reality, only portions of the parcel are improved, and improvements may or may not fall within the inundated portion of a parcel; thus, areas of improvements inundated, calculated through this method, may be higher or lower than those actually seen in a similar real-world event.

Analysis Results

The following tables represent a summary and detailed analysis of total acres for each dam inundation area in the Planning Area. Table 4-39 shows the flooded acres of the Plumas County Planning Area in the inundation areas of each extremely high hazard dam. Table 4-40 shows the flooded acres of the Plumas County Planning Area in the inundation areas of each high hazard dam

Table 4-39 Plumas County – Flooded Acres from Extremely High Hazard Dams

Dam Inundation Area	Total Acres	Improved Acres	Unimproved Acres
Lake Almanor	3,346.4	69.0	3,277.4
Bucks Storage	1,291.2	1.6	1,289.5

Source: Cal OES

Table 4-40 Plumas County – Flooded Acres from High Hazard Dams

Dam Inundation Area	Total Acres	Improved Acres	Unimproved Acres
Antelope	9,558.5	2562.2	6996.3
Bidwell Lake	2,657.5	500.3	2157.2
Bucks Diversion	821.2	1.9	819.3
Butt Valley	1,648.3	29.4	1618.9
Caribou Afterbay	753.8	3.2	750.5
Chester Diversion	2,810.7	618.5	2192.3
Cresta	43.9	0.0	43.9
Frenchman	34,473.7	8735.5	25738.2
Grizzly Creek	638.3	79.5	558.8
Grizzly Forebay	700.4	0.0	700.4
Grizzly Valley	16,487.4	3202.2	13285.2
Indian Ole	25,743.4	4.8	25738.6
Rock Creek	474.6	0.0	474.6
Silver Lake	973.0	281.8	691.2

Source: Cal OES

Population at Risk

A separate analysis was performed to determine population in dam inundation areas for dams with available inundation maps. Using GIS, the dam inundation area dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect an inundation area were counted and multiplied by the Census Bureau average household size for Plumas County. Table 4-41 shows the populations at risk to dam failure flooding for extremely high hazard dams. According to this analysis, for the entire Planning Area, there is a population of 35 in extremely high hazard dam inundation areas. It is unlikely that both dams that could affect Plumas County would fail at the same time.

Table 4-41 Plumas County – Residential Population at Risk in Extremely High Hazard Dam Inundation Area

Jurisdiction	Bucks Storage		Lake Almanor	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Unincorporated County	0	0	15	35
Total	**0**	**0**	**15**	**35**

Source: Cal OES Dam Inundation Data, US Census Bureau Average Household Sizes: unincorporated Plumas County (2.32)

Table 4-42 shows the populations at risk to dam failure flooding for high hazard dams. It is unlikely that all dams that could affect Plumas County would fail at the same time.

Table 4-42 Plumas County – Residential Population at Risk in High Hazard Dam Inundation Area

Dam Inundation Area	Improved Residential Parcels	Population
Antelope	164	380
Bidwell Lake	115	267
Bucks Diversion	0	0
Butt Valley	5	12
Caribou Afterbay	2	5
Chester Diversion	1,004	2,329
Cresta	0	0
Frenchman	105	244
Grizzly Creek	27	63
Grizzly Forebay	0	0
Grizzly Valley	383	889
Indian Ole	139	322
Rock Creek	0	0
Silver Lake	56	130

Source: Cal OES Dam Inundation Data, US Census Bureau Average Household Sizes: unincorporated Plumas County (2.32)

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Plumas County to determine critical facilities in the areas affected dam failure. Using GIS, the Cal OES and CA DWR DSOD dam inundation areas were overlayed on the critical facility GIS layer. The analysis was broken up by dam hazard classification:

- Figure 4-52 shows the critical facilities and extremely high hazard dam inundation areas. Figure 4-53 and Figure 4-54 show closer views of Lake Almanor and Buck Storage dam inundation areas and the critical facilities they intersect. Table 4-43 shows a summary of critical facilities in extremely high dam inundation areas. Table 4-44 details the critical facilities in the unincorporated County that fall in extremely high dam inundation zones.
- Figure 4-55 shows the critical facilities and high hazard dam inundation areas. Table 4-45 shows a summary of critical facilities in high hazard dam inundation areas. Four maps were created to zoom into the areas affected by dam inundation in the County:
  - ✓ Figure 4-56 show the Bidwell Lake, Butt Valley, Chester Diversion Caribou Afterbay, and Indian Ole dam inundation areas.
  - ✓ Figure 4-57 show the Antelope and Bidwell Lake dam inundation areas.
  - ✓ Figure 4-58 show the Butt Valley, Caribou Afterbay, Cresta, Grizzly Forebay, Rock Creek, and Silver Lake dam inundation areas.
  - ✓ Figure 4-59 show the Bucks Diversion, Frenchman, Grizzly Valley, Lake Davis, and Grizzly Creek dam inundation areas.
  - ✓ Table 4-46 details the critical facilities in the unincorporated County that fall in high dam inundation zones.

Figure 4-52 Plumas County – Critical Facilities in Extremely High Hazard Dam Inundation Areas

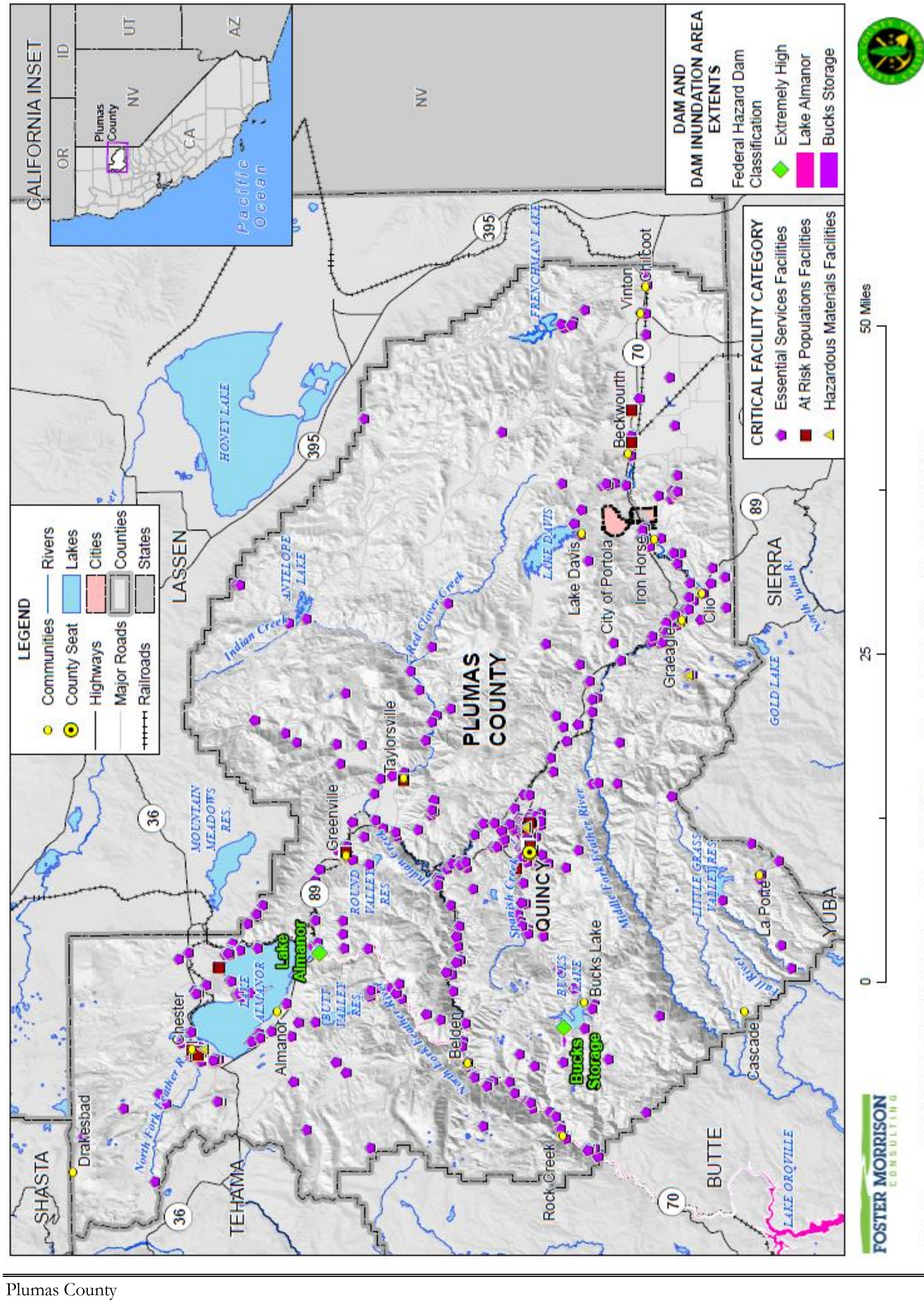


Figure 4-53 Plumas County – Lake Almanor Dam Inundation Areas and Critical Facilities

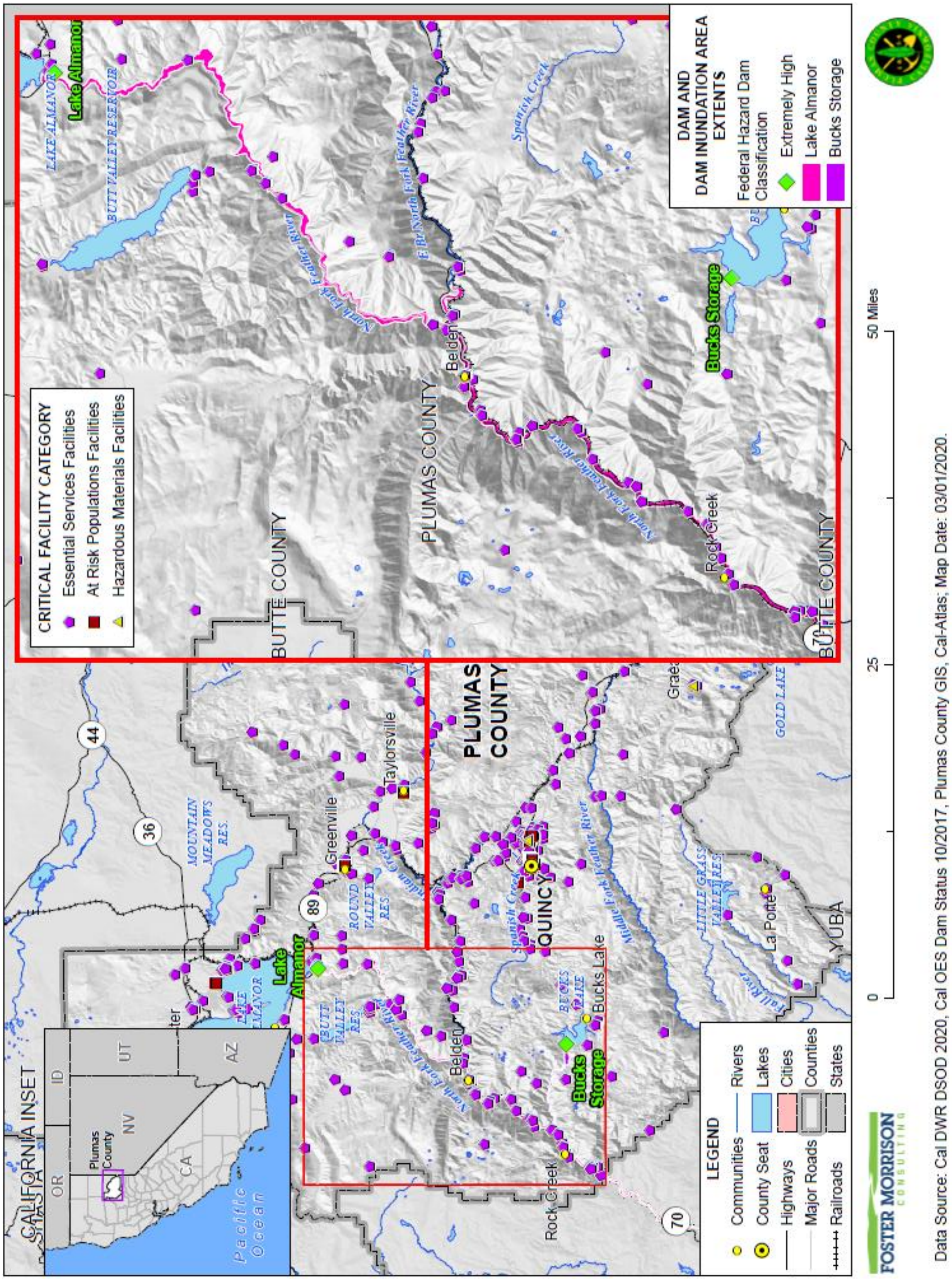
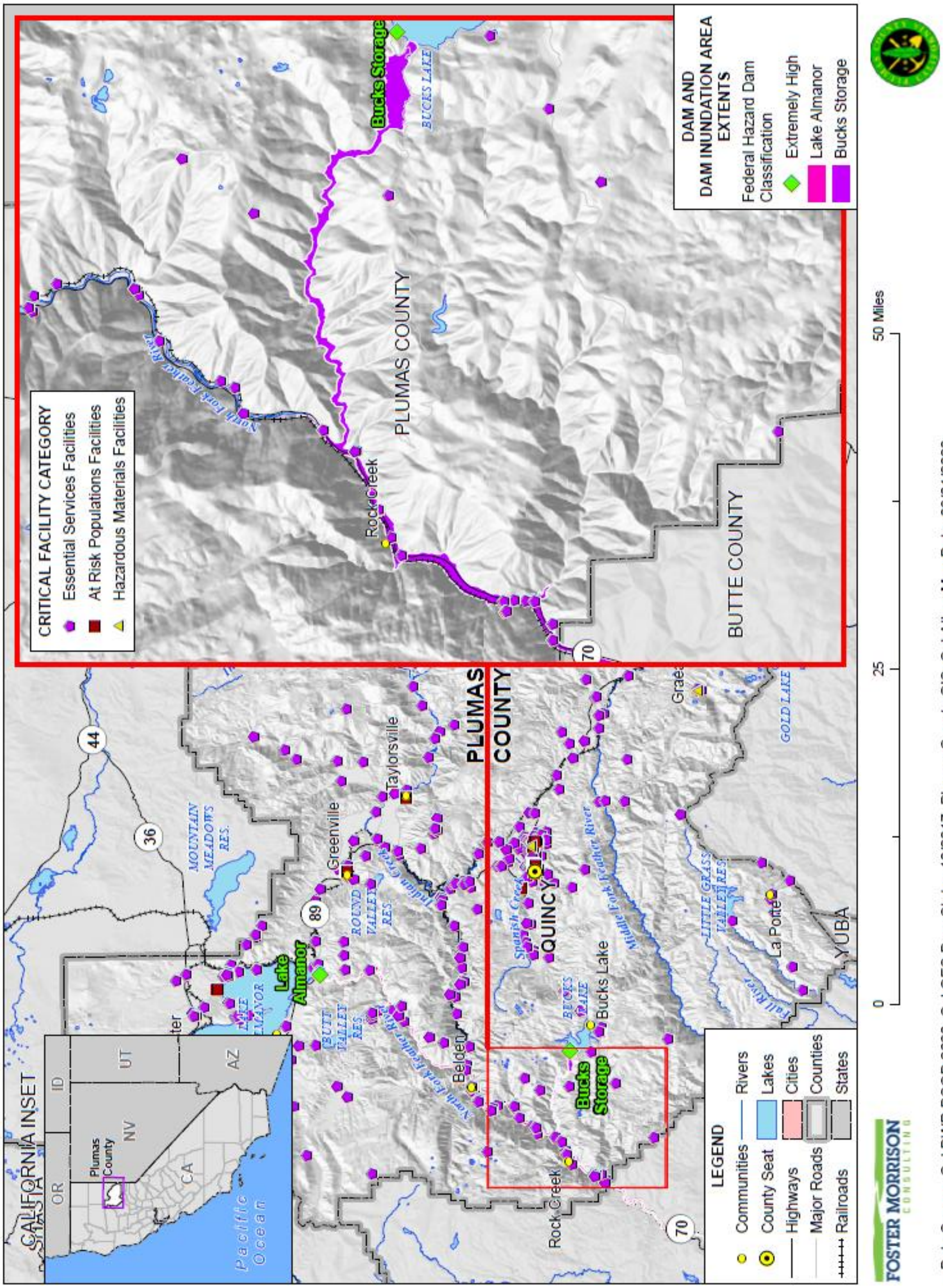


Figure 4-54 Plumas County – Bucks Storage Dam Inundation Areas and Critical Facilities



Data Source: Cal DWR DSOD 2020, Cal OES Dam Status 10/2017, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Table 4-43 Plumas County – Critical Facilities in Extremely High Hazard Dam Inundation Areas by Facility Category

Dam Inundation Area	Critical Facility Category	Facility Count
Extremely High Dam Inundation Area	Essential Services Facilities	45
	Total	**45**
Outside of Extremely High Dam Inundation Area	Essential Services Facilities	728
	At Risk Populations Facilities	38
	Hazardous Materials Facilities	4
	Total	**770**
Grand Total		**815**

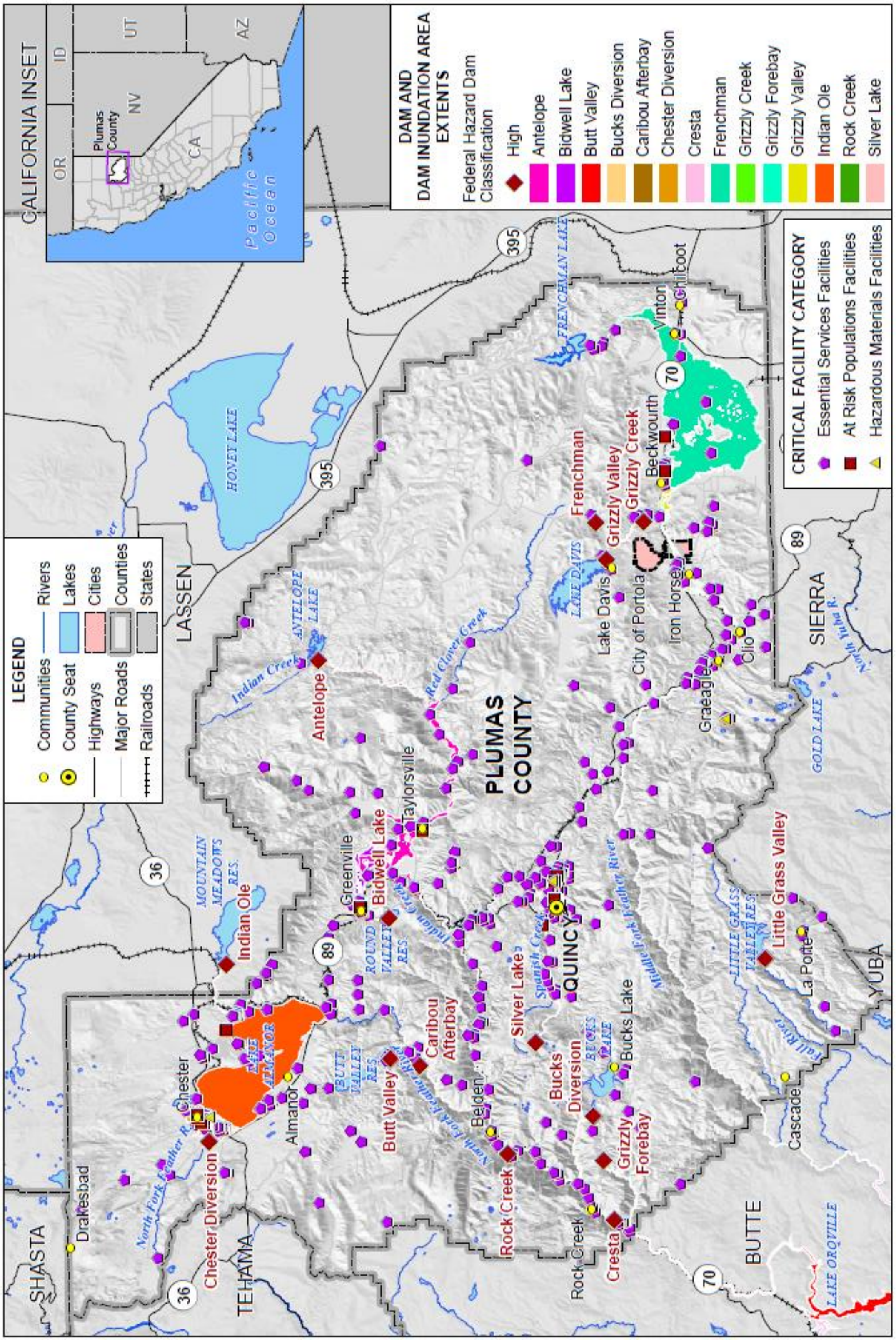
Source: Plumas County GIS, Cal OES, DSOD

Table 4-44 Plumas County – Critical Facilities in Extremely High Hazard Dam Inundation Zones by Facility Category and Type

Dam Inundation Area	Critical Facility Category	Lake Almanor	Bucks Storage
		Facility Count	
Extremely High Dam Inundation Area	Essential Services Facilities	44	17
	At Risk Populations Facilities	0	0
	Hazardous Materials Facilities	0	0
Grand Total		**44**	**17**

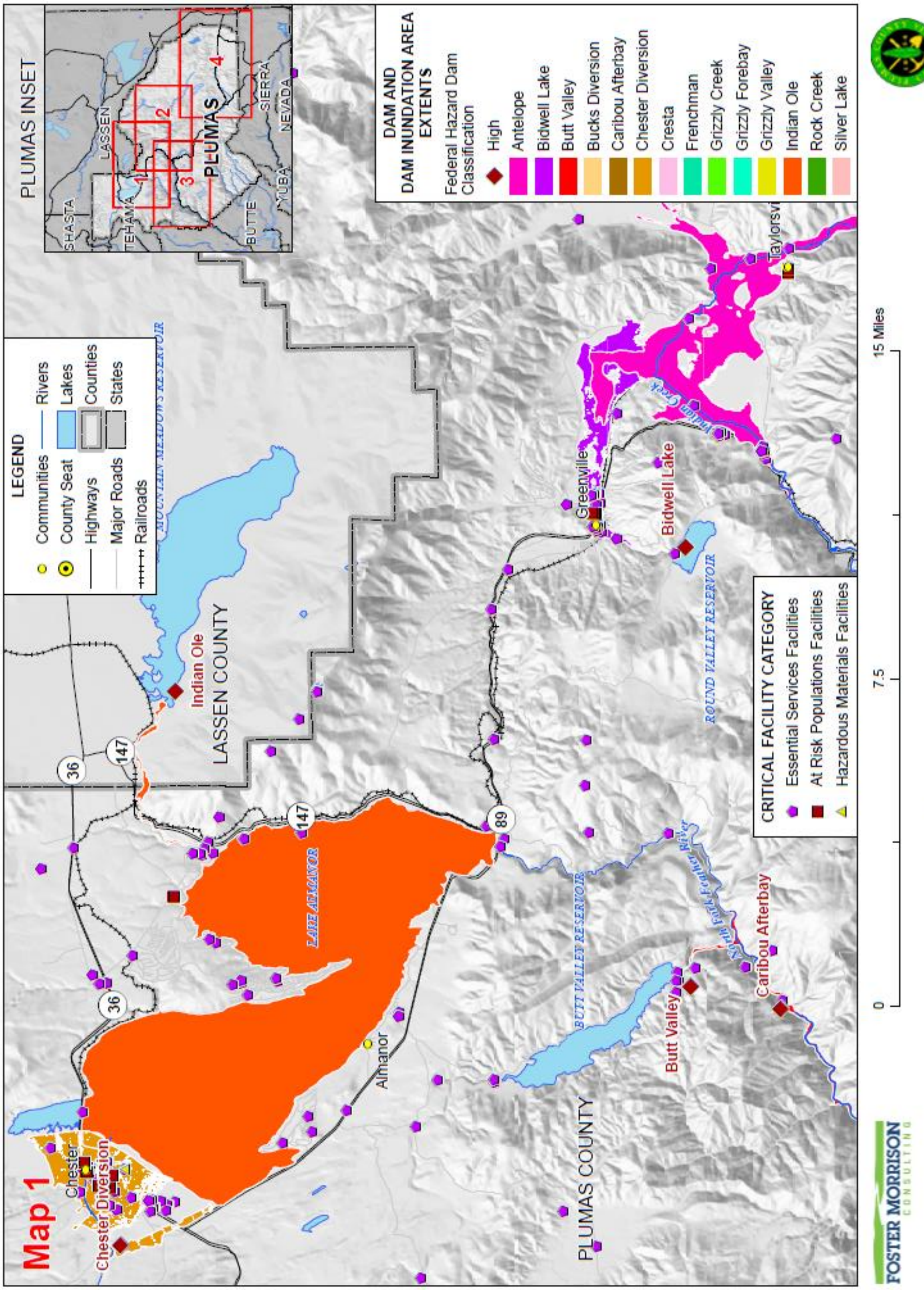
Source: Plumas County GIS, Cal OES, DSOD

Figure 4-55 Plumas County – Critical Facilities in High Hazard Dam Inundation Areas



Data Source: Cal DWR DSOD 2020, Cal OES Dam Status 10/2017, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Figure 4-56 Plumas County – High Hazard Dam Inundation Areas and Critical Facilities Map 1



Data Source: Cal DWR DSOD 2020, Cal OES Dam Status 10/2017, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Figure 4-57 Plumas County – High Hazard Dam Inundation Areas and Critical Facilities Map 2

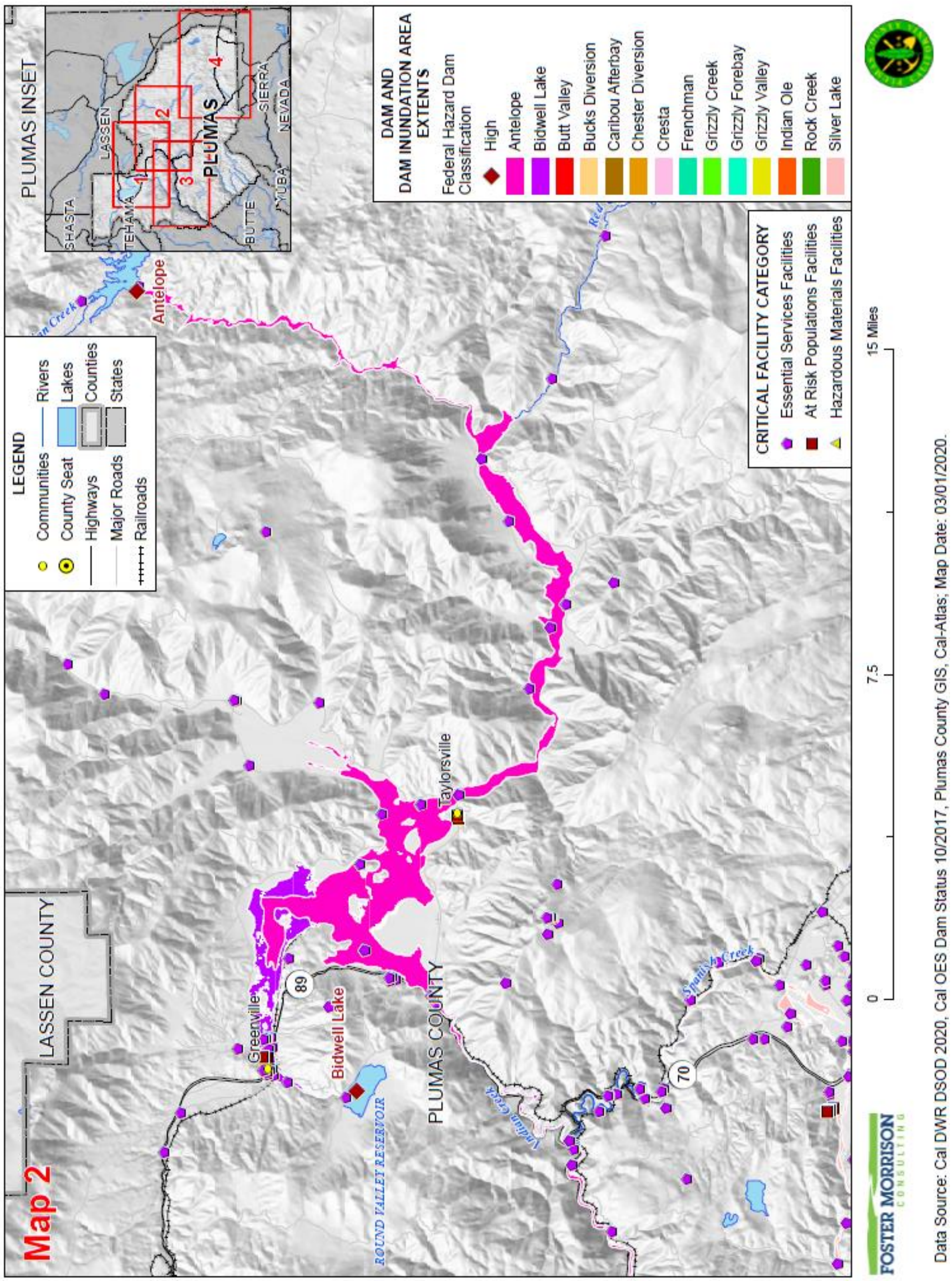


Figure 4-58 Plumas County – High Hazard Dam Inundation Areas and Critical Facilities Map 3

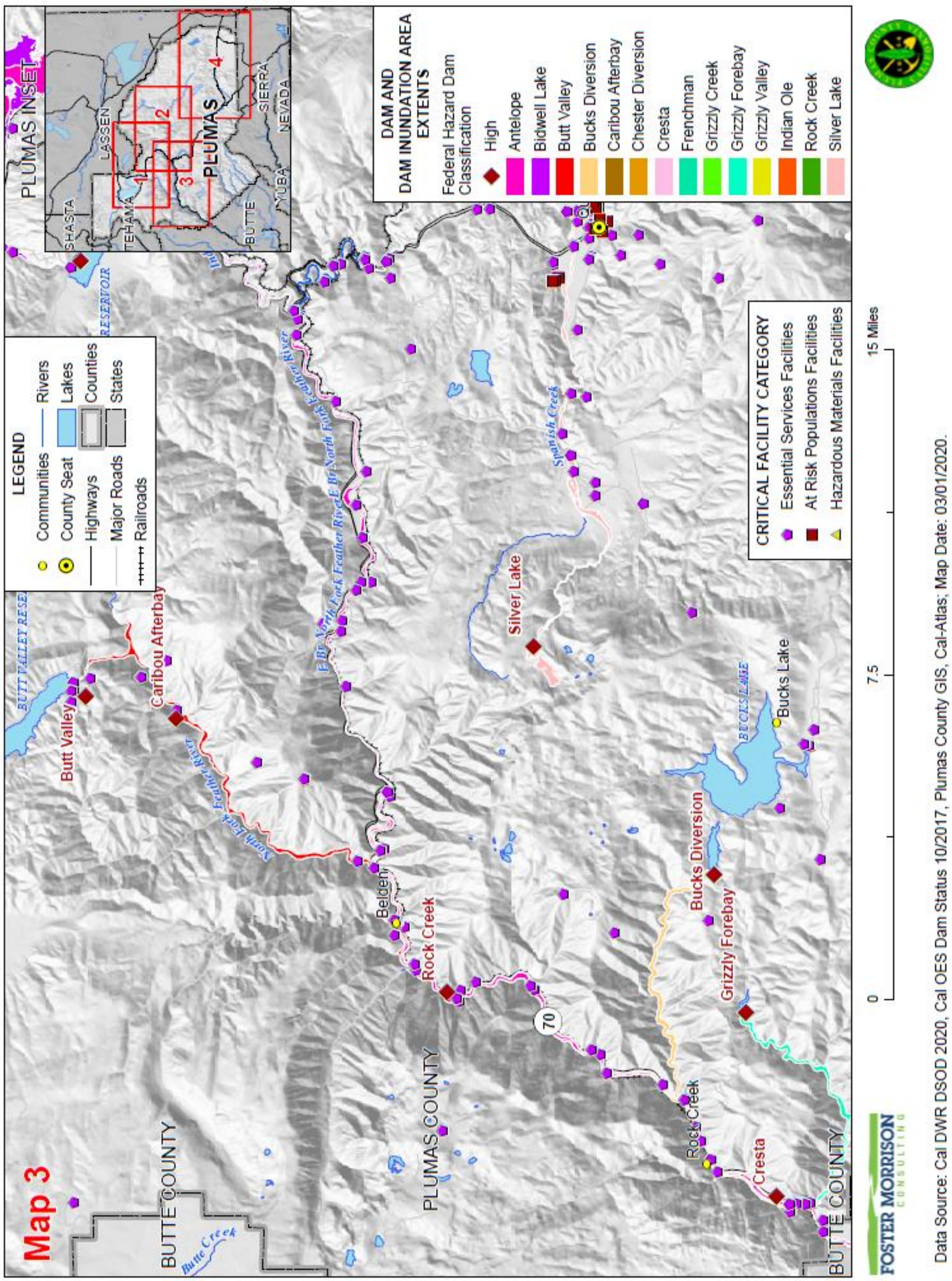


Figure 4-59 Plumas County – High Hazard Dam Inundation Areas and Critical Facilities Map 4

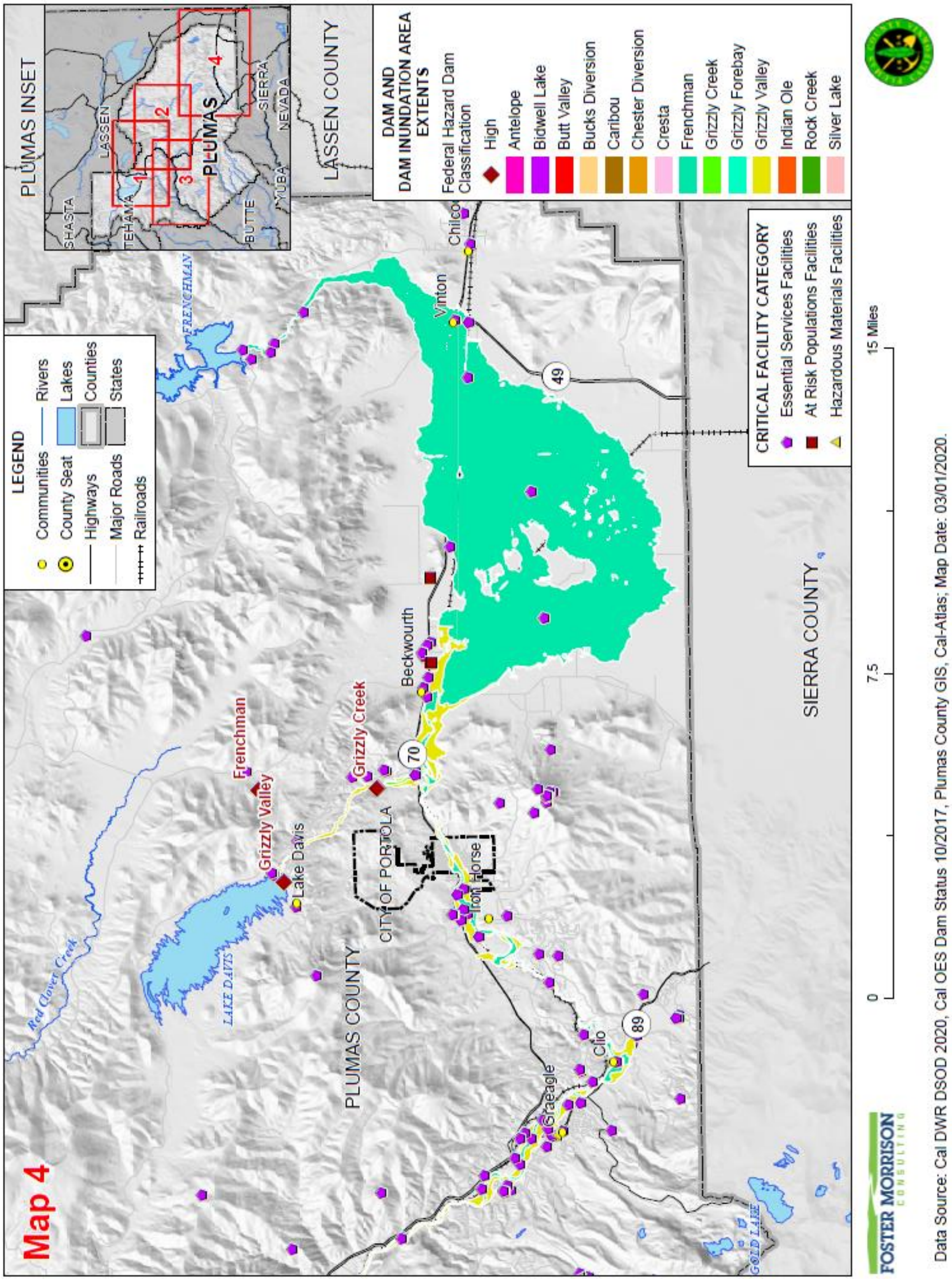


Table 4-45 Plumas County – Critical Facilities in High Hazard Dam Inundation Areas by Facility Category

Dam Inundation Area	Critical Facility Category	Facility Count
High Dam Inundation Area	Essential Services Facilities	135
	At Risk Populations Facilities	14
	Hazardous Materials Facilities	1
	Total	**150**
Outside of High Dam Inundation Area	Essential Services Facilities	638
	At Risk Populations Facilities	24
	Hazardous Materials Facilities	3
	Total	**665**
Grand Total		**815**

Source: Plumas County GIS, Cal OES, DSOD

Table 4-46 Plumas County – Critical Facilities in High Hazard Dam Inundation Zones by Facility Category and Type

Dam Inundation Area	Critical Facility Category	Antelope	Bidwell Lake	Butt Valley	Bucks Diversion	Caribou Afterbay	Chester Diversion	Cresta	Frenchman	Grizzly Creek	Grizzly Forebay	Grizzley Valley	Indian Ole	Rock Creek	Silver Lake
		Facility Count													
High Dam Inundation Area	Essential Services Facilities	37	11	37	8	14	32	3	15	2	1	20	4	14	11
	At Risk Populations Facilities	0	4	0	0	0	10	0	0	0	0	0	0	0	0
	Hazardous Materials Facilities	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Grand Total		**37**	**15**	**37**	**8**	**14**	**43**	**3**	**15**	**2**	**1**	**20**	**4**	**14**	**11**

Source: Plumas County GIS, Cal OES, DSOD

Overall Community Impact

Dam failure floods and their impacts vary by location and severity of any given dam failure event and will likely only directly affect certain areas of the Plumas County Planning Area during specific times. Based on the risk assessment, it is evident that dam failure floods have the potential for devastating life safety, property, environmental, and economic impacts to certain areas of the County. Impacts that are not always quantified, but can be anticipated in a large dam failure event, include:

- Injury and loss of life;

- Impacts to agricultural;
- Commercial and residential structural and property damage;
- Disruption of and damage to critical infrastructure and services;
- Health hazards associated with mold and mildew, contamination of drinking water, etc.;
- Damage to roads/bridges resulting in loss of mobility;
- Significant economic impact (jobs, sales, tax revenue) to the community;
- Negative impact on commercial and residential property values; and
- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.
- Impact on the overall mental health of the community.

Future Development

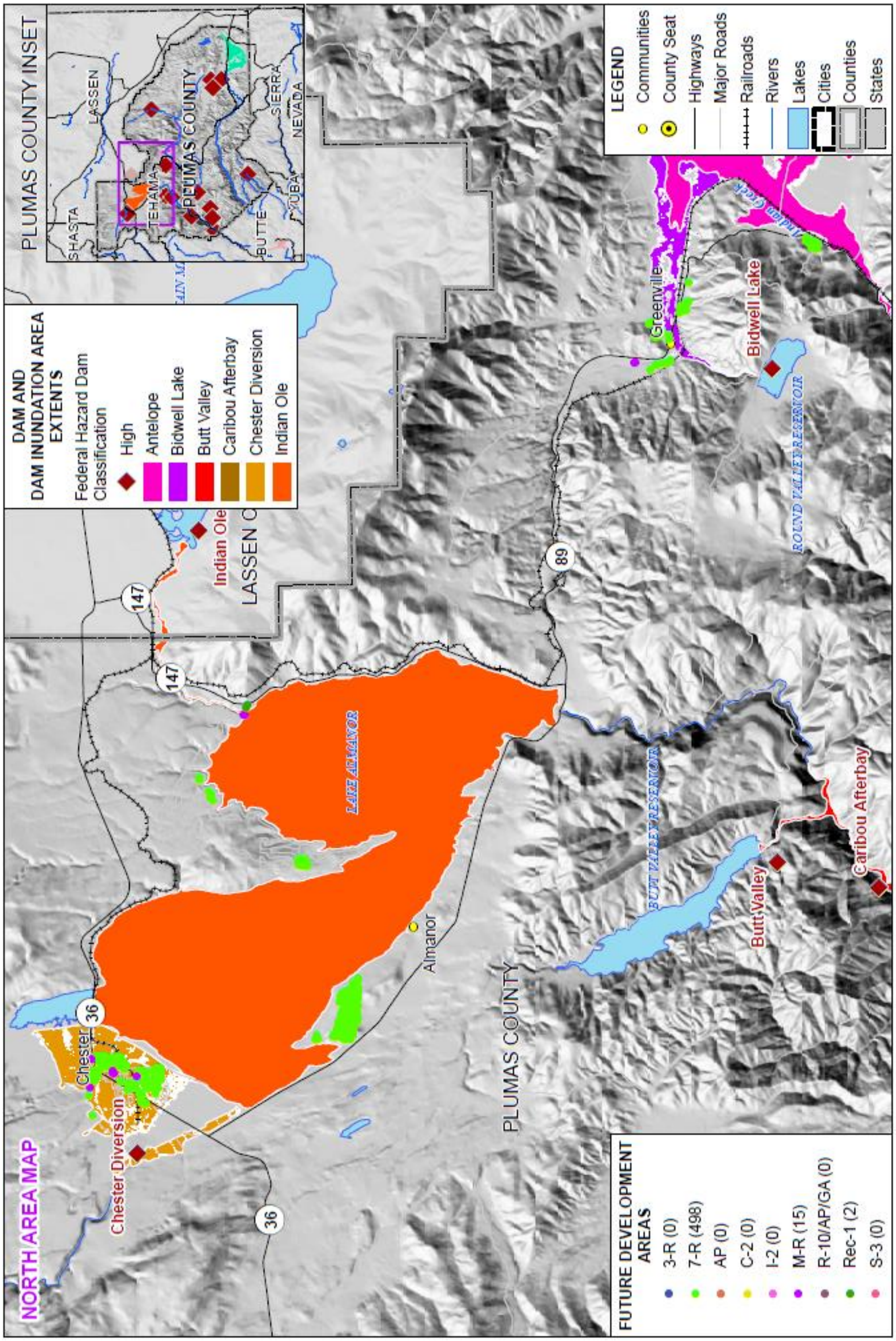
Although new growth and development corridors would fall in the area flooded by a dam failure, given the limited potential of total dam failure and the large area that a dam failure would affect, development in the dam inundation area will continue to occur.

Future Development GIS Analysis

Plumas County's February 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. The Plumas County Planning Department provided a table containing the assessor parcel numbers (APNs) for the 1,075 parcels representing the different future development projects or areas. Using the GIS parcel spatial file and the APNs, the future development projects were mapped.

For the dam inundation analysis of future development areas, the parcel data was converted to a point layer using a centroid conversion process, in which each parcel was identified by a central point and linked to the Assessor's data. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts and acreage within each individual dam inundation area provided by Cal OES. The County was separated into three areas. Figure 4-60 shows the dam inundation areas and future development areas in the north portion of the County. Figure 4-61 shows the dam inundation areas and future development areas in the central portion of the County. Figure 4-62 shows the dam inundation areas and future development areas in the south portion of the County. Parcels and acreages in those areas are summarized in Table 4-47, and detailed by dam inundation area in Table 4-48.

Figure 4-60 Plumas County North – Future Development in Dam Inundation Areas



Data Source: Cal DWR DSOD 2020, Cal OES Dam Status 10/2017, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Figure 4-61 Plumas County Central – Future Development in Dam Inundation Areas

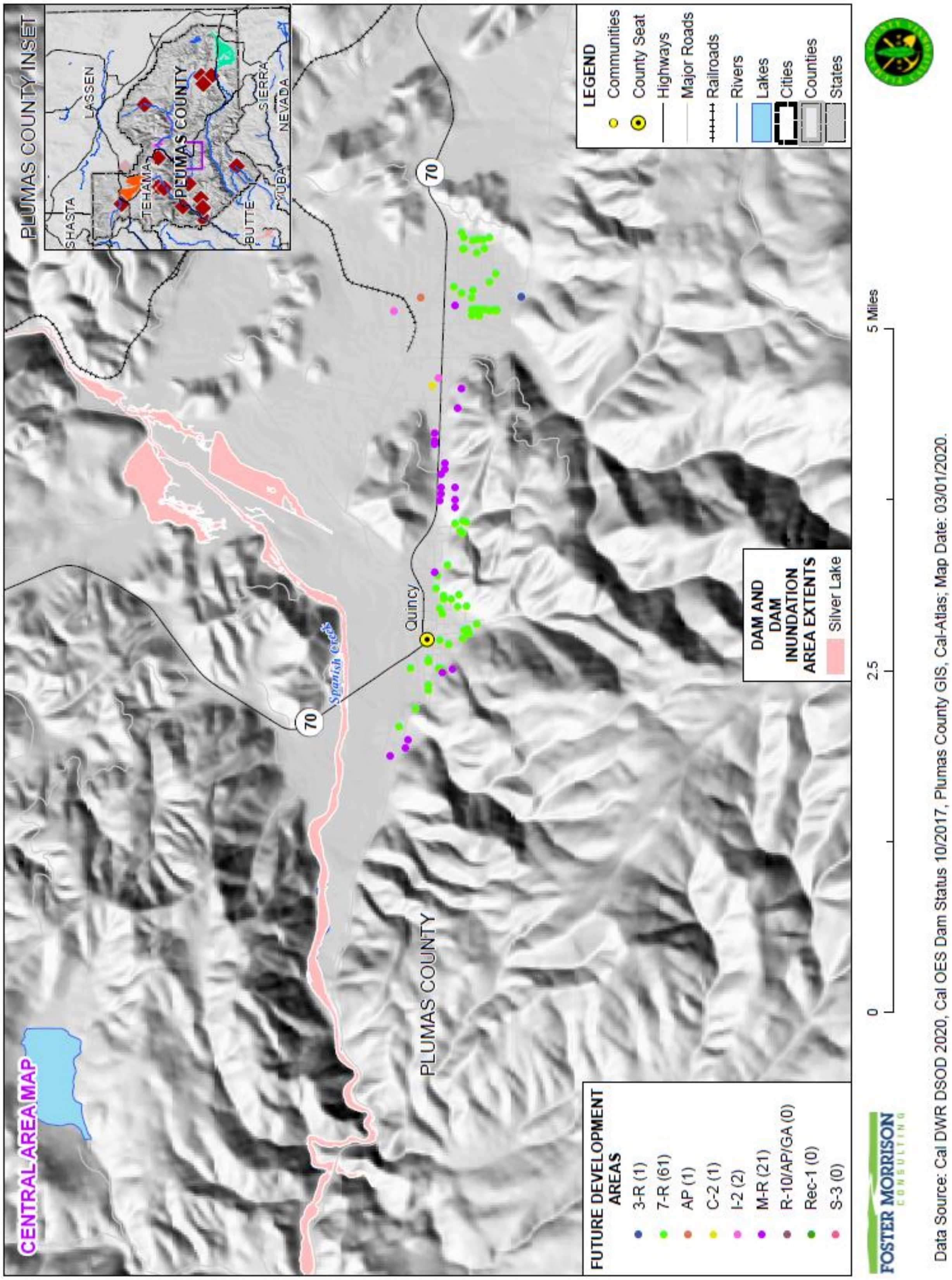
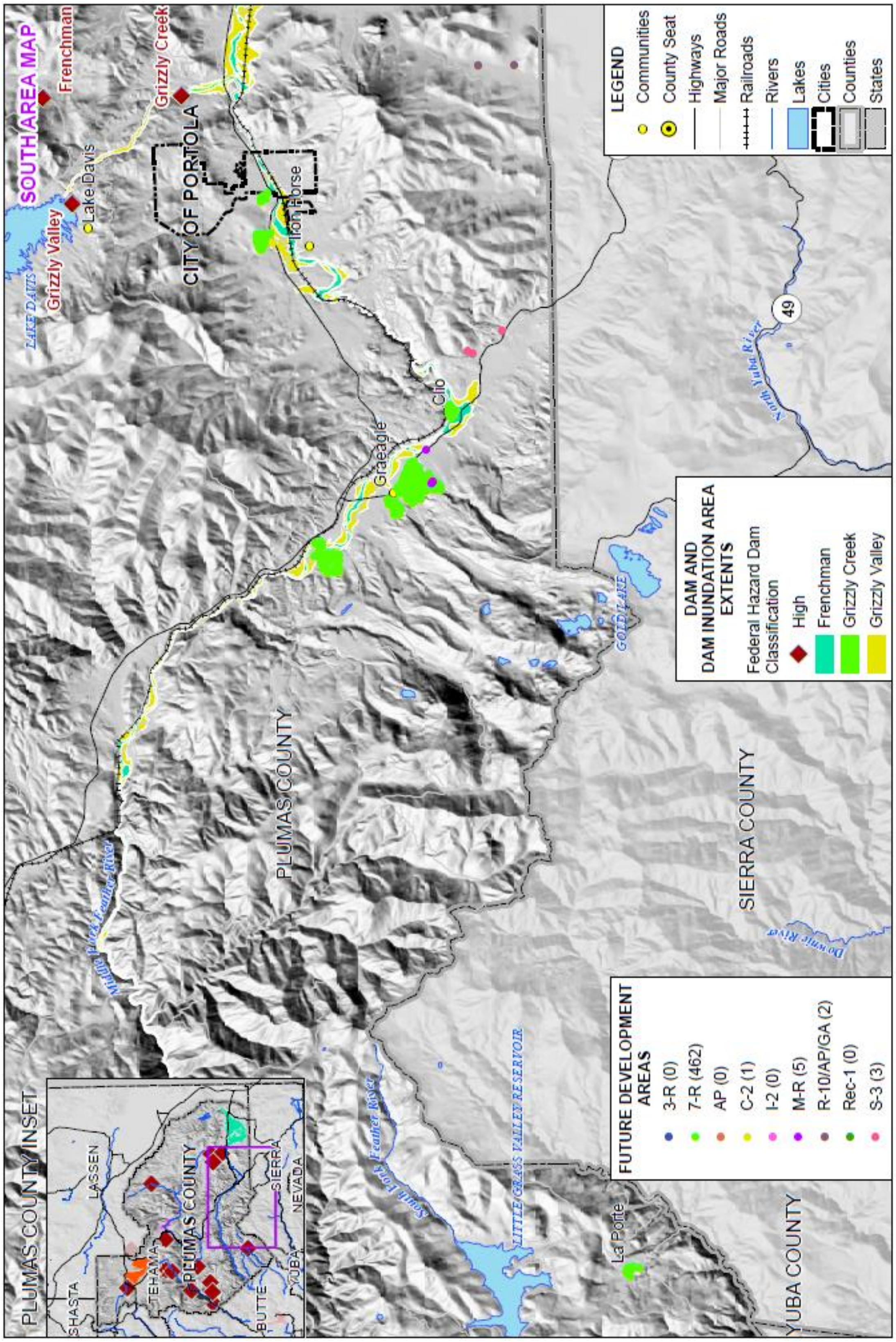


Figure 4-62 Plumas County South – Future Development in Dam Inundation Areas



FOSTER MORRISON CONSULTING

Data Source: Cal DWR DSOD 2020, Cal OES Dam Status 10/2017, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Table 4-47 Plumas County – Future Development Parcel and Acre Count Summary by Dam Hazard Class and Area

Dam Inundation Area/ Map Area / Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
High Dam Inundation Area			
North Area			
7-R	191	94	57.395
M-R	11	1	9.520
North Area Total	**202**	**95**	**66.915**
South Area			
7-R	20	3	12.009
South Area Total	**20**	**3**	**12.009**
High Dam Inundation Area Total	**222**	**98**	**78.924**

Source: Plumas County GIS, Cal OES

Table 4-48 Plumas County – Future Development Parcel and Acre Counts by Dam Inundation Area and Physical Area

Dam Inundation Area/ Map Area / Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Bidwell Lake			
North Area			
M-R	1		0.510
North Area Total	**1**		**0.510**
Bidwell Lake Total	**1**		**0.510**
Chester Diversion			
North Area			
7-R	191	94	57.395
M-R	10	1	9.010
North Area Total	**201**	**95**	**66.405**
Chester Diversion Total	**201**	**95**	**66.405**
Frenchman			
South Area			
7-R	7	1	4.064
South Area Total	**7**	**1**	**4.064**
Frenchman Total	**7**	**1**	**4.064**
Grizzly Valley			
South Area			
7-R	20	3	12.009
South Area Total	**20**	**3**	**12.009**

Dam Inundation Area/ Map Area / Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Grizzly Valley Total	**20**	**3**	**12.009**

Source: Plumas County GIS, Cal OES

4.3.9. Drought and Water Shortage

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

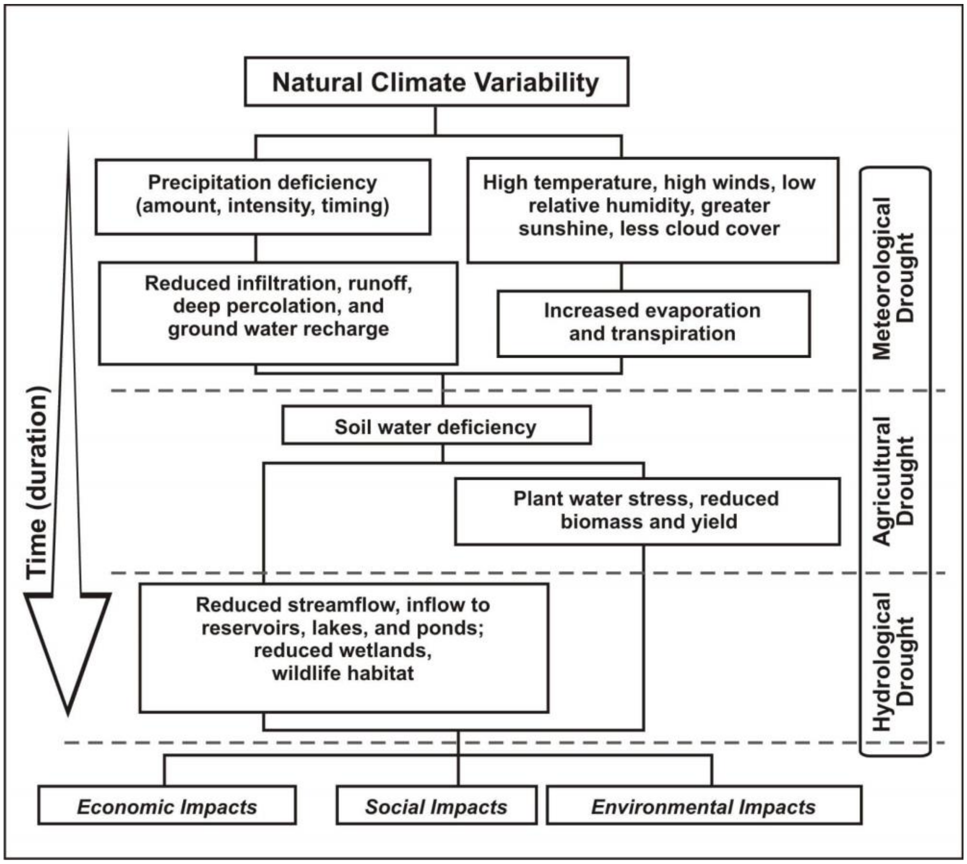
Drought

Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Water districts normally require at least a 10-year planning horizon to implement a multiagency improvement project to mitigate the effects of a drought and water supply shortage.

Drought is a complex issue involving (see Figure 4-63) many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects:

- **Meteorological drought** is usually defined by a period of below average water supply.
- **Agricultural drought** occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock.
- **Hydrological drought** is defined as deficiencies in surface and subsurface water supplies. It is generally measured as streamflow, snowpack, and as lake, reservoir, and groundwater levels.
- **Socioeconomic drought** occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Figure 4-63 Causes and Impact of Drought



Source: National Drought Mitigation Center (NDMC)

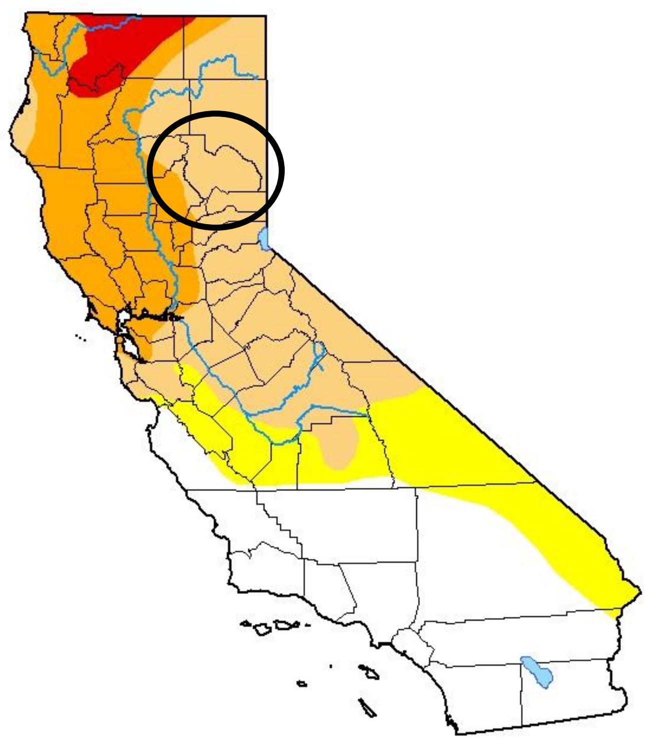
The HMPC noted that drought can cause increased wildfire risk, discussed in Section 4.3.18. During periods of drought, subsidence can also occur, though the risk of subsidence in Plumas County is minimal.

Location and Extent

Since drought is a regional phenomenon, it affects the whole of the County. Speed of onset of drought is slow, while the duration varies from short (months) to long (years) Drought in the United States is monitored by the National Integrated Drought Information System (NIDIS). A major component of this portal is the U.S. Drought Monitor. The Drought Monitor concept was developed jointly by the NOAA's Climate Prediction Center, the NDMC, and the USDA's Joint Agricultural Weather Facility in the late 1990s as a process that synthesizes multiple indices, outlooks and local impacts, into an assessment that best represents current drought conditions. The final outcome of each Drought Monitor is a consensus of federal, state, and academic scientists who are intimately familiar with the conditions in their respective regions. A snapshot of the drought conditions in California and Plumas County (2020) can be found in Figure 4-64. Snapshots from 2014 through 2019 is shown in Figure 4-65.

Figure 4-64 Plumas County – Current Drought Status

U.S. Drought Monitor
California



August 4, 2020
(Released Thursday, Aug. 6, 2020)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	33.74	66.26	50.38	21.50	3.04	0.00
Last Week *07-28-2020*	40.34	59.66	50.38	21.50	3.04	0.00
3 Months Ago *05-05-2020*	41.80	58.20	42.87	19.56	3.94	0.00
Start of Calendar Year *12-31-2019*	96.43	3.57	0.00	0.00	0.00	0.00
Start of Water Year *10-01-2019*	95.29	4.71	2.06	0.00	0.00	0.00
One Year Ago *08-06-2019*	95.55	4.45	0.00	0.00	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

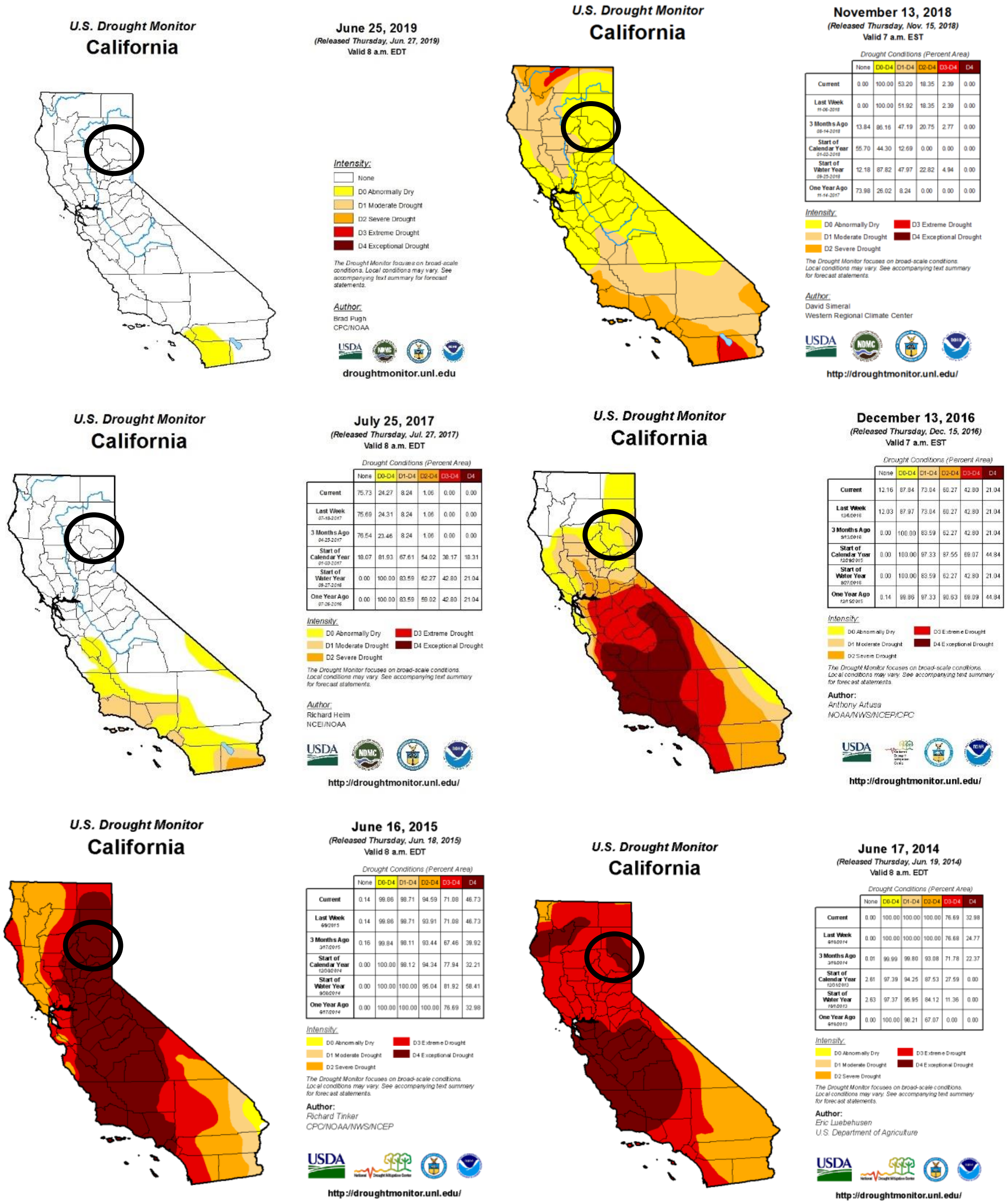
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:
Brian Fuchs
National Drought Mitigation Center

droughtmonitor.unl.edu

Source: US Drought Monitor

Figure 4-65 Previous Drought Status in Plumas County



Source: US Drought Monitor

CA DWR says the following about drought:

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

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

As shown on the previous figures, drought is tracked by the US Drought Monitor. The Drought Monitor includes a scale to measure drought intensity:

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)

Water Shortage

Northern Sacramento Valley counties, including Plumas County, generally have sufficient groundwater and surface water supplies to mitigate even the severest droughts of the past century. Many other areas of the State, however, also place demands on these water resources during severe drought

The 2035 Plumas County General Plan Water Resources Element noted that the amount of precipitation received throughout the watershed varies but greatly contributes to the significant amount of water available in the County and throughout the region. The Sierra Crest, centrally located within Plumas County, acts as a barrier to storm systems between the western and eastern portions of the County. The western side of the Sierra Nevada Mountains receives over 90 inches of precipitation annually while the area east of the Sierra Crest receives only 11 inches. Snowpack levels in the County's higher elevation areas serve as natural water reservoirs for surface water that becomes available as the snow melts and drains into the regional waterway system.

The HMPC noted that the Plumas County Flood Control and Water Conservation District (PCFCWCD) is one of the 29 State Water Contractors within the State of California. The PCFCWCD has annual entitlements to 2,700 acre feet of water from the State Water project with 3 water customers. Water customers include City of Portola, Grizzly Ranch Golf Club and Grizzly Lake CSD. The project water is transported from the Lake Davis by Grizzly Valley Pipeline to the Lake Davis Water Treatment plant and transported to City of Portola through the pipeline. Grizzly Ranch Golf Club has an intake pump on Grizzly Creek and pumps the water for irrigating the golf course. City of Portola currently purchases 946 acre-feet, Grizzly Golf Club 250 Acre-feet and Grizzly Lake CSD purchases 57 acre-feet. Grizzly Lake currently does not use the entitlement, but could in the future access the water by building a pipeline from the Lake Davis treatment plant. Grizzly Lake CSD currently pumps groundwater and Portola utilizes a natural spring seasonally. Over 1,400 acre-feet annual entitlement is currently available for sale, but not utilized due to lack of customers.

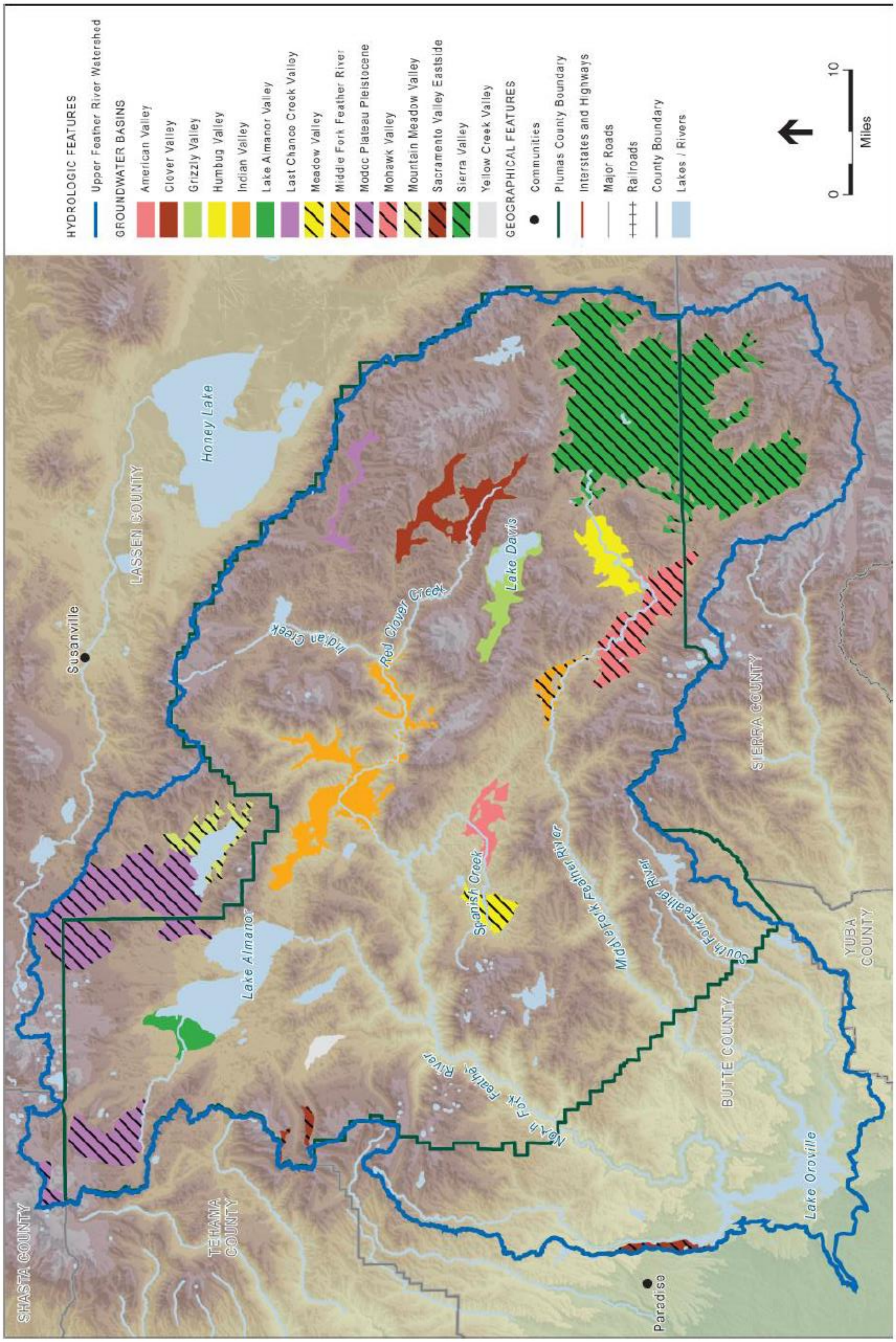
The Upper Feather River watershed covers a majority of the County (98%), which is about 72% of the watershed. The tributaries of the Upper Feather River watershed drain over 2 million acres of land in the Sierra Nevada Mountains, flowing southwest into Lake Oroville in neighboring Butte County. The Upper Feather River watershed is divided into four main branches with respective watersheds: the West Branch, the North Fork, the Middle Fork and the South Fork of the Feather River. The North Fork Feather River drainage area is the largest drainage area in the watershed covering approximately 1.4 million acres and contributing a yearly average flow of over 2.3 million acre-feet of water to Lake Oroville. The South Fork Feather River drainage is the smallest of the four drainage areas and contributes an average of over 189,000 acre-feet to Lake Oroville each year. The Upper Feather River watershed serves as an important supply of surface water resources. Water has been a valuable export from Plumas County since the State Water Project (SWP) located its main storage facility fed by the Feather River at Lake Oroville. This watershed supplies 3.2 million acre-feet per year for downstream urban, industrial and agricultural use as part of the State Water Project and delivers water to 29 agencies. The State Water Project also operates three reservoirs in Plumas County; Antelope Lake, Frenchman Lake and Lake Davis, which flow into Lake Oroville.

The main stems of the Upper Feather River watershed in addition to many of the tributaries exhibit some level of degradation, primarily due to human activities. The east side of the County experiences much more erosion than the west side, which greatly affects surface water quality. Timber harvesting, water diversion, irrigation practices, road and railroad construction, grazing and mining have all contributed to in-stream water quality issues, such as increased sediment transport, that impact aquatic life and riparian vegetation.

Plumas County contains fourteen groundwater basins, which are primarily located in the valleys on the east side of the Sierra Crest. These groundwater basins are also shown Figure 4-66. Sierra Valley is the largest groundwater basin, covering 125,250 acres, and underlies the Middle Fork of the Feather River. The smallest groundwater basin identified in the figure is Yellow Creek Valley Groundwater Basin covering 2,310 acres. Some of the County's groundwater basins have been depleted as a result of high extraction rates and slow recharge. For example, the Sierra Valley groundwater basin has experienced significant declines due to human activity and agricultural practices.

Groundwater quality is currently monitored in nine of the County's groundwater basins. Groundwater quality in the County varies by basin. Water quality in the Sierra Valley basin is primarily affected by geothermal activity which causes the groundwater to contain high concentrations of boron, fluoride, iron and sodium. Some wells within the Sierra Valley Sub-Basin also exhibit high levels of arsenic and manganese. Localized groundwater quality has been influenced in some areas by the use of septic systems.

Figure 4-66 Plumas County – Hydrologic Features



Source: Plumas County General Plan Water Resources Element

Location and Extent

Since water shortage happens on a regional scale, the entirety of the County is at risk. There is no established scientific scale to measure water shortage. The speed of onset of water shortage tends to be lengthy. The duration of water shortage can vary, depending on the severity of the drought that accompanies it.

Past Occurrences

Disaster Declaration History

There has been one federal disaster related to drought and water shortage in Plumas County issued in 1977. There have been two state disasters related to drought and water shortage in Plumas County issued in 1977 and 2014. This can be seen in Table 4-49.

Table 4-49 Plumas County – Disaster Declarations from Drought 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Drought	2	1977, 2014	1	1977

Source: FEMA, Cal OES

NCDC Events

There have been 2 NCDC drought events in Plumas County, related to events in the 2014 to 2016 drought. This is likely low due to underreporting to the NCDC database. No deaths, injuries, or property damages were reported to the NCDC from these events.

*Table 4-50 NCDC Drought Events for Plumas County 1996-9/30/2019**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Drought	2	0	0	0	0	$50,000	$0

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Plumas County

CA DWR and Hazard Mitigation Planning Committee Events

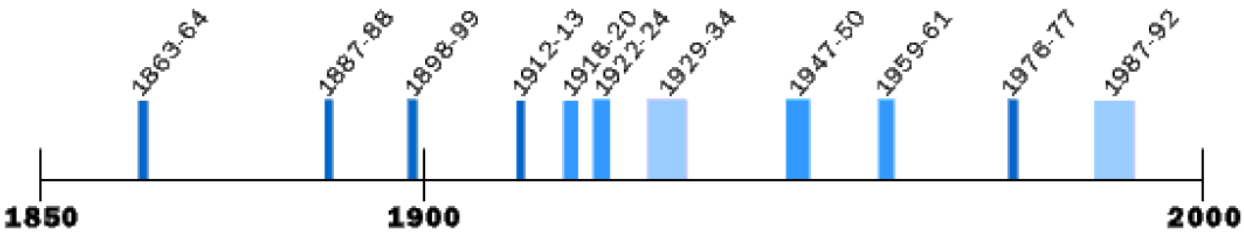
Historically, California has experienced multiple severe droughts. According to CA DWR, droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large northern California reservoirs. Table 4-51 compares the 1929-34 drought in the Sacramento and San Joaquin Valleys to the 1976-77, 1987-92, and 2007-09 droughts. Figure 4-67 depicts California's Multi-Year Historical Dry Periods, 1850-2000.

Table 4-51 Severity of Extreme Droughts in the Sacramento and San Joaquin Valleys

Drought Period	Sacramento Valley Runoff		San Joaquin Valley Runoff	
	(maf*/yr)	(percent Average 1901-96)	(maf*/yr)	(percent Average 1906-96)
1929-34	9.8	55	3.3	57
1976-77	6.6	37	1.5	26
1987-92	10.0	56	2.8	47
2007-09	11.2	64	3.7	61

Source: California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources.
*maf=million acre feet

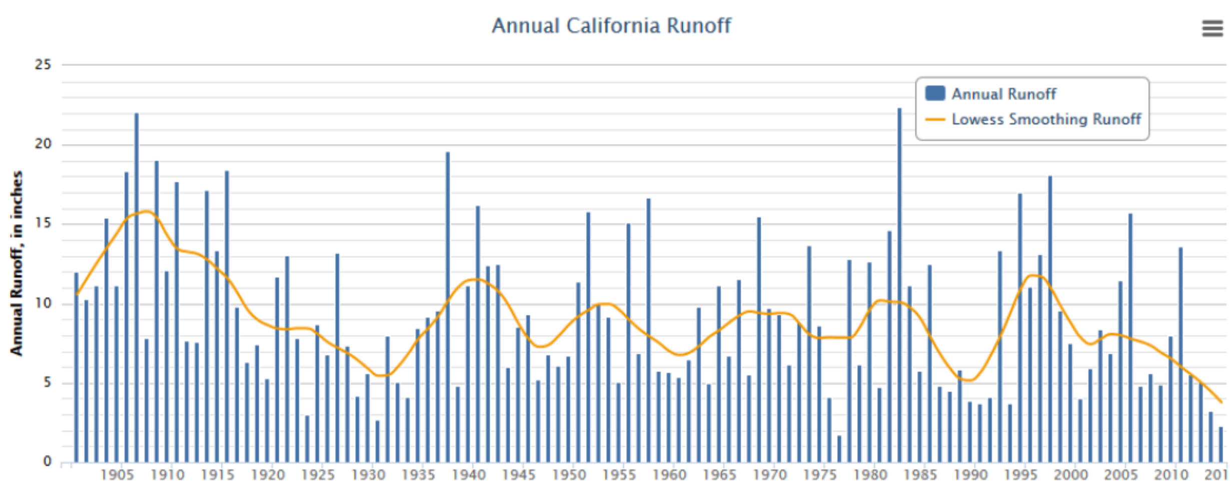
Figure 4-67 California's Multi-Year Historical Dry Periods, 1850-2000



Source: California Department of Water Resources, www.water.ca.gov/
Notes: Dry periods prior to 1900 estimated from limited data; covers dry periods of statewide or major regional extent

Figure 4-68 depicts runoff for the State from 1900 to 2015. This gives a historical context for the 2014-2015 drought to compare against past droughts.

Figure 4-68 Annual California Runoff –1900 to 2015



Source: CA DWR

The 2018 California State Hazard Mitigation Plan fleshed out the major droughts from 1900 to 2017. This discussion below appends to the tables and figures above.

The 1975-1977 Drought

From November 1975 through November 1977, California experienced one of its most severe droughts. Although people in many areas of the state are accustomed to very little precipitation during the growing season (April to October), they expect it in the winter. In 1976 and 1977, the winters brought only one-half and one-third of normal precipitation, respectively. Most surface storage reservoirs were substantially drained in 1976, leading to widespread water shortages when 1977 turned out to be even drier. 31 counties were affected, resulting in $2.67 billion in crop damages.

The 1987-1992 Drought

From 1987 to 1992, California again experienced a serious drought due to low precipitation and run-off levels. The hardest-hit region was the Central Coast, roughly from San Jose to Ventura. In 1988, 45 California counties experienced water shortages that adversely affected about 30 percent of the state's population, much of the dry-farmed agriculture, and over 40 percent of the irrigated agriculture. Fish and wildlife resources suffered, recreational use of lakes and rivers decreased, forestry losses and fires increased, and hydroelectric power production decreased. In February 1991, CA DWR and Cal OES surveyed drought conditions in all 58 California counties and found five main problems: extremely dry rangeland, irrigated agriculture with severe surface water shortages and falling groundwater levels, widespread rural areas where individual and community supplies were going dry, urban area water rationing at 25 to 50 percent of normal usage, and environmental impacts.

Storage in major reservoirs had dropped to 54 percent of average, the lowest since 1977. The shortages led to stringent water rationing and severe cutbacks in agricultural production, including threats to survival of permanent crops such as trees and vines. Fish and wildlife resources were in critical shape as well. Not since the 1928-1934 drought had there been such a prolonged dry period. In response to those conditions, the Governor established the Drought Action Team. This team almost immediately created an emergency drought water bank to develop a supply for four critical needs: municipal and industrial uses, agricultural uses, protection of fish and wildlife, and carryover storage for 1992. The large-scale transfer program, which involved over 800,000 acre-feet of water, was implemented in less than 100 days with the help and commitment of the entire water community and established important links between state agencies, local water interests, and local governments for future programs.

The 2007-2009 Drought

Water years 2007-2009 were collectively the 15th driest three-year period for CA DWR's eight-station precipitation index, which is a rough indicator of potential water supply availability to the State Water Project (SWP) and Central Valley Project (CVP). Water year 2007 was the driest single year of that drought, and fell within the top 20 percent of dry years based on computed statewide runoff. In June 2008, a state emergency proclamation was issued due to water shortage in selected Central Valley counties. In February 2009, for the first time in its history, the State of California proclaimed a statewide drought. The state placed unprecedented restrictions on CVP and SWP diversions from the Delta to protect listed fish species, a regulatory circumstance that exacerbated the impacts of the drought for water users.

The greatest impacts of the 2007–2009 drought were observed in the CVP service area on the west side of the San Joaquin Valley, where hydrologic conditions combined with reduced CVP exports resulted in substantially reduced water supplies (50 percent supplies in 2007, 40 percent in 2008, and 10 percent in 2009) for CVP south-of Delta agricultural contractors. Small communities on the west side highly dependent on agricultural employment were especially affected by land fallowing due to lack of irrigation supplies, as well as by factors associated with current economic recession. The coupling of the drought and economic recession necessitated emergency response actions related to social services, such as food banks and unemployment assistance.

The 2012-2017 Drought

The statewide drought of 2012-2017 will be remembered as one of the most severe and costliest droughts of record in California. The drought that spanned water years 2012 through 2017 included the driest four-year statewide precipitation on record (2012-2015) and the smallest Sierra-Cascades snowpack on record (2015, with 5 percent of average). It was marked by extraordinary heat: 2014, 2015, and 2016 were California's first, second, and third warmest years in terms of statewide average temperatures. By the time the drought was declared officially over in April 2017, the state had expended $6.6 billion in drought response and mitigation programs, and had been declared a federal disaster area. The immediate cause of California's 2014 drought can be traced to the altered route of atmospheric water vapor, which is necessary for strong winter precipitation in the state. Ordinarily, water evaporates from the ocean in the warm Tropical Pacific Ocean and winds carry that water vapor to the U.S. west coast. However, in 2014 the water vapor transport split into two branches and ended up going either north or south of California. The HMPC noted that in the Sierra Valley in 2016, severe drought caused well abandonment. 4 wells in the area went dry due to pumping sand, and one well had to be permanently abandoned. 3 new wells had to be dug, with a cost of $250,000 each. In addition, many wells in the areas were deepened considerably to reach the lowering water tables. Additional depths varied by well, and costs were borne by local ranchers.

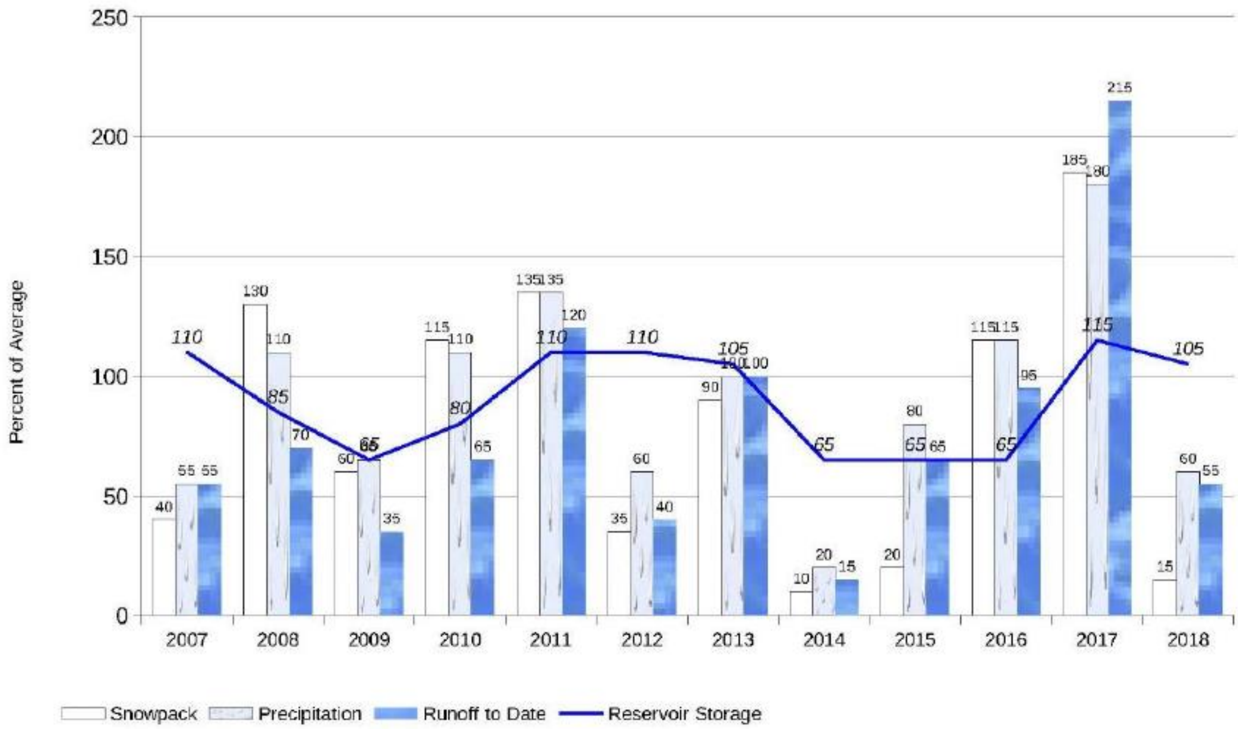
Other Events

In addition to the above, a member of the HMPC from Viera Ranch noted on **October 27th of 1999**, the Quincy area saw 145 days without rain.

Water Shortage

Figure 4-69 illustrates several indicators commonly used to evaluate water conditions in California. The percent of average values are determined by measurements made in each of the ten major hydrologic regions. The chart describes water conditions in California between 2007 and 2018. The chart illustrates the cyclical nature of weather patterns in California.

Figure 4-69 Water Supply Conditions, 2007 to 2018



Source: 2018 State of California Hazard Mitigation Plan

Beginning in 2012, snowpack levels in California dropped dramatically. 2015 estimates place snowpack as 5 percent of normal levels. Snowpack measurements have been kept in California since 1950 and nothing in the historic record comes close to 2015's severely depleted level. The previous record for the lowest snowpack level in California, 25 percent of normal, was set both in 1976-77 and 2013-2014. In "normal" years, the snowpack supplies about 30 percent of California's water needs, according to the California Department of Water Resources. Snowpack levels began to increase in 2016, and in 2017 snowpack increased to the largest in 22 years, according to the State Department of Water Resources. In late 2017 and early 2018, drought conditions began to return to California but have been dampened by periods of above average rainfall in the first part of 2019.

The Sierra Valley Groundwater District provided graphs of District water levels from 1980 to 2016. These can be seen on Figure 4-70, Figure 4-71, and Figure 4-72.

Figure 4-70 Plumas County – Loyalton Water Levels 1980-2016

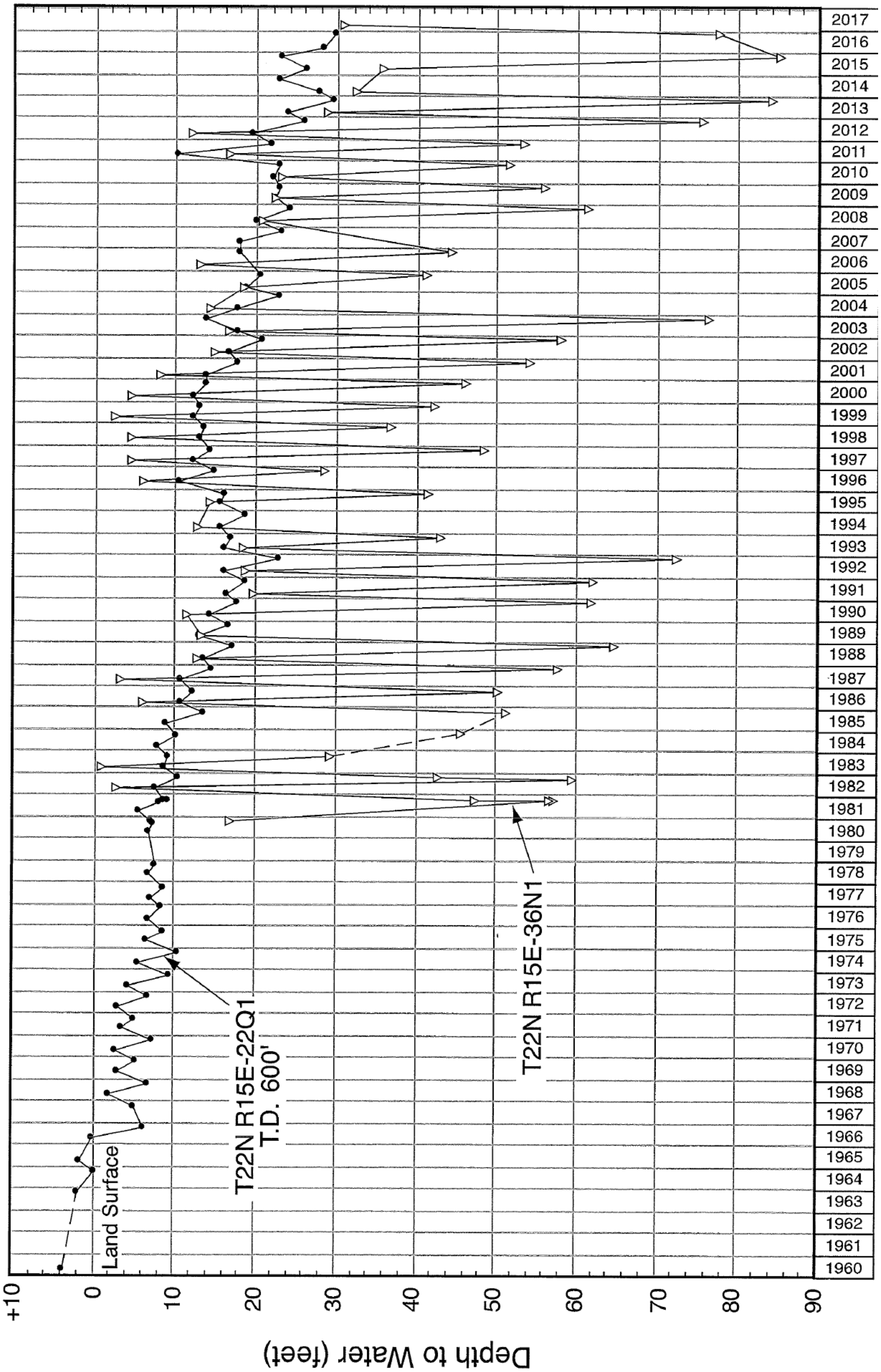


Figure 4-71 Plumas County – Vinton Water Levels 1980-2016

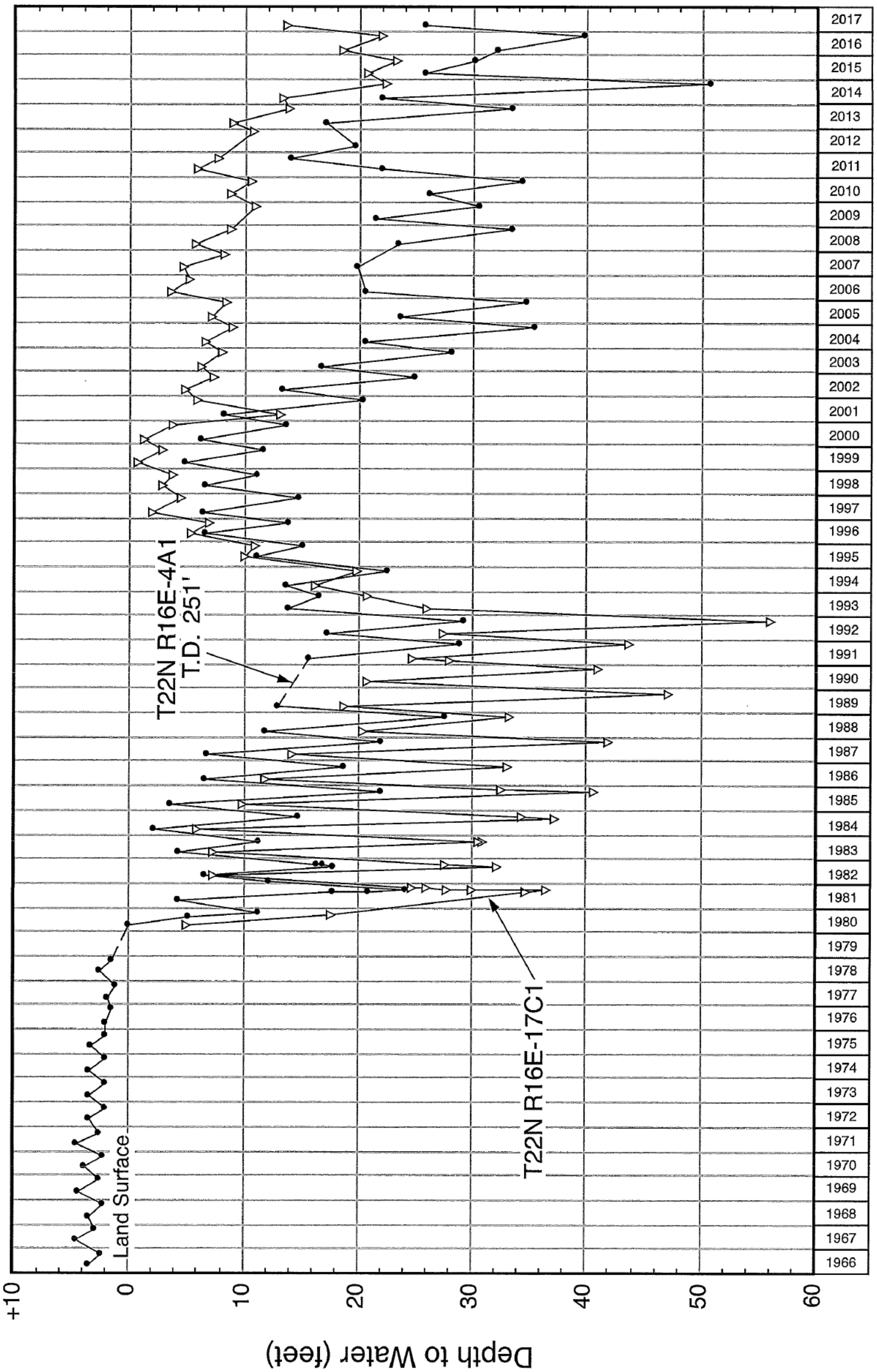
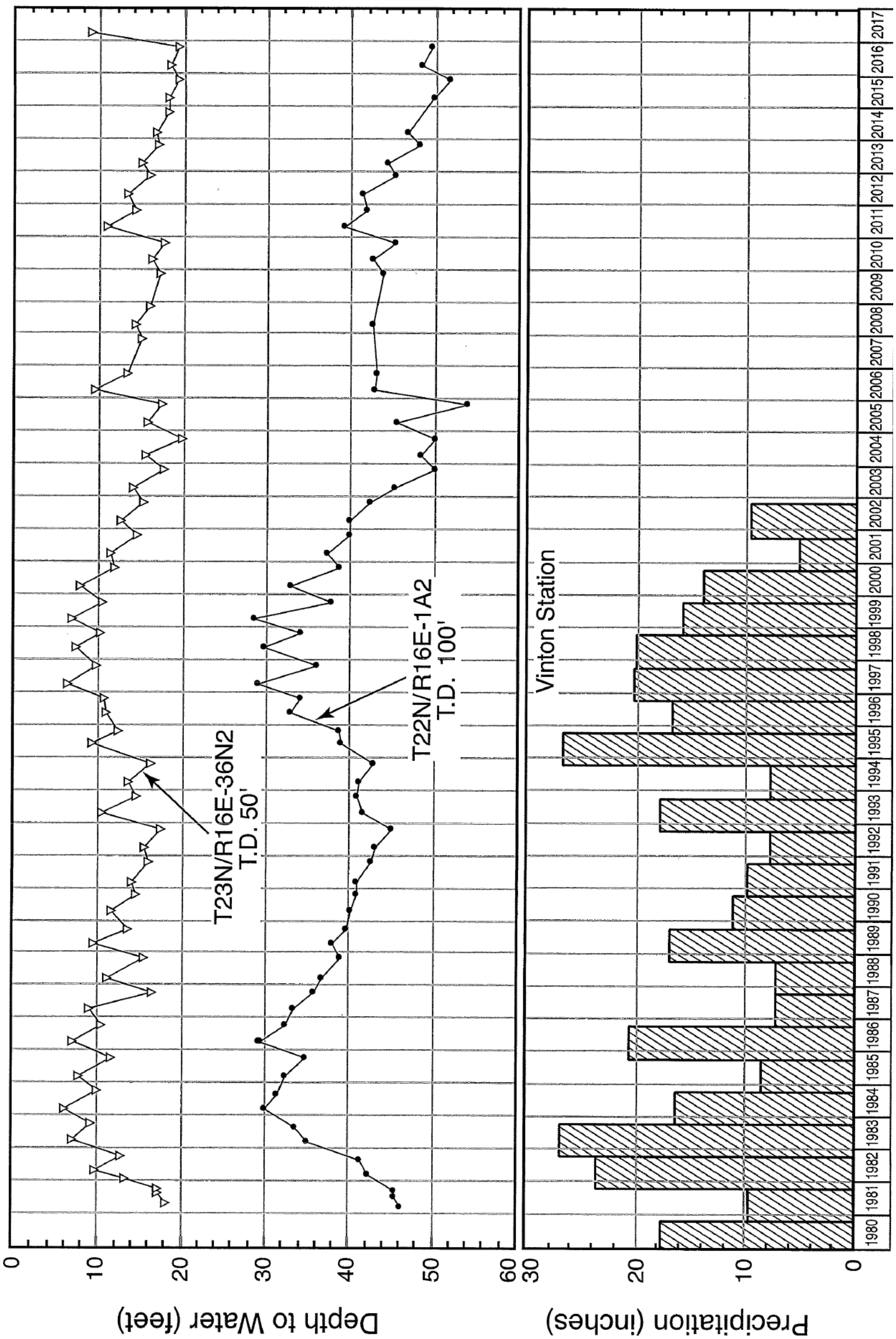


Figure 4-72 Plumas County – Chilcoot Water Levels 1980-2016



The HMPC noted that during PSPS events, or severe storm events that knock out power, can cause water to stop being pumped by water companies or by individual wells in the County. PSPS events are usually not long lasting, but severe weather can knock the power out for five to seven days.

Likelihood of Future Occurrence

Drought

Likely—Historical drought data for the Plumas County Planning Area and region indicate there have been 5 significant droughts in the last 85 years. This equates to a drought every 17 years on average or a 5.9 percent chance of a drought in any given year. However, based on this data and given the multi-year length and cyclical nature of droughts, the HMPC determined that future drought occurrences in the Planning Area are likely.

Water Shortage

Occasional — Recent historical data for water shortage indicates that Plumas County may at some time be at risk to both short and prolonged periods of water shortage. Based on this it is possible that water shortages will affect the County in the future during extreme drought conditions. However, to date, Plumas County has continued to have relatively consistent water supply.

Climate Change and Drought and Water Shortage

Climate scientists studying California find that drought conditions are likely to become more frequent and persistent over the 21st century due to climate change. The experiences of California during recent years underscore the need to examine more closely the state's water storage, distribution, management, conservation, and use policies. The 2014 CAS stresses the need for public policy development addressing long term climate change impacts on water supplies. The CAS notes that climate change is likely to significantly diminish California's future water supply, stating that: California must change its water management and uses because climate change will likely create greater competition for limited water supplies needed by the environment, agriculture, and cities.

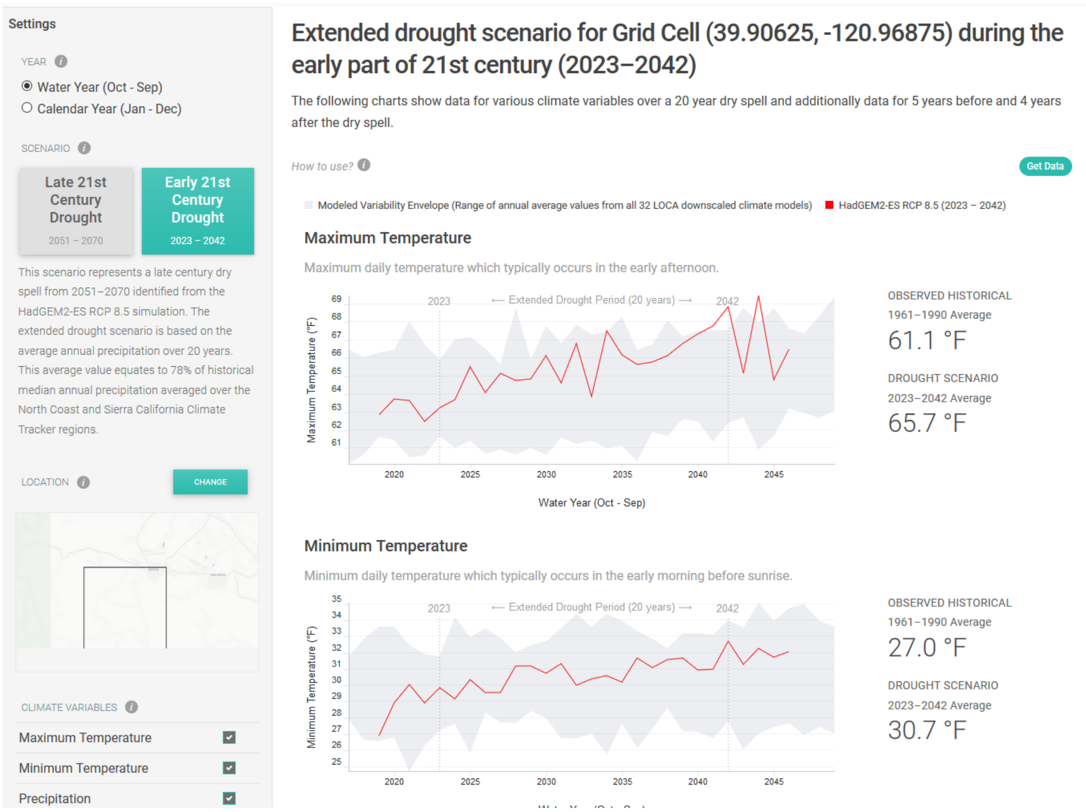
A report from the Public Policy Institute of California noted that thousands of Californians – mostly in rural, small, disadvantaged communities – already face acute water scarcity, contaminated groundwater, or complete water loss. Climate change would make these effects worse.

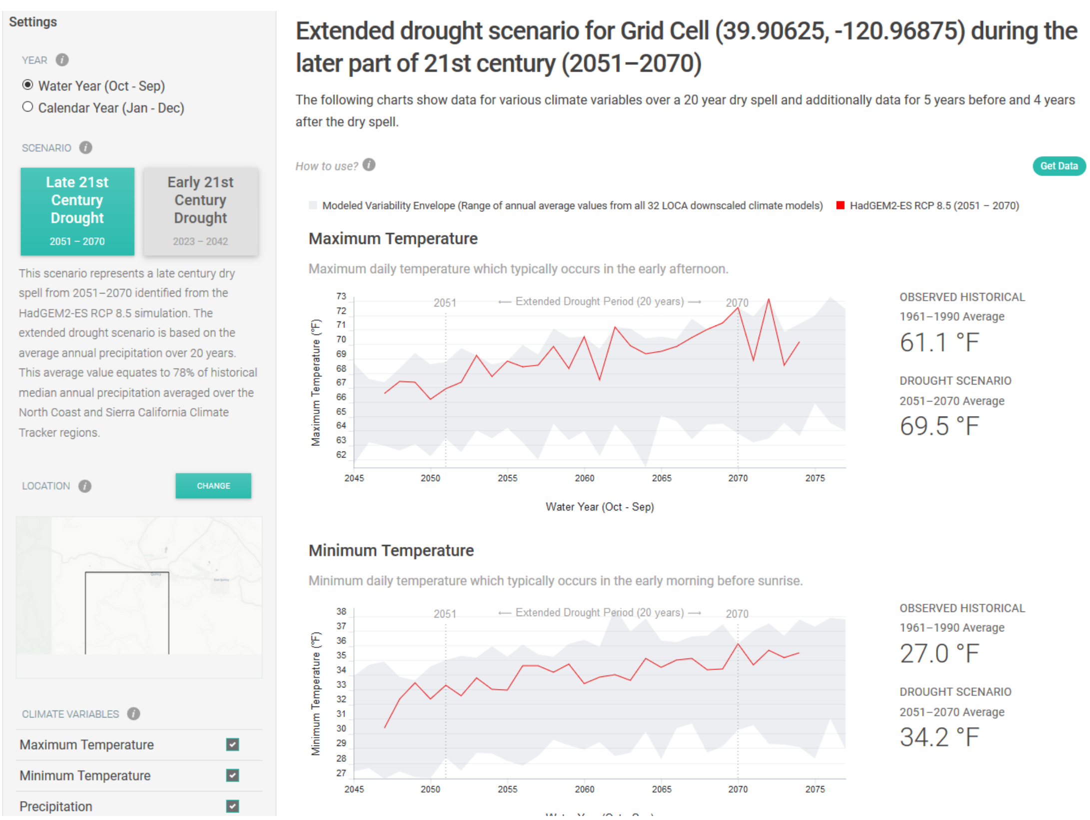
Cal-Adapt has modeled future risk of drought. Recent research suggests that extended drought occurrence ("mega-drought") could become more pervasive in future decades. This tool explores data for two 20-year drought scenarios (using the quad that contains the City of Quincy) derived from LOCA downscaled meteorological and hydrological simulations (Figure 4-73) – one for the earlier part of the 21st century, and one for the latter part:

- The upper chart represents a mid-century dry spell from 2023-2042 identified from the HadGEM2-ES RCP 8.5 simulation. The extended drought scenario is based on the average annual precipitation over 20 years. This average value equates to 78% of historical median annual precipitation averaged over the North Coast and Sierra California Climate Tracker regions.

- The lower chart represents a late century dry spell from 2051–2070 identified from the HadGEM2-ES RCP 8.5 simulation. The extended drought scenario is based on the average annual precipitation over 20 years. This average value equates to 78% of historical median annual precipitation averaged over the North Coast and Sierra California Climate Tracker regions.

Figure 4-73 Plumas County – Future Extended Drought Scenarios





Source: Cal-Adapt – Extended Drought Scenarios

Vulnerability Assessment

Vulnerability—Medium

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue for agricultural, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water. In the populated areas of the County, community service districts provide water and sewer services. In the rural areas, wells and septic systems are more prevalent.

Impacts

Based on historical information, the occurrence of drought in California, including Plumas County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The vulnerability of Plumas County to drought is countywide, but impacts may vary and may include reduction in water supply, agricultural losses, and an increase in dry fuels.

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. Tracking drought impacts can be difficult. The Drought Impact Reporter from the NDMC is a useful reference tool that compiles reported drought impacts nationwide. Table 4-52 show drought impacts for the Plumas County Planning Area from 1850 to March 2020. The data represented is skewed, with the majority of these impacts from records within the past ten years.

Table 4-52 Plumas County Drought Impacts

Category	Number of Impacts
General Awareness	35
Agriculture	67
Business and Industry	18
Energy	6
Fire	19
Plants & Wildlife	45
Relief, Response, and Restrictions	181
Society and Public Health	61
Tourism and Recreation	18
Water Supply and Quality	145
Total	**595**

Source: National Drought Mitigation Center, 1/1/1850-3/31/2020

The most significant qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Mandatory conservation measures are typically implemented during extended droughts. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

With a reduction in water, water supply issues based on water rights becomes more evident. Some agricultural uses are severely impacted through limited water supply, especially those with livestock. Drought and water supply issues will continue to be a concern to the Planning Area. The drawdown of the groundwater table is one factor that has been recognized to occur during repeated dry years. Lowering of groundwater levels results in the need to deepen wells, which subsequently lead to increased pumping costs. These costs are a major consideration for residents relying on domestic wells and agricultural producers that irrigate with groundwater and/or use it for frost protection. Land subsidence can also occur when the groundwater table is depleted.

Recently, a draft report by CA DWR (titled Small Water Suppliers and Rural Communities at Risk of Drought and Water Shortage Vulnerability and Recommendations and Guidance to Address the Planning Needs of these Communities), sought to quantify the drought and water shortage vulnerability to rural counties, like Plumas County, in the State of California. Included in the draft report is the methodology for developing relative risk assessment scores that show where small water systems rank on an index of drought and water shortage vulnerability and recommendations on drought and water shortage vulnerability for small water systems. It is important to note that the primary benefit of this scoring exercise is to offer local and regionally-specific information to assist with drought and water shortage planning.

CA DWR developed a tool to rate drought and water shortage risk by water provider. To develop the tool, CA DWR used statewide datasets to estimate risk of drought and water shortage for small water suppliers and rural communities. CA DWR was only able to calculate relative risk scores for small water systems that had a digital service area boundary, with data available from the Water Board. CA DWR is working with the Water Board to create a process to obtain service areas boundaries for the remaining small water systems. Table 4-53 was extracted from the Excel table from the report, and shows the systems in Plumas County that were reviewed and their risk score for drought and water shortage.

Table 4-53 Plumas County – Drought and Water Shortage Risk Factors for Small Water Suppliers

System Name	County	Risk Score
FRCCSD LITTLE INDIAN CREEK	PLUMAS	50.29
CALTRANS-MASSACK REST STOP	PLUMAS	89.43
CALTRANS-L.T. DAVIS RESTSTOP	PLUMAS	65.4
CALTRANS-CHESTER SAFETY REST STOP	PLUMAS	81.47
DREAM CATCHER CAMPGROUND	PLUMAS	7.71
BIG MEADOWS SUBDIVISION	PLUMAS	38.72
COPPERCREEK CAMP	PLUMAS	93.87
FRCCSD OLD MILL RANCH	PLUMAS	69.2

System Name	County	Risk Score
KEDDIE RESORT	PLUMAS	42.17
WHITEHAWK RANCH MWC	PLUMAS	25.87
GRIZZLY LAKE CSD-DELLEKER	PLUMAS	37
GRIZZLY LAKE CSD-CROCKER/WELCH	PLUMAS	40.4
EVERGREEN MOTEL & MHP	PLUMAS	81.62
ARLINGTON HEIGHTS MHP	PLUMAS	71.24
PRATTVILLE WATER ASSN	PLUMAS	50.8
BLAIRSDEN WATER USERS ASSN	PLUMAS	79.83
JD TRAILER RANCH	PLUMAS	54.46
FEATHER RIVER RV & MHP	PLUMAS	13.63
HAMILTON BRANCH MWC	PLUMAS	37.1
FRCCSD HOT SPRINGS	PLUMAS	86.64
WEST END WATER ASSOCIATION	PLUMAS	45.88
GREENHORN CREEK CSD	PLUMAS	65.96
VALIVU ESTATES MHP	PLUMAS	70.44
GREENHAVEN HOA	PLUMAS	57.27
RED BARN MHP	PLUMAS	21.29
SOPER WHEELER CORP HOUSING #2	PLUMAS	58.27
CLIO PUBLIC UTILITY DISTRICT	PLUMAS	43.74
IVCSD CRESCENT MILLS	PLUMAS	4.51
RIVER RANCH RV PARK	PLUMAS	83.85
WALKER RANCH CSD	PLUMAS	75.19
GOLD MOUNTAIN CSD	PLUMAS	8.63
GRIZZLY RANCH CSD	PLUMAS	47.6
IVCSD-GREENVILLE	PLUMAS	6.38
CITY OF PORTOLA	PLUMAS	1.21
AMERICAN VALLEY CSD	PLUMAS	36.06
GRAEAGLE WATER COMPANY	PLUMAS	83.44
LAKE ALMANOR COUNTRY CLUB MWC	PLUMAS	12.75
WEST ALMANOR M.W.C.	PLUMAS	37.88
EAST QUINCY SERVICES DISTRICT	PLUMAS	14.74
CHESTER PUBLIC U.D.	PLUMAS	11.52
PLUMAS EUREKA CSD	PLUMAS	32.01

Source: CDAG Report

Note: It is important to note that the primary benefit of this scoring exercise is to offer local and regionally specific information to assist with drought and water shortage planning.

0 is the lowest risk and 100 is highest risk, compared to other small water suppliers

Future Development

According to the HMPC, Plumas County has access to large quantities of water through its surface water as well as through ground water. Population in the County in the future is expected to shrink (see Table 4-17), which reduces pressure on water companies during periods of drought and water shortage. Water companies will need to continue to plan for and add infrastructure capacity to replace aging systems.

4.3.10. Earthquake

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction. This section briefly discusses issues related to types of seismic hazards.

Ground Shaking

Groundshaking is motion that occurs as a result of energy released during faulting. The damage or collapse of buildings and other structures caused by groundshaking is among the most serious seismic hazards. Damage to structures from this vibration, or groundshaking, is caused by the transmission of earthquake vibrations from the ground to the structure. The intensity of shaking and its potential impact on buildings is determined by the physical characteristics of the underlying soil and rock, building materials and workmanship, earthquake magnitude and location of epicenter, and the character and duration of ground motion.

Actual ground breakage generally affects only those buildings directly over or nearby the fault. Ground shaking generally has a much greater impact over a greater geographical area than ground breakage. The amount of breakage and shaking is a function of earthquake magnitude, type of bedrock, depth and type of soil, general topography, and groundwater.

Seismic Structural Safety

Older buildings constructed before building codes were established, and even newer buildings constructed before earthquake-resistance provisions were included in the codes, are the most likely to be damaged during an earthquake. Buildings one or two stories high of wood-frame construction are considered to be the most structurally resistant to earthquake damage. Older masonry buildings without seismic reinforcement (unreinforced masonry buildings [URM]) and soft story buildings are the most susceptible to the type of structural failure that causes injury or death.

The susceptibility of a structure to damage from ground shaking is also related to the underlying foundation material. A foundation of rock or very firm material can intensify short-period motions which affect low-rise buildings more than tall, flexible ones. A deep layer of water-logged soft alluvium can cushion low-rise buildings, but it can also accentuate the motion in tall buildings. The amplified motion resulting from softer alluvial soils can also severely damage older masonry buildings.

Other potentially dangerous conditions include, but are not limited to: building architectural features that are not firmly anchored, such as parapets and cornices; roadways, including column and pile bents and abutments for bridges and overcrossings; and above-ground storage tanks and their mounting devices. Such features could be damaged or destroyed during strong or sustained ground shaking.

Liquefaction Potential

Liquefaction is a process whereby soil is temporarily transformed to a fluid formed during intense and prolonged ground shaking. Areas most prone to liquefaction are those that are water saturated (e.g., where the water table is less than 30 feet below the surface) and consist of relatively uniform sands that are loose to medium density. In addition to necessary soil conditions, the ground acceleration and duration of the earthquake must be of sufficient energy to induce liquefaction.

Liquefaction during major earthquakes has caused severe damage to structures on level ground as a result of settling, titling, or floating. Such damage occurred in San Francisco on bay-filled areas during the 1989 Loma Prieta earthquake, even though the epicenter was several miles away. If liquefaction occurs in or under a sloping soil mass, the entire mass may flow toward a lower elevation. Also of particular concern in terms of developed and newly developing areas are fill areas that have been poorly compacted.

No known liquefaction areas exist in Plumas County.

Settlement

Settlement can occur in poorly consolidated soils during ground shaking. During settlement, the soil materials are physically rearranged by the shaking to result in a less stable alignment of the individual minerals. Settlement of sufficient magnitude to cause significant structural damage is normally associated with rapidly deposited alluvial soils or improperly founded or poorly compacted fill. These areas are known to undergo extensive settling with the addition of irrigation water, but evidence due to ground shaking is not available.

Location and Extent

California is seismically active because it sits on the boundary between two of the earth's tectonic plates. Most of the state - everything east of the San Andreas Fault - is on the North American Plate. The cities of Monterey, Santa Barbara, Los Angeles, and San Diego are on the Pacific Plate, which is constantly moving northwest past the North American Plate. The relative rate of movement is about two inches per year. The San Andreas Fault is considered the boundary between the two plates, although some of the motion is taken up on faults as far away as central Utah.

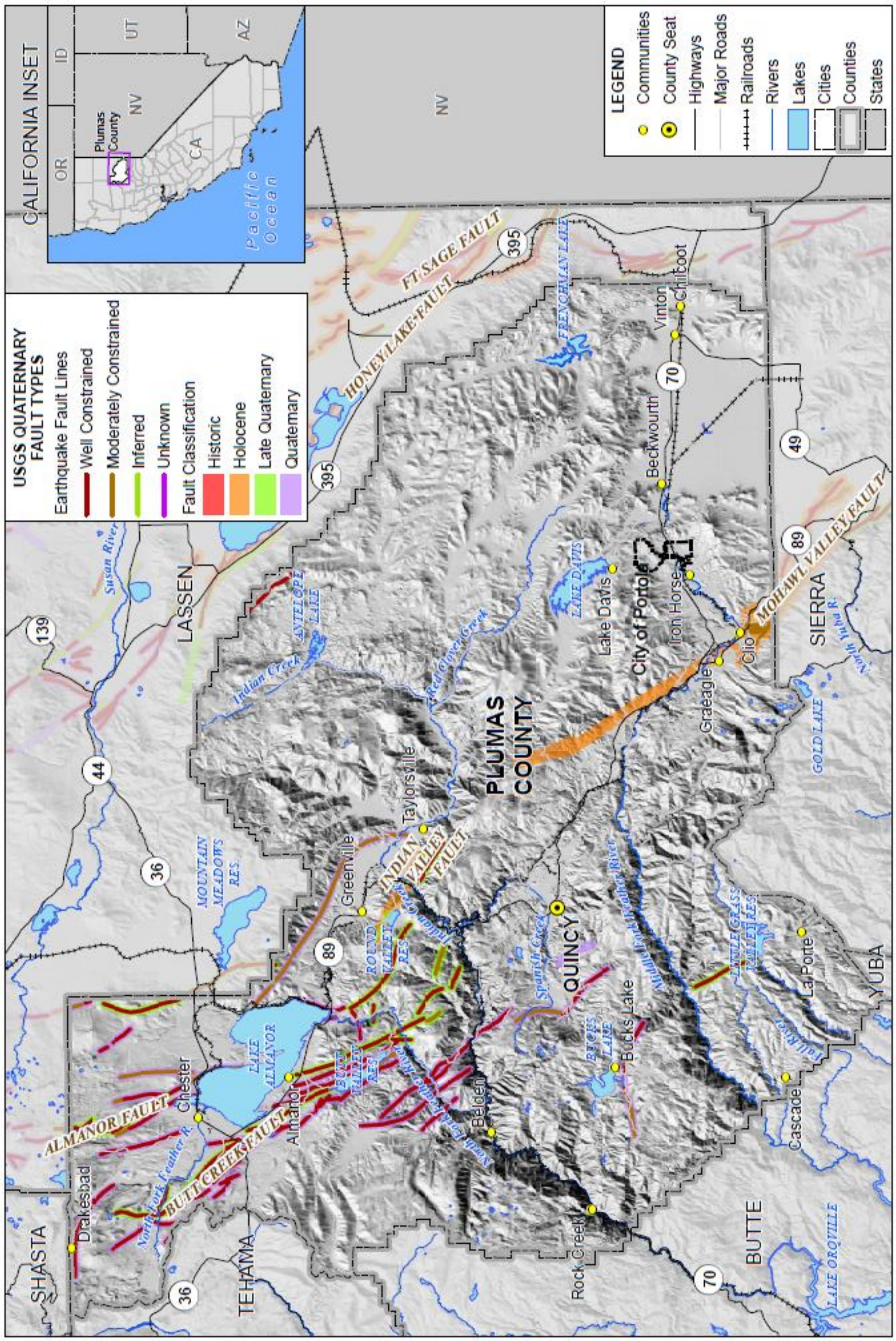
Faults

A fault is defined as "a fracture or fracture zone in the earth's crust along which there has been displacement of the sides relative to one another." For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant. This does not mean, however, that faults having no evidence of surface displacement within the last 11,000 years are necessarily inactive. For example, the 1975 Oroville earthquake, the 1983 Coalinga earthquake, and the 1987 Whittier Narrows earthquake occurred on faults not previously recognized as active. Potentially active faults are those that have shown displacement within the last 1.6 million years (Quaternary). An inactive fault shows no evidence of movement in historic (last 200 years) or geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

The 2035 Plumas County General Plan Public Health and Safety Element noted that the risk of seismic hazards to residents of Plumas County is based on the approximate location of earthquake faults within and outside of the County. Several potentially active faults pass through Plumas County. The Almanor Fault, Butt Creek Fault Zone, and the Mohawk Valley Fault traverse the County. The Indian Valley Fault is also considered an active fault located within the County. Additionally, the Honey Lake and Fort Sage Faults are two active faults located east of the County. Figure 4-74 shows fault locations in and near Plumas County. The HMPC noted that an area of concern for the County is the Sierra Valley.

Figure 4-74 Active Faults in and near Plumas County



Data Source: CGS Alquist Priolo Earthquake Fault Zones 2015, USGS Quaternary Faults (July 17, 2014), Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales. One of the first was the Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The Richter Magnitude Scale is used to quantify the magnitude or strength of the seismic energy released by an earthquake. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface (see Table 4-54). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4-54 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors; by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, and great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: Multi-Hazard Identification and Risk Assessment, FEMA 1997

Other Hazards

Earthquakes can also cause landslides and dam failures. Earthquakes may cause landslides (discussed in Section 4.3.13), particularly during the wet season, in areas of high water or saturated soils. Finally, earthquakes can cause dams to fail (see Section 4.3.8 Dam Failure).

Past Occurrences

Disaster Declaration History

There have been no disaster declarations in the County related to earthquakes, as shown on Table 4-4.

NCDC Events

Earthquake events are not tracked by the NCDC database.

USGS Events

The USGS National Earthquake Information Center database contains data on earthquakes in the Plumas County area. Table 4-55 shows the approximate distances earthquakes can be felt away from the epicenter. According to the USGS data, a magnitude 5.0 earthquake could be felt up to 90 miles away. The USGS database was searched for magnitude 5.0 or greater on the Richter Scale within 90 miles of the City of Quincy in Plumas County. There are 41 results that are detailed in Table 4-56.

Table 4-55 Approximate Relationships between Earthquake Magnitude and Intensity

Richter Scale Magnitude	Maximum Expected Intensity*	Distance Felt (miles)
2.0 - 2.9	I – II	0
3.0 - 3.9	II – III	10
4.0 - 4.9	IV – V	50
5.0 - 5.9	VI – VII	90
6.0 - 6.9	VII – VIII	135
7.0 - 7.9	IX – X	240
8.0 - 8.9	XI – XII	365

*Modified Mercalli Intensity Scale.

Source: United State Geologic Survey, Earthquake Intensity Zonation and Quaternary Deposits, Miscellaneous Field Studies Map 9093, 1977.

*Table 4-56 Magnitude 5.0 Earthquakes or greater within 90 Miles of Plumas County**

Date	Richter Magnitude	Location
5/24/2013	5.69	10km WNW of Greenville, California
4/26/2008	5.1	1km NW of Mogul, Nevada
8/10/2001	5.2	Northern California
11/26/1998	5.1	7km NW of Redding, CA
11/28/1980	5.1	Northern California
2/22/1979	5.3	Northern California
11/27/1976	5	Northern California
8/2/1975	5.2	Northern California
8/2/1975	5.1	Northern California
8/1/1975	5.7	0km WSW of Palermo, California
4/29/1968	5	Northern California
9/12/1966	5.91	Northern California
4/1/1959	5.6	Northern California
9/26/1953	5.3	Nevada

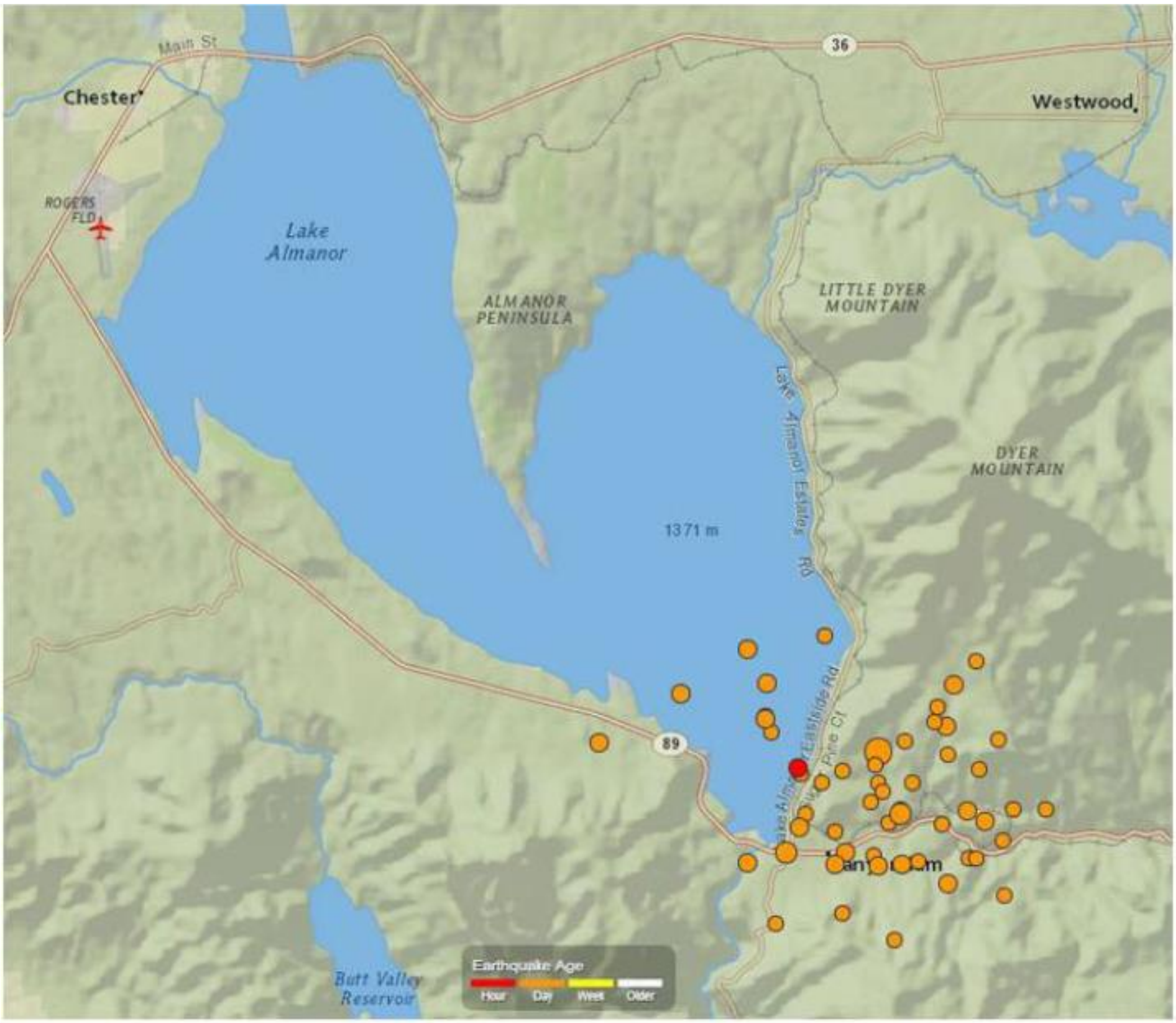
Date	Richter Magnitude	Location
3/22/1953	5	Northern California
5/9/1952	5.1	Nevada
12/14/1950	5.6	Northern California
3/20/1950	5.5	Lassen Peak area, California
12/29/1948	6	Northern California
7/7/1946	5	Lassen Peak area, California
3/30/1943	5.3	Northern California
12/17/1942	5.1	Northern California
12/3/1942	5.5	Nevada
2/8/1940	5.7	Northern California
4/24/1914	6.4	Nevada
2/18/1914	6	Nevada
6/23/1909	5.7	Northern California
3/3/1909	5	Northern California
6/20/1889	5.9	Northern California
4/29/1888	5.9	Northern California
6/3/1887	6.3	Nevada
1/31/1885	5.7	Northern California
1/7/1881	5.6	Near Red Bluff, California
7/10/1877	5.5	Lake Tahoe area, California-Nevada border
1/24/1875	6.2	South of Janesville, California
12/27/1869	6.2	Near Carson City, Nevada
12/27/1869	6.4	Northwest of Virginia City, Nevada
5/30/1868	6	Near Virginia City, Nevada
3/15/1860	6.5	East of Reno, Nevada
9/3/1857	6	California-Nevada Border east of Truckee
1/25/1855	5.5	Sierra County, California

Source: USGS
*Search dates 1/1/1850 – 4/1/2019

As shown on Table 4-56, series of earthquakes occurred near Lake Almanor on May 24, 2013. The series of earthquakes included a 5.7 magnitude earthquake near Canyon Dam, near the southern end of Lake Almanor. See Figure 4-75 for location of the May 24th earthquake series. Injuries were reported and damage to infrastructure and homes were sustained. Lake Almanor Mutual Water Company sustained a water main rupture which resulted in water supply loss, and 600 PG&E customers on the Lake Almanor peninsula lost power.

As a result of the 5.7 event, Plumas County BOS instituted an emergency proclamation. This provides businesses and homeowners official documentation in potential damage claim activity. Over one million dollars in damages were reported and over 50 homes in the Lake Almanor basin were impacted. Broken or toppled chimneys were the most common report, however broken water lines caused flooding and water damage. At least one residential structure was shifted off its foundation as a result of ground shaking. Figure 4-76 depicts damage to a home in the Lake Almanor area.

Figure 4-75 Plumas County – May 2013 Canyon Dam Earthquakes



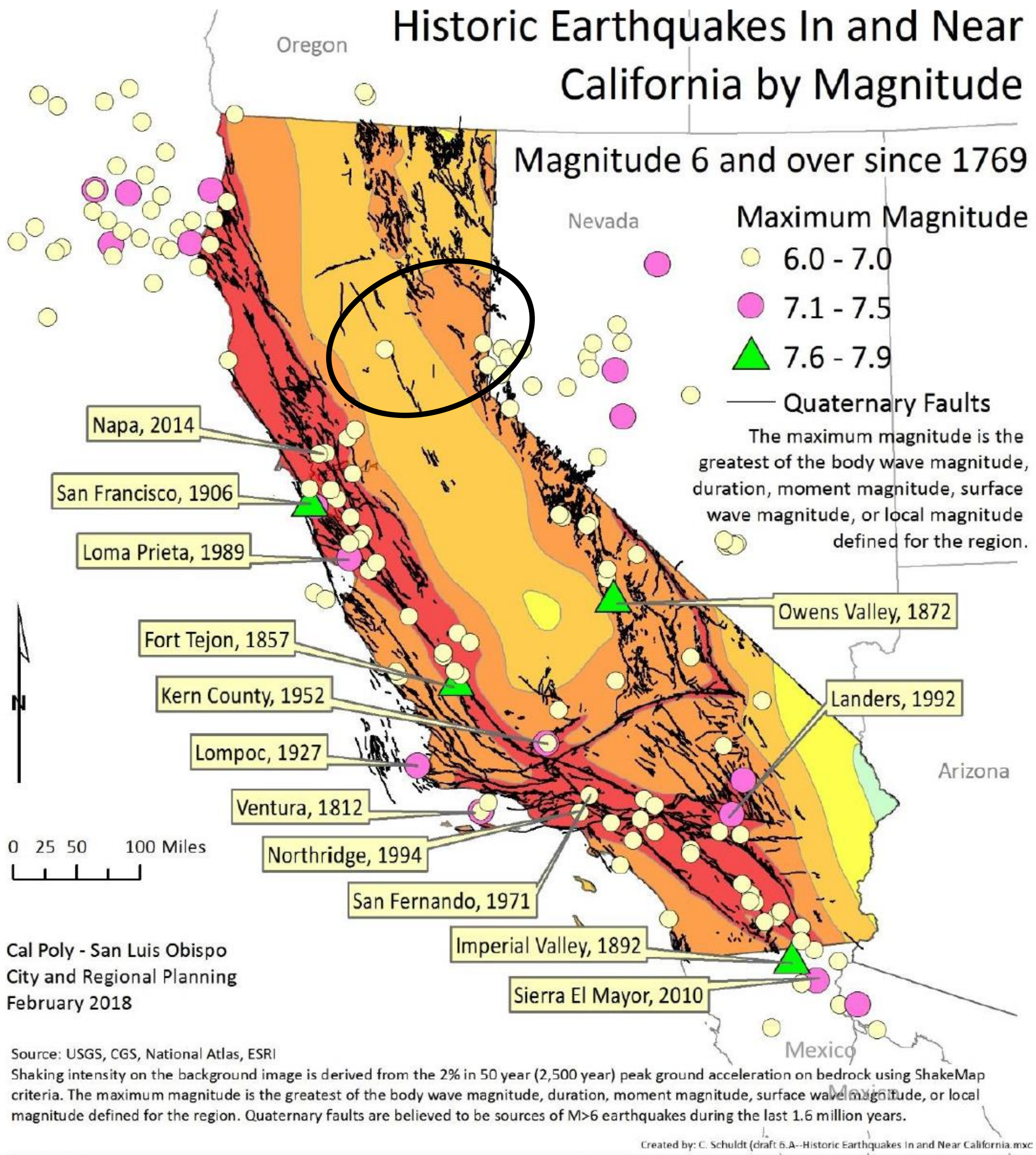
Source: USGS

Figure 4-76 Plumas County – Home Damaged by Canyon Dam Earthquake

Source: Plumas County

Figure 4-77 shows major historical earthquakes in California from 1769 to 2017.

Figure 4-77 Historic Earthquakes in California 1769 to 2017



	MMI	Damage	Effects
	X	Very Heavy	Some well-built, wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
	IX	Heavy	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.
	VIII	Moderate to Heavy	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.
	VII	Moderate	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.
	VI	Light	Felt by all, many frightened. Some heavy furniture moved; a few instance of fallen plaster. Damage slight.
	V	Very Light	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

Source: 2018 State of California Multi-Hazard Mitigation Plan

Hazard Mitigation Planning Committee Events

The HMPC member from Viera Ranch noted that on **August 1, 1975**, the Oroville earthquake occurred in nearby Butte County. There was strong shaking noted in Quincy. Other events noted by this member include:

- **December 24, 1992** – an earthquake of 5.6 magnitude hit, causing ground shaking in Quincy.
- **January 16, 1993 –** a small earthquake was felt in Quincy.
- **August 13, 1994** – a small earthquake of 3.0 magnitude was felt in Quincy.
- **June 8, 1995 –** an earthquake of 4.1 was felt in the Cromberg area.
- **February 1, 1996** – a small earthquake was felt in Quincy.
- **November 5, 1997** – a 4.8 earthquake was felt in the Spring Garden Area.
- **June 5, 2001** – a small earthquake was felt in Quincy.
- **June 10, 2001** – a5.5 earthquake was felt. It was centered in Portola. The County Courthouse was checked for cracks.
- **January 7, 2003** – a 2.8 earthquake was felt in Quincy.

The HMPC noted a press release from the **May 23, 2013** 5.7 magnitude event. On Thursday May 23, 2013, Plumas County experienced a 5.7 magnitude earthquake near Canyon Dam, near the southern end of Lake Almanor. This report updates information available as of May 24th.

- No reports of injuries due to the earthquake.
- No reports of damage to the county and state roadways. All roadways are open at this time to the public.
- Some minor damage reported in the Chester area to several businesses. However the damage will not preclude them from being open to the public.
- The damage reported to the LACC Mutual Water Company water system has been repaired but the boil water advisory is still in effect.
- Almanor North and South Campgrounds are open to the public as well as the Canyon Dam Boat Launch and Canyon Dam Day Use Area. Rocky Point Campground on Lake Almanor and Ponderosa Flat Campground on Butt Lake are open as well.
- No events have been canceled in the Lake Almanor Area due to this incident.

A USGS Report on this event noted that Felt intensity among the communities around Lake Almanor appeared to vary significantly. Lake Almanor West, Lake Almanor Country Club, and Hamilton Branch experienced MMI $\geq$7, whereas other communities around the lake experienced MMI $\leq$6; the maximum observed intensity was MMI 8, in Lake Almanor West. Damage in the high intensity areas consisted of broken and collapsed chimneys, ruptured pipes, and some damage to foundations and to structural elements within houses. Although this shaking damage is not usually expected for an Mw 5.7 earthquake, the intensities at Lake Almanor Country Club correlate with the peak ground acceleration (38 percent g) and peak ground velocity (30 centimeters per second) recorded by the California Strong Motion Instrumentation Program accelerometer located at the nearby Lake Almanor Fire Station. The intensity distribution for the three hardest hit areas (LAW, LACC, and HB) appears to increase as the azimuth from epicenter to the intensity sites approaches the fault strike. The small communities of Almanor and Prattville on the southwestern shore of Lake Almanor experienced somewhat lower intensities. The town of Canyon Dam experienced a lower intensity as well, despite its location up-dip of the earthquake rupture.

Figure 4-78 shows interior damages done to a house in the Lake Almanor Country Club area. Figure 4-79 shows a water tank. The earthquake caused a coupling to break, spilling 50,000 gallons of water before the LACC Mutual Water Company shut off the leak. Figure 4-80 shows the exterior of a house where a chimney collapsed.

Figure 4-78 Damage at Home in Lake Almanor Country Club Area

Source: Chapman, K., Gold, M.B., Boatwright, J., Sipe, J., Quitoriano, V., Dreger, D., and Hardebeck, J., 2016, Faulting, damage, and intensity in the Canyondam earthquake of May 23, 2013: U.S. Geological Survey Open-File Report 2016-1145, 49 p., http://dx.doi.org/10.3133/ofr20161145.

Figure 4-79 Water Tank in Lake Almanor Country Club Area

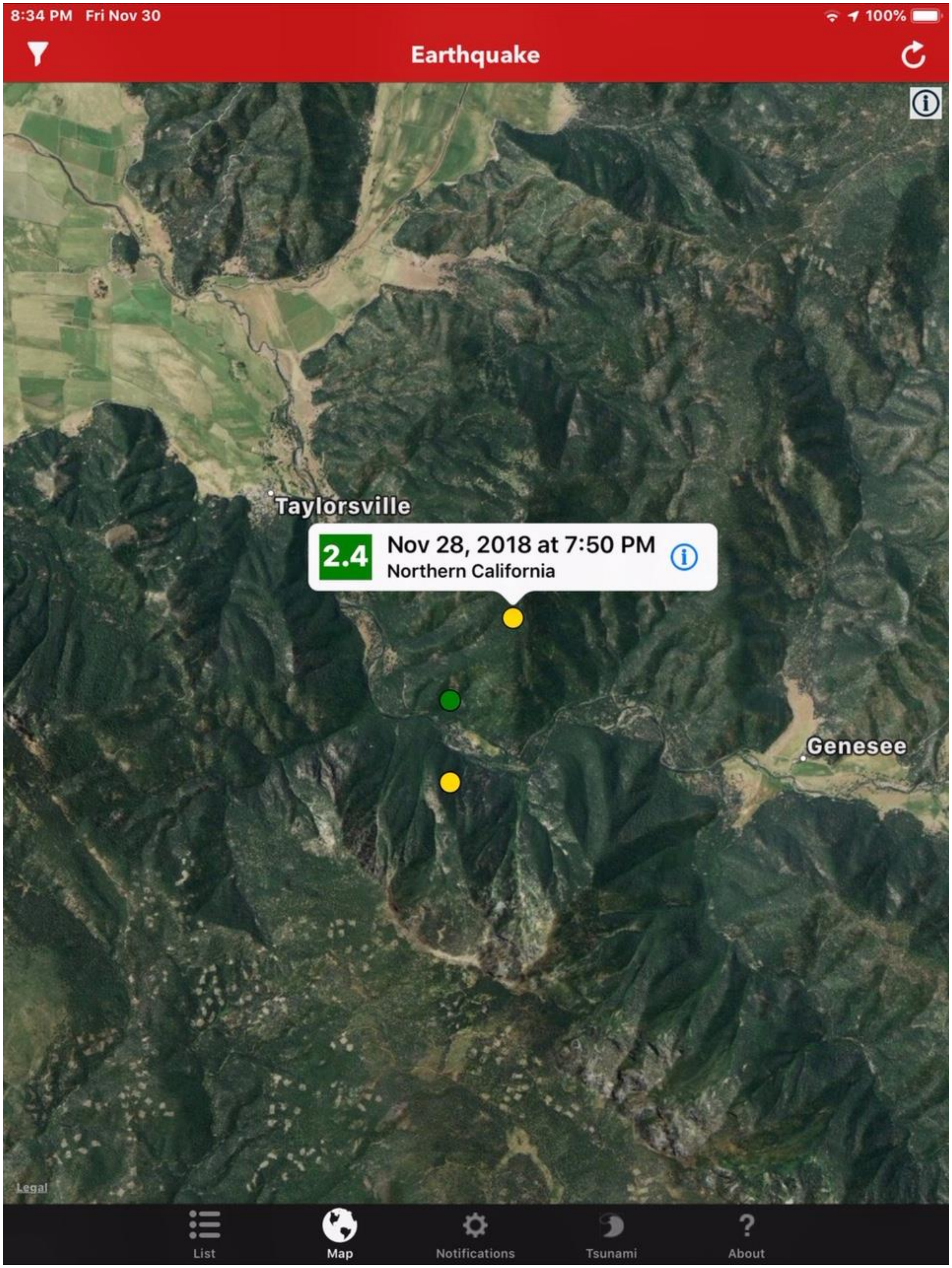
Source: Chapman, K., Gold, M.B., Boatwright, J., Sipe, J., Quitoriano, V., Dreger, D., and Hardebeck, J., 2016, Faulting, damage, and intensity in the Canyon dam earthquake of May 23, 2013: U.S. Geological Survey Open-File Report 2016-1145, 49 p., http://dx.doi.org/10.3133/ofr20161145.

Figure 4-80 Chimney Collapse at a Home in Lake Almanor Country Club Area

Source: Chapman, K., Gold, M.B., Boatwright, J., Sipe, J., Quitoriano, V., Dreger, D., and Hardebeck, J., 2016, Faulting, damage, and intensity in the Canyondam earthquake of May 23, 2013: U.S. Geological Survey Open-File Report 2016-1145, 49 p., http://dx.doi.org/10.3133/ofr20161145.

In **November of 2019**, a small cluster of earthquakes ranging from 2.5 to 3.3 on the Richter Scale occurred near Taylorsville. No damages occurred, but the earthquake were felt.

Figure 4-81 Taylorsville Earthquakes



Source: Plumas County

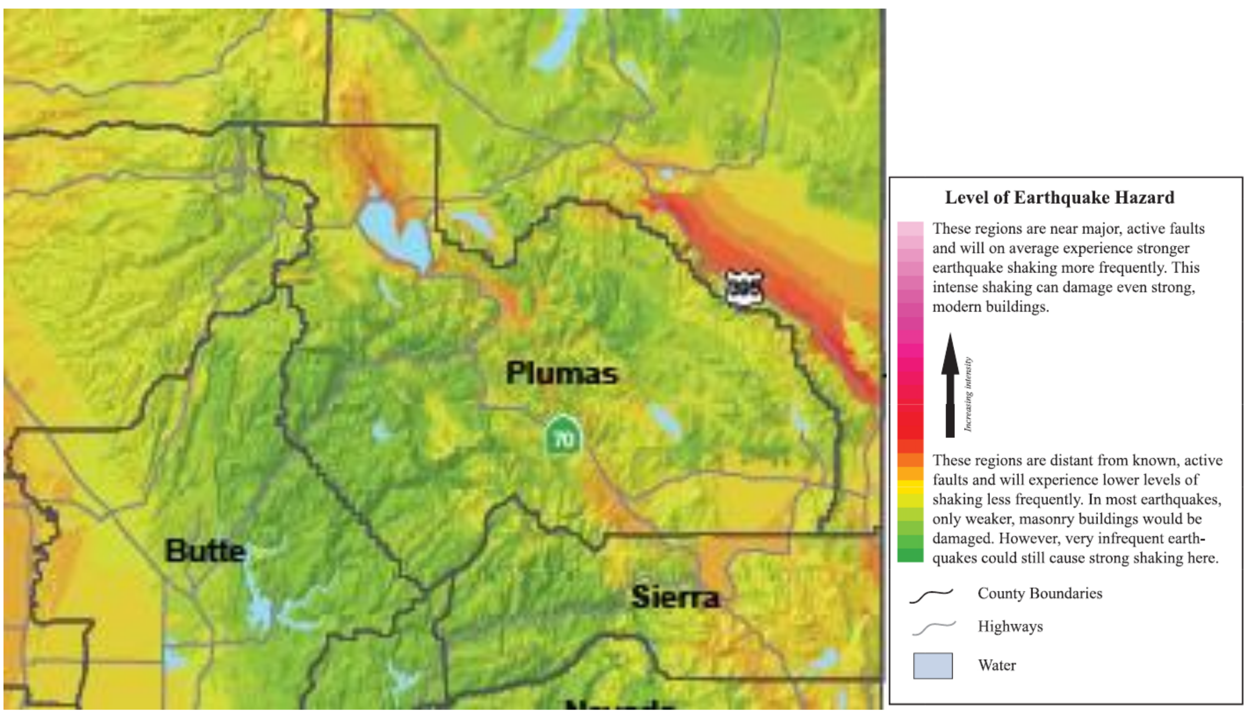
Likelihood of Future Occurrence

Unlikely (major earthquake); Likely (minor earthquake)— A few sizeable earthquakes have been recorded within the County. The possibility of an earthquake is an ever-present phenomenon in California and Plumas County. The combination of plate tectonics and associated California coastal mountain range building geology essentially guarantees earthquake as a result of the periodic release of tectonic stresses.

Mapping of Future Occurrences

Maps indicating the maximum expectable intensity of ground shaking for the County are available through several sources. Figure 4-82, prepared by the California Division of Mines and Geology, shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2,500-year average repeat time. This data shows that Plumas County falls within an area of mostly low to moderate seismic risk.

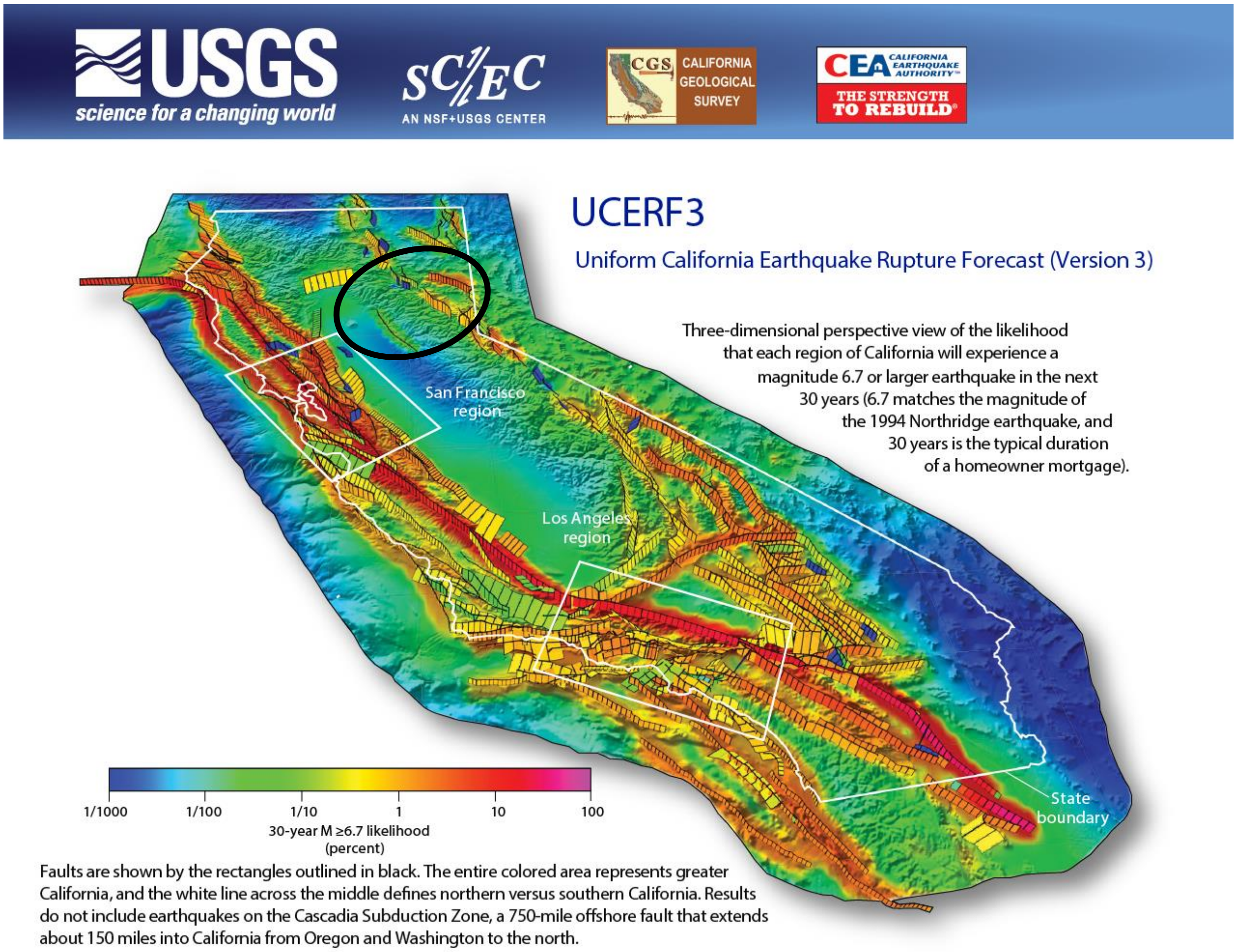
Figure 4-82 Maximum Expectable Earthquake Intensity – 2% Chance in 50 Years



Source: California Division of Mines and Geology

In 2014, the USGS and the California Geological Survey (CGS) released the time-dependent version of the Uniform California Earthquake Rupture Forecast (UCERF III) model. The UCERF III results have helped to reduce the uncertainty in estimated 30-year probabilities of strong ground motions in California. The UCERF map is shown in Figure 4-83 and indicates that Plumas County has a low to moderate risk of earthquake occurrence, which coincides with the likelihood of future occurrence rating of occasional.

Figure 4-83 Probability of Earthquake Magnitudes Occurring in 30 Year Time Frame



Source: United States Geological Survey Open File Report 2015-3009

Climate Change and Earthquake

Climate changes is unlikely to increase earthquake frequency or strength.

Vulnerability Assessment

Vulnerability—High

Earthquake vulnerability is primarily based on population and the built environment. Urban areas in high seismic hazard zones are the most vulnerable, while uninhabited areas are less vulnerable. The primary impacts of concern are life safety and property damage. Although several faults are within and near the County, seismic hazard mapping indicates that the County has low seismic hazard potential. Additionally, the County is not located within a delineated Alquist-Priolo Earthquake Fault Zone. The risks associated with earthquakes, such as surface fault rupture, within the County are considered low.

Ground shaking is the primary earthquake hazard. Many factors affect the survivability of structures and systems from earthquake-caused ground motions. These factors include proximity to the fault, direction of rupture, epicentral location and depth, magnitude, local geologic and soils conditions, types and quality of construction, building configurations and heights, and comparable factors that relate to utility, transportation, and other network systems. Ground motions become structurally damaging when average peak accelerations reach 10 to 15 percent of gravity, average peak velocities reach 8 to 12 centimeters per second, and when the Modified Mercalli Intensity Scale is about VII (18-34 percent peak ground acceleration), which is considered to be very strong (general alarm; walls crack; plaster falls).

The combination of plate tectonics and associated California coastal mountain range building geology essentially guarantees earthquake as a result of the periodic release of tectonic stresses. Plumas County's mountainous terrain lies near the North American and Pacific tectonic plate activity. There have been earthquakes as a result of this activity in the historic past, and there will continue to be earthquakes in the future of the California north coastal mountain region. According to maps developed by the Department of Conservation's California Geological Survey, Plumas County has potential for ground shaking from earthquakes. The seismic hazard in this area is related to faults on both sides of the California-Nevada border. The eastern, upcountry portion of the county is at greatest risk from earthquakes. Structural damage from ground shaking has not historically been reported in Plumas County.

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault. In general, newer construction is more earthquake resistant than older construction due to enforcement of improved building codes. Manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry, as was seen in the Oroville, Coalinga, Santa Cruz, and Paso Robles earthquakes. This was seen to a certain extent in the Lake Almanor earthquake.

Seismic events can have particularly negative effects on older buildings constructed of URM, including materials such as brick, concrete and stone. The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. Plumas County is within the less hazardous Zone 3. The County Building Department does not track, or keep an inventory of URM buildings. The first building permit was issued in 1959, and at that time they were issued by the Assessor's office. The Building Department did not come into existence until 1968 and at that time the 1967 edition of the Uniform Building Code was in force. Under the 67 UBC Chapter 24, all habitable structures constructed of masonry were required to be reinforced. It would be safe to assume that prior to the existence of the Building Department in 1968, any structure built of masonry may not be reinforced.

Impacts

Impacts to the County would include damages to infrastructure (roads, bridges, railroad tracks, etc.), damages to utilities and critical infrastructure, damages to residential and commercial buildings, and possible loss of life and injuries. The HMPC also noted that there is PG&E infrastructure and dams above the County that could affect Plumas County if they were to fail. This could also impact the water supply, as one of the main pump stations is thought to be original and has not been updated.

Estimating Potential Losses

Earthquake losses will vary across the Plumas County Planning Area depending on the source and magnitude of the event. To further evaluate potential losses associated with earthquake activity in the Planning Area, two HAZUS-MH earthquake scenario was run for this 2020 LHMP Update:

- A deterministic 6.7 Honey Lake Fault Event
- A probabilistic 6.7 earthquake event

2020 Earthquake Scenarios

Deterministic 6.7 Lake Almanor Fault Earthquake Event

HAZUS-MH 4.2 was utilized to model earthquake losses for the County. Specifically, the deterministic magnitude used for Plumas County utilized a 6.7 Lake Almanor Fault magnitude earthquake, based on data from the Plumas County General Plan. Level 1 analyses were run, meaning that only the default data was used and not supplemented with local building inventory or hazard data. There are certain data limitations when using the default data, so the results should be interpreted accordingly; this is a planning level analysis.

The methodology for running the deterministic earthquake scenario used seismic hazard contour maps developed by the U.S. Geological Survey (USGS) for the 2002 update of the National Seismic Hazard Maps that are included with HAZUS-MH. The USGS maps provide estimates of potential ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively. The 2,500-year return period analyzes ground shaking estimates with a 2 percent probability of being exceeded in 50 years, from the various seismic sources in the area. The International Building Code uses this level of ground shaking for building design in seismic areas and is more of a worst-case scenario.

The results of the deterministic scenario are captured in Table 4-57 and shown on Figure 4-84. Key losses included the following:

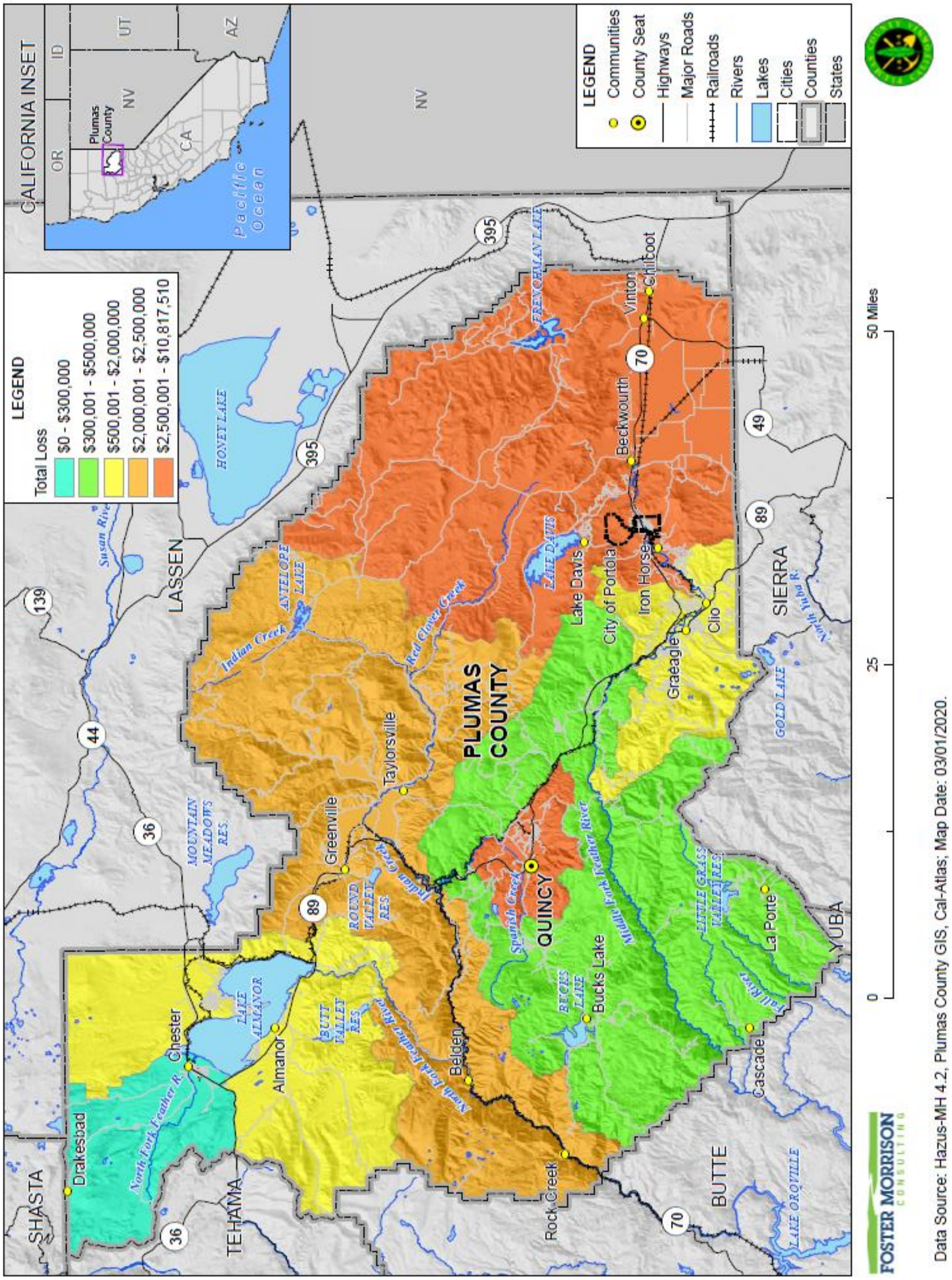
- Total economic loss estimated for the earthquake was $28,350,000, which includes building losses and lifeline losses based on the HAZUS-MH inventory.
- Building-related losses, including direct building losses and business interruption losses, totaled $19,750,000.
- 317 buildings in the County were at least moderately damaged. 12 buildings were completely destroyed.
- Over 56 percent of the building- and income-related losses were residential structures.
- 13 percent of the estimated losses were related to business interruptions.
- No change was observed in casualties, regardless of time of strike. All modeled casualties were 0.
- No households experienced a loss of potable water or electricity the first day after the earthquake.

Table 4-57 HAZUS-MH Earthquake Loss Estimation Probabilistic 2,500-Year Scenario Results

Type of Impact	Impacts to County from 6.7 Honey Lake Earthquake	
Total Buildings Damaged (based on 15,000 buildings)	Slight: 929 Moderate: 274 Extensive: 31 Complete: 12	
Building and Income Related Losses	$19,750,000	
Total Economic Losses (Includes building, income and lifeline losses)	$28,350,000	
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 2 Requiring hospitalization: 0 Life threatening: 0 Fatalities: 0	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 2 Requiring hospitalization: 0 Life threatening: 0 Fatalities: 0	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 2 Requiring hospitalization: 0 Life threatening: 0 Fatalities: 0	
Damage to Transportation Systems	None with at least moderate damage	
Damage to Essential Facilities	None with at least moderate damage	
Damage to Utility Systems	No facilities with at least moderate damage 41 potable water line breaks, 21 wastewater line breaks, and 7 natural gas line breaks	
Households without Power/Water Service (Based on 8,977 total households)	Power loss, Day 1: 0 Power loss, Day 3: 0 Power loss, Day 7: 0 Power loss, Day 30: 0 Power loss, Day 90: 0	Water loss, Day 1: 0 Power loss, Day 3: 0 Power loss, Day 7: 0 Water loss, Day 30: 0 Water loss, Day 90: 0
Displaced Households	1 displaced households	
Shelter Requirements	0 persons	
Debris Generation	3,000 tons	

Source: HAZUS-MH 4.2, 2020

Figure 4-84 Plumas County – Total Loss Map from 6.7 Magnitude Lake Almanor Fault Deterministic Hazus Earthquake Scenario



Probabilistic 6.7 Earthquake Event

HAZUS-MH 4.2 was utilized to model earthquake losses for the County. Specifically, the probablistic magnitude used for Plumas County utilized a 6.7 magnitude earthquake. Level 1 analyses were run, meaning that only the default data was used and not supplemented with local building inventory or hazard data. There are certain data limitations when using the default data, so the results should be interpreted accordingly; this is a planning level analysis.

The methodology for running the probabilistic earthquake scenario used probabilistic seismic hazard contour maps developed by the USGS for the 2002 update of the National Seismic Hazard Maps that are included with HAZUS-MH. The USGS maps provide estimates of potential ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively. The 2,500-year return period analyzes ground shaking estimates with a 2 percent probability of being exceeded in 50 years, from the various seismic sources in the area. The International Building Code uses this level of ground shaking for building design in seismic areas and is more of a worst-case scenario.

- The results of the probabilistic scenario are captured in Table 4-58 and shown on Figure 4-85. Key losses included the following:
- Total economic loss estimated for the earthquake was $960.2 million, which includes building losses and lifeline losses based on the HAZUS-MH inventory.
- Building-related losses, including direct building losses and business interruption losses, totaled $663.03 million.
- 5,887 buildings in the County were at least moderately damaged. 383 buildings were completely destroyed.
- Over 67 percent of the building- and income-related losses were residential structures.
- 15 percent of the estimated losses were related to business interruptions.
- The mid-day scenario estimated the greatest number of modeled casualties with 7.
- 3,310 households experienced a loss of potable water the first day after the earthquake.
- 6,631 households experienced a loss of electricity the first day after the earthquake.

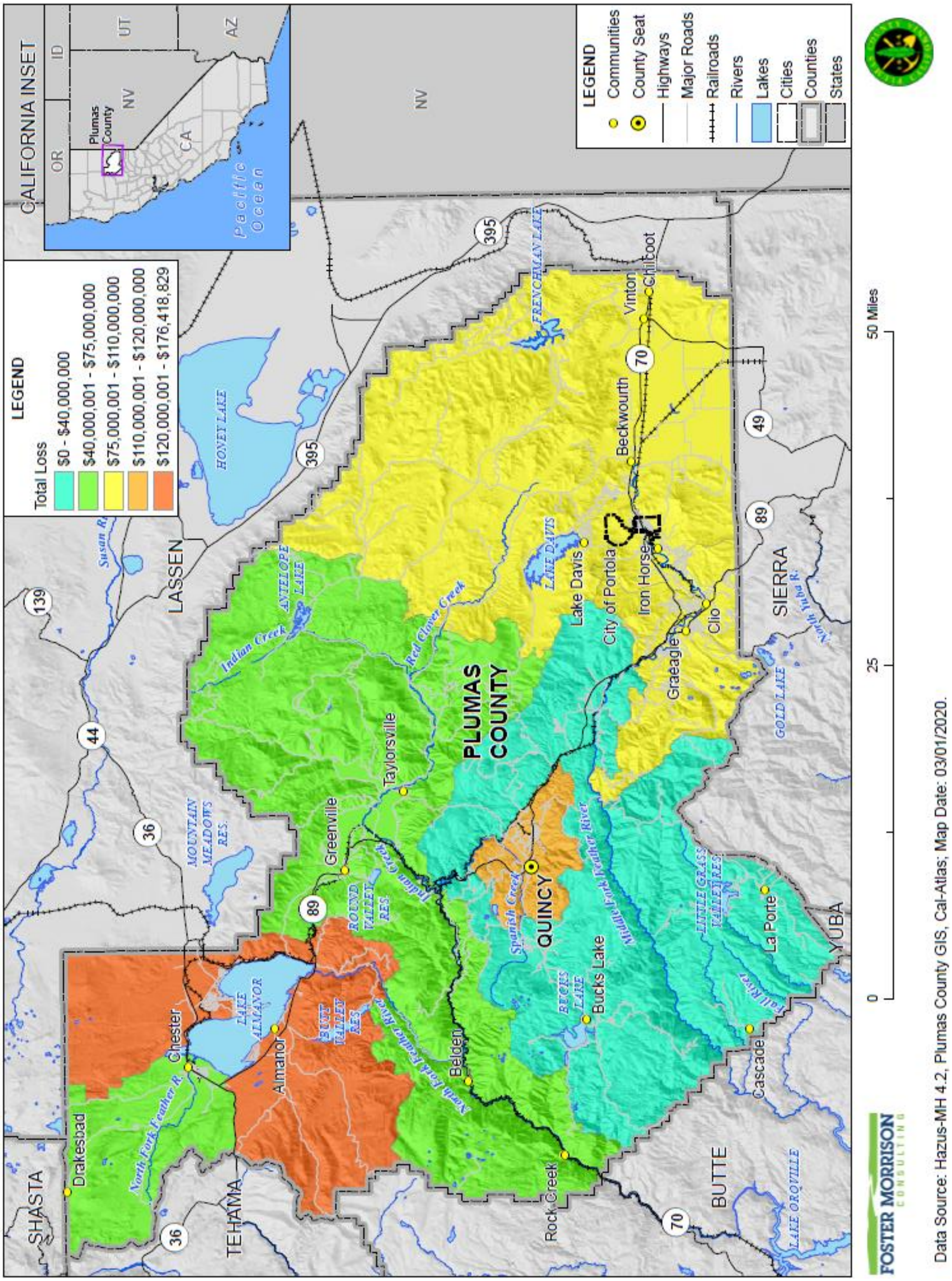
Table 4-58 HAZUS-MH Earthquake Loss Estimation Probabilistic 2,500-Year Scenario Results

Type of Impact	Impacts to County from 6.7 Deterministic
Total Buildings Damaged (based on 15,000 buildings)	Slight: 5,611 Moderate: 4,245 Extensive: 1,259 Complete: 383
Building and Income Related Losses	$960,190,000
Total Economic Losses (Includes building, income and lifeline losses)	$663,030,000
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 55 Requiring hospitalization: 10 Life threatening: 1 Fatalities: 1
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 104 Requiring hospitalization: 26

Type of Impact	Impacts to County from 6.7 Deterministic	
	Life threatening: 4 Fatalities: 7	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 74 Requiring hospitalization: 20 Life threatening: 7 Fatalities: 5	
Damage to Transportation Systems	18 bridges and 3 airports with at least moderate damage	
Damage to Essential Facilities	None with at least moderate damage	
Damage to Utility Systems	10 facilities with at least moderate damage 1,018 potable water line breaks, 511 wastewater line breaks, and 175 natural gas line breaks	
Households without Power/Water Service (Based on 8,977 total households)	Power loss, Day 1: 6,631 Power loss, Day 3: 4,169 Power loss, Day 7: 1,751 Power loss, Day 30: 343 Power loss, Day 90: 9	Water loss, Day 1: 3,310 Power loss, Day 3: 3,107 Power loss, Day 7: 2,683 Water loss, Day 30: 273 Water loss, Day 90: 0
Displaced Households	148 displaced households	
Shelter Requirements	81 persons	
Debris Generation	114,000 tons	

Source: HAZUS-MH 4.2, 2020

Figure 4-85 Plumas County – Total Loss Map from 6.7 Magnitude Probabilistic Hazus Earthquake Scenario



Future Development

Although new growth and development corridors would fall in the area affected by earthquake, given the small chance of major earthquake and the building codes in effect, development in the earthquake area will continue to occur.

4.3.11. Flood: 1%/0.2% Annual Chance

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Flooding is the rising and overflowing of a body of water onto normally dry land. History clearly highlights floods as one of the primary natural hazards impacting Plumas County. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The Plumas County Planning Area is susceptible to various types of flood events as described below.

- **Riverine flooding** – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Plumas County Planning Area, riverine flooding is largely caused by heavy and continued rains, sometimes combined with snowmelt, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. The warning time associated with slow rise floods assists in life and property protection.
- **Flash flooding** – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives
- **Localized/Stormwater flooding** – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems. More on localized flooding can be found in Section 4.3.12.
- **Dam failure flooding** – Flooding from failure of one or more upstream dams is also a concern to the Plumas County Planning Area. A catastrophic dam failure could easily overwhelm local response capabilities and require mass evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could

result, and there could be associated health concerns as well as problems with the identification and burial of the deceased. Dam failure is further addressed in Section 4.3.8 Dam Failure.

The 2005 FIS for Plumas County noted that, for the unincorporated County, there are no significant flood-protection measures in the study area, nor are any currently planned. The 2035 Plumas County General Plan Public Health & Safety Element noted that the County contains an extensive network of rivers and other waterways that flow out of higher elevations to the valley areas.

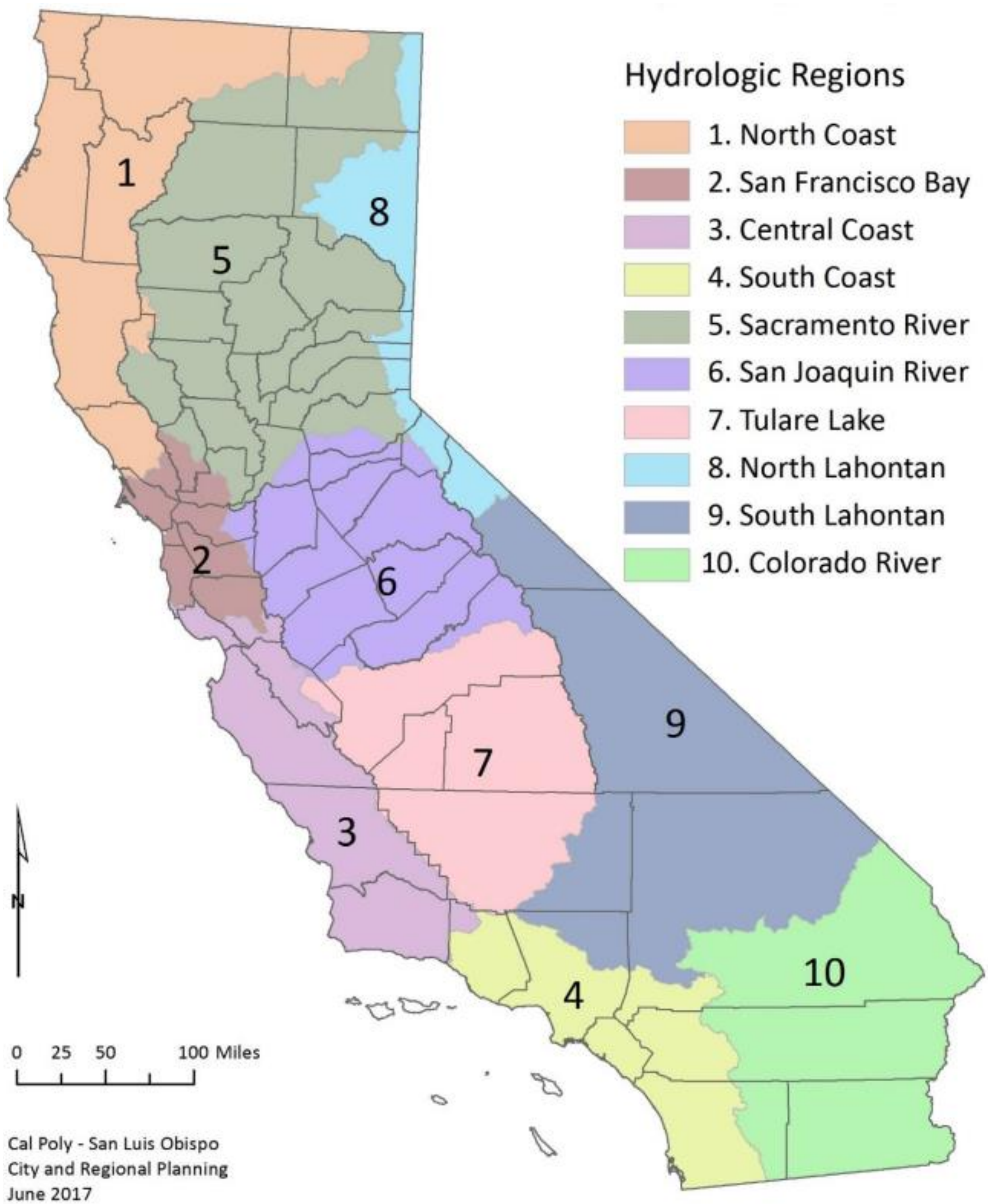
Location and Extent

Major Sources of Flooding

California has 10 hydrologic regions. Plumas County sits in the Sacramento hydrologic region. The Sacramento River hydrologic region covers approximately 17.4 million acres (27,200 square miles). The region includes all or large portions of Modoc, Siskiyou, Lassen, Shasta, Tehama, Glenn, Plumas, Butte, Colusa, Sutter, Yuba, Sierra, Nevada, Placer, Sacramento, El Dorado, Yolo, Solano, Lake, and Napa counties. Small areas of Alpine and Amador counties are also within the region. Geographically, the region extends south from the Modoc Plateau and Cascade Range at the Oregon border, to the Sacramento-San Joaquin Delta. The Sacramento Valley, which forms the core of the region, is bounded to the east by the crest of the Sierra Nevada and southern Cascades and to the west by the crest of the Coast Range and Klamath Mountains. The Sacramento metropolitan area and surrounding communities form the major population center of the region. With the exception of Redding, cities and towns to the north, while steadily increasing in size, are more rural than urban in nature, being based in major agricultural areas.

A map of the California's hydrological regions is provided in Figure 4-86.

Figure 4-86 California Hydrologic Regions

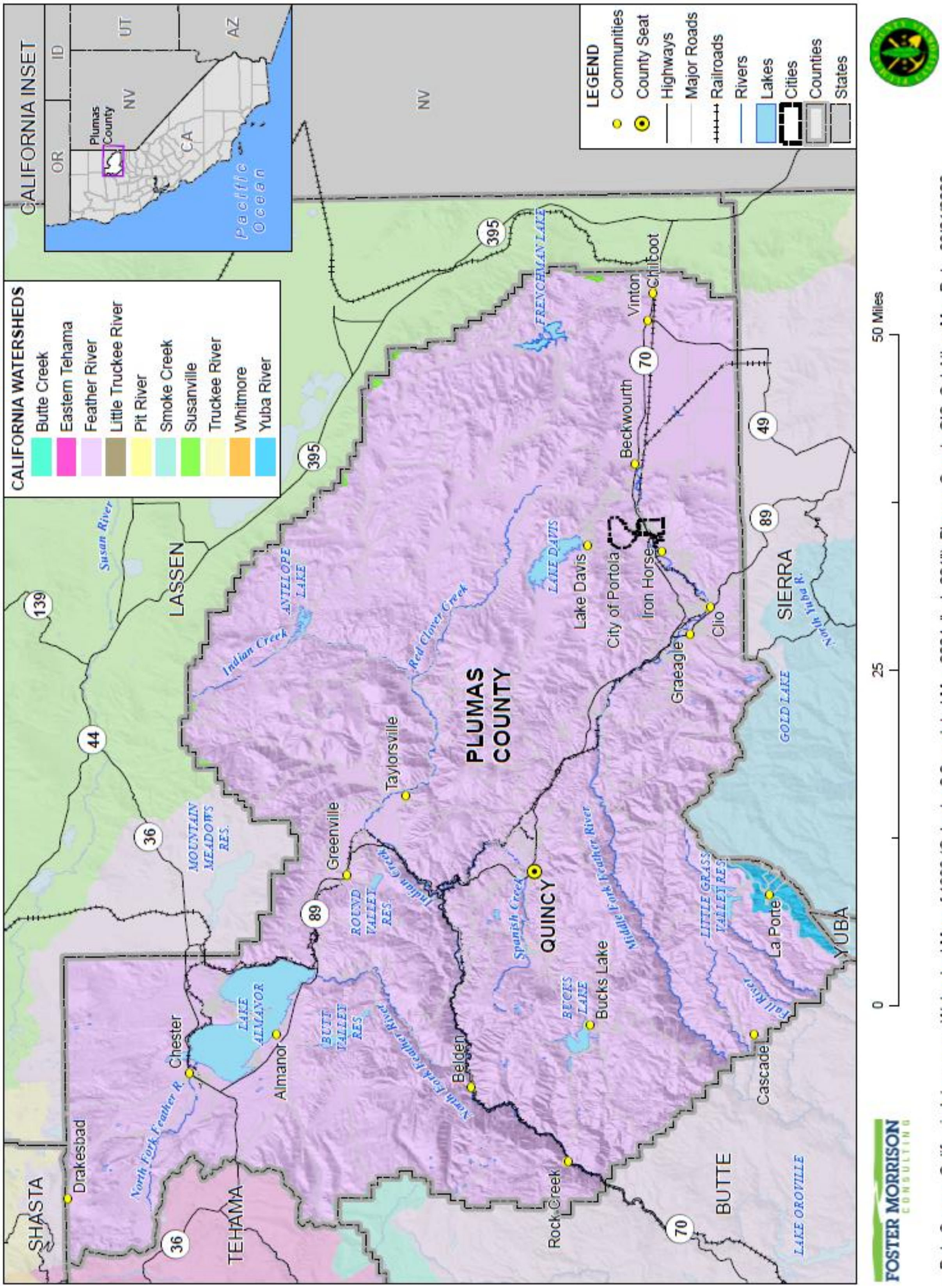


Source: 2018 State of California Hazard Mitigation Plan

The Plumas County Waterway System

Plumas County encompasses multiple rivers, streams, creeks, and associated watersheds. Plumas County is in the Feather River Watershed. Figure 4-87 illustrates the primary watersheds of Plumas County, as well as the primary waterways in the County.

Figure 4-87 Primary Watersheds and Waterways of Plumas County



Data Source: California Interagency Watershed Map of 1999 (Calwater 2.2, updated May 2004, "calw221"), Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Feather River Watershed

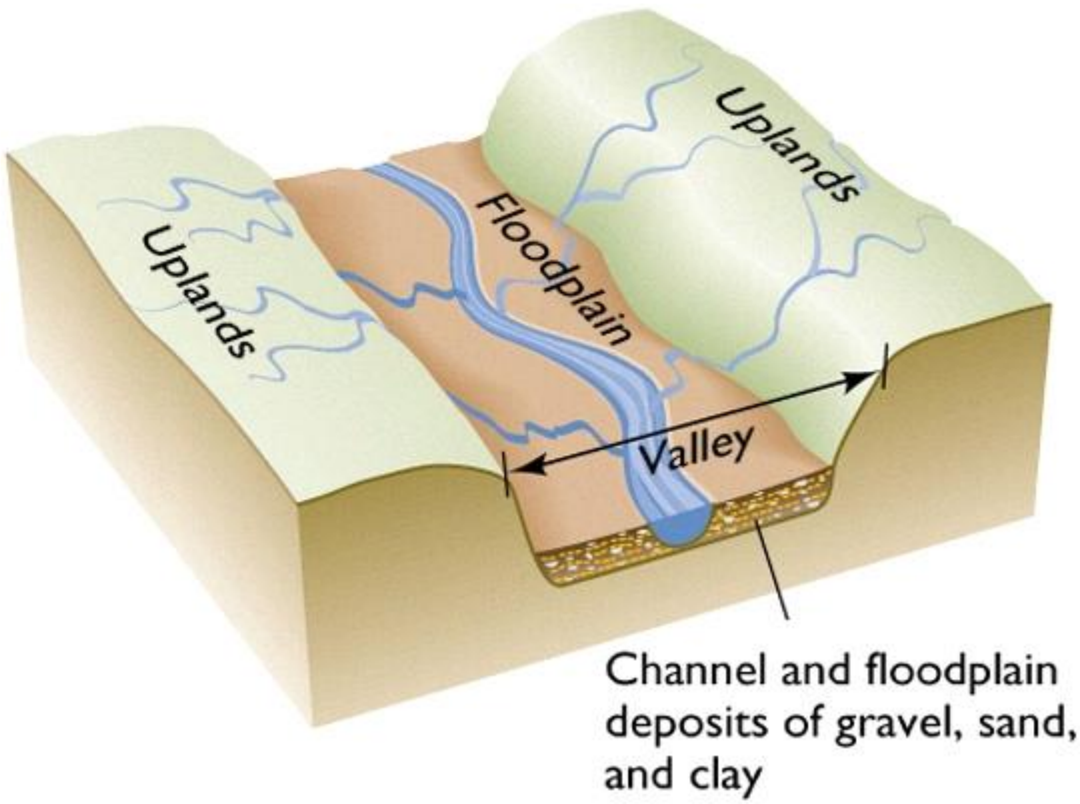
The Upper Feather River watershed encompasses 2.3 million acres in the northern Sierra Nevada, where that range intersects the Cascade Range to the north and the Diamond Mountains of the Great Basin and Range Province to the east. The watershed drains generally southwest to Lake Oroville, the largest reservoir of the SWP.

Land ownership in the IRWM Plan Area is approximately 64 percent Federal, 1 percent State, and 35 percent private. Federal lands are managed primarily by the U.S. Forest Service (USFS) except for less than 1 percent of the watershed that is within Lassen Volcanic National Park and some Bureau of Land Management lands in the Sierra Valley watershed. The boundary of the watershed largely corresponds to the boundary of Plumas County, but also includes portions of six neighboring counties.

Floodplains

The area adjacent to a channel is the floodplain (see Figure 4-88). Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 1% annual chance (or 100-year) flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 1% annual chance flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 500-year flood is the flood that has a 0.2% chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Figure 4-88 Floodplain Schematic



Source: FEMA

According to the 2005 Flood Insurance Study for Plumas County Flooding in Plumas County may be caused by either general rainstorms or cloudburst storms. General rainstorms can occur from late fall to early spring, but mostly in the winter months of December through March. Cloudburst storms can be expected in the spring, summer, and fall. General rain floods resulting from prolonged heavy rainfall over tributary areas are characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when antecedent rainfall results in saturated ground conditions, when the ground is frozen and infiltration is minimal, or when rain on snow in the higher elevations adds snowmelt to rain flood runoff.

Cloudburst storms, sometimes lasting as long as 6 hours in the study areas, are high intensity storms that can produce floods characterized by high peak flows, short duration flood flows, and small runoff volume. In small drainage basins such as Portola Tributary, cloudbursts can produce peak flows substantially larger than those of general rainstorms.

The FIS also noted the following flood areas in the County.

- 1% annual chance flood flows on the Middle Fork Feather River are attributed to combined general rain/snowmelt runoff. The 1% annual chance flooding on Portola Tributary is a result of cloudburst storms.
- Flood elevations in Spanish Creek were high enough to necessitate failure scenarios of the embankments along Spanish Creek's right bank. Upstream of the SH 70/89 crossing, the failure of the

right bank of Spanish Creek causes flow into the Clear Stream drainage. This split flow is less than the natural peak from the Clear Stream drainage. The right embankment overflow downstream of the SH 70/89 crossing flows across the valley as sheetflow until it accumulates in the lower Nugget Creek drainage, creating the highest flow condition in this Nugget Creek reach. The last substantial out-of-bank flow from Spanish Creek fills the valley area just upstream of its confluence with Mill Creek, where the flood storage in this portion of the valley significantly attenuates the peak flows downstream in Spanish Creek. Each of these out-of-bank spills along Spanish Creek was analyzed independently of each other as a stand-alone scenario. This is because the spills could not concurrently occur as a worst-case condition.

- The Greenhorn Creek drainage is conveyed through a narrow valley with occasional division of flow at road crossings lacking capacity to convey the entire 100-year flow. Although the main channel does not contain the 100-year and 500-year (0.2-percent-annual-chance) flows, the right and left overbank flows are conveyed parallel and contiguous to Greenhorn Creek, except where a portion of the Greenhorn Creek flows spill into the lower reach of Thompson Creek. This spill is also parallel to Greenhorn Creek, downstream of the SH 70/89 crossing and upstream of the confluence of Greenhorn and Thompson Creeks. Although Greenhorn Creek flooding is not contained in the main channel, the overbank floodplain is generally shallower than Spanish Creek, and the floodplain storage was considered to have negligible effect on the calculated peak flow values.
- Gansner Creek flows out-of-bank from upstream of Bucks Lake Road until beyond its confluence with Clear Stream.
- Clear Stream spills into the upper reaches of the unnamed tributary at SH 70/89 and continues downstream with less than a 10-year capacity.
- Boyle Ravine spills most of its flow over its left bank just upstream of Alder Street and conveys less than a 10-year capacity until just upstream of its confluence with the unnamed tributary, where the Alder Street split flow returns.
- Nugget Creek spills overland and recombines several times within its studied reach upstream and downstream of SH 70/89. The worst-case flooding for the lower reach of Nugget Creek is when the right bank of Spanish Creek fails and the overflow is conveyed through Nugget Creek.
- Mill Creek spills significant flows over the left bank at locations upstream of SH 70/89, Lee Road, and Bell Lane. These flows are recombined (ponded) upstream of Quincy Junction Road and are again split before reaching the lowest part of the Mill Creek drainage before combining with Spanish Creek. The worst-case flooding for Mill Creek downstream of Quincy Junction Road is when Spanish Creek flows out-of-bank and inundates the portion of the valley upstream of their confluence.
- Thompson Creek splits and recombines several times upstream of SH 70/89; most of its natural drainage spills into Greenhorn Creek just upstream of SH 70/89, before Greenhorn Creek reaches its peak flow.
- Chandler Creek and Taylor Creek spill out-of-bank before they reach Chandler Road. The spills then flow into Greenhorn Creek rather than returning to their respective channels.
- The unnamed tributary to Boyle Ravine appears to be sized to convey its local drainage area while acting as an outlet (overflow) path for the larger spills from the Clear Stream drainage.

The HMPC noted that the north end of Greenville in the Willow area there are flooding issues. The HMPC also noted that Most of the stream channels of interest in this hazard planning have been significantly modified, or wholesale moved, to facilitate drainage, irrigation and/or road crossings. Much of this modification effort occurred between the 1890's and 1960's, pre-CEQA. These modifications generally initiated rapid channel incision, which in turn developed numerous gravel deposits and subsequent instream gravel mining operations. The gravel mining mostly over-drafted the gravel supplies, leading to additional incision. By the late 1990's, California Department of Fish and Wildlife (CDFW) monitoring requirements shut down these operations, with the exception of Green Flat northwest of Meadow Valley. These channels are gradually trying to adjust to new sediment inputs, small and regular or large and episodic, often with abrupt catastrophic results.

The HMPC noted that there are three primary conditions that contribute to major flooding. High antecedent basin moisture; high intensity, long duration rainfall; high water content snow at all elevations, high snow levels. 1986 had low antecedent basin moisture; long duration' high intensity rain, ~25 inches in 6 days; low snow water content, level 7,000 feet. 1997 had fully saturated antecedent moisture; long duration, low/moderate rainfall intensity, ~12 inches in 6 days; and high snow water content, 8" water in 22" of snow in Genesee (personal observation of HMPC members), snow level 10,000 feet. None of these events had all 3 components at max. When these components converge, it will be catastrophic for Plumas County, as well as everything downstream. The 1862 flood is probably the only analog. More information on these events can be found in the Past Occurrences section below.

Plumas County Flood Mapping

As part of the County's ongoing efforts to identify and manage their flood prone areas, Plumas County relies on a variety of different mapping efforts. What follows is a brief description of FEMA and CA DWR mapping efforts covering the Plumas County Planning Area.

FEMA Floodplain Mapping

FEMA established standards for floodplain mapping studies as part of the National Flood Insurance Program (NFIP). The NFIP makes flood insurance available to property owners in participating communities adopting FEMA-approved local floodplain studies, maps, and regulations. Floodplain studies that may be approved by FEMA include federally funded studies; studies developed by state, city, and regional public agencies; and technical studies generated by private interests as part of property annexation and land development efforts. Such studies may include entire stream reaches or limited stream sections depending on the nature and scope of a study. A general overview of floodplain mapping is provided in the following paragraphs. Details on the NFIP and mapping specific to the County are in Section 4.3 Vulnerability Assessment.

Flood Insurance Study (FIS)

The FIS develops flood-risk data for various areas of the community that will be used to establish flood insurance rates and to assist the community in its efforts to promote sound floodplain management. The current Plumas County FIS is dated March 2, 2005. This study covers both the unincorporated and incorporated areas of the County.

Flood Insurance Rate Map (FIRM)

The FIRM is designed for flood insurance and floodplain management applications. For flood insurance, the FIRM designates flood insurance rate zones to assign premium rates for flood insurance policies. For floodplain management, the FIRM delineates 1% and 0.2% annual chancer floodplains, floodways, and the locations of selected cross sections used in the hydraulic analysis and local floodplain regulation. The County FIRMs have been replaced by digital flood insurance rate maps (DFIRMs) as part of FEMA's Map Modernization program, which is discussed further below.

Letter of Map Revision (LOMR) and Map Amendment (LOMA)

LOMRs and LOMAs represent separate floodplain studies dealing with individual properties or limited stream segments that update the FIS and FIRM data between periodic FEMA publications of the FIS and FIRM.

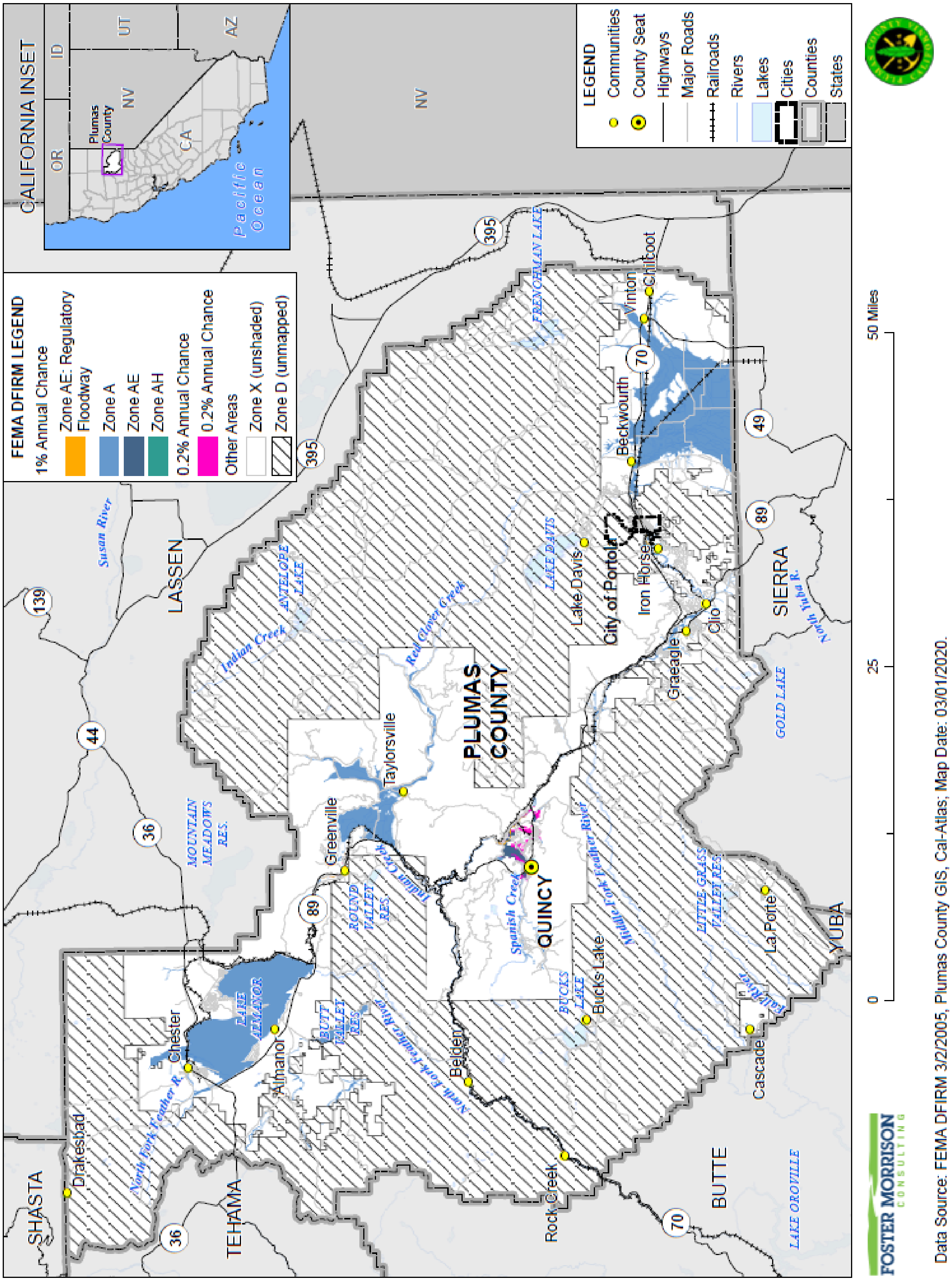
Digital Flood Insurance Rate Maps (DFIRM)

As part of its Map Modernization program, FEMA is converting paper FIRMS to digital FIRMs, DFIRMS. These digital maps:

- Incorporate the latest updates (LOMRs and LOMAs);
- Utilize community supplied data;
- Verify the currency of the floodplains and refit them to community supplied basemaps;
- Upgrade the FIRMs to a GIS database format to set the stage for future updates and to enable support for GIS analyses and other digital applications; and
- Solicit community participation.

DFIRMs for Plumas County have been developed, are dated March 2, 2005, and are being used for the flood analysis for this LHMP Update. The DFIRM is shown in Figure 4-89.

Figure 4-89 Plumas County DFIRM Flood Zones



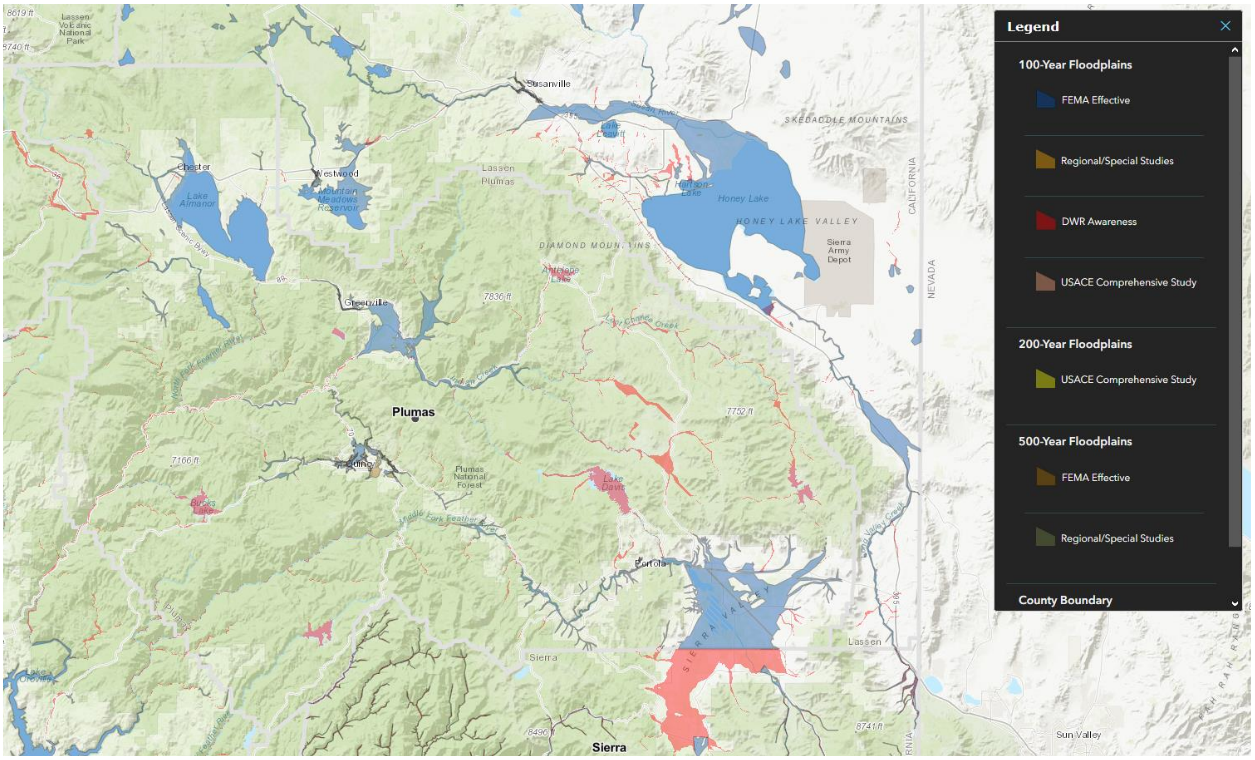
California Floodplain Mapping

Also to be considered when evaluating the flood risks in Plumas County are various floodplain maps developed by CA DWR for various areas throughout California, and in the Sacramento-San Joaquin Valley cities and counties. The FEMA regulatory maps provide just one perspective on flood risks in Plumas County. Senate Bill 5 (SB 5), enacted in 2007, authorized CA DWR to develop the Best Available Maps (BAM) displaying 1% and 0.5% (200-year) annual chance floodplains for areas located within the Sacramento-San Joaquin (SAC-SJ) Valley watershed. This effort was completed by CA DWR in 2008. DWR has expanded the BAM to cover all counties in the State and to include 0.2% annual chance flood zones.

Different than the FEMA DFIRMs which have been prepared to support the NFIP and generally reflect only the 1% and 0.2% annual chance flood risks, the BAMs are provided for informational purposes and are intended to reflect current 1%, 0.5% (200-year) as applicable, and 0.2% annual chance flood risks using the best available data. The 100-year floodplain limits on the BAM are a composite of multiple 1% annual chance floodplain mapping sources. It is intended to show all currently identified areas at risk for a 100-year flood event, including FEMA's 1% annual chance flood zones. The BAM are comprised of different engineering studies performed by FEMA, Corps, and CA DWR for assessment of potential 1%, 0.5%, and 0.2% annual chance floodplain areas. These studies are used for different planning and/or regulatory applications, and for each flood frequency may use varied analytical and quality control criteria depending on the study type requirements.

The value in the BAMs is that they provide a bigger picture view of potential flood risk to the County than that provided in the FEMA DFIRMs. This provides the community and residents with an additional tool for understanding potential flood hazards not currently mapped as a regulated floodplain. Improved awareness of flood risk can reduce exposure to flooding for new structures and promote increased protection for existing development. Informed land use planning will also assist in identifying levee maintenance needs and levels of protection. By including the FEMA 1% annual chance flood zone, it also supports identification of the need and requirement for flood insurance. Figure 4-90 shows the BAM for the Plumas County Planning Area.

Figure 4-90 Plumas County– Flood Awareness (Best Available) Map



Source: CA DWR, Retrieved 4/8/2020

Legend explanation: Blue - FEMA 1%, Orange – Local 1% (developed from local agencies), Red – DWR 1%r (Awareness floodplains identify the 1% annual chance flood hazard areas using approximate assessment procedures.), Pink – USACE 1% (2002 Sac and San Joaquin River Basins Comp Study), Yellow – USACE 0.5% (2002 Sac and San Joaquin River Basins Comp Study), Tan – FEMA 0.2%, Grey – Local 0.2% (developed from local agencies), Purple – USACE 0.2%(2002 Sac and San Joaquin River Basins Comp Study).

Flood extents are usually measured in depths of flooding, geographical extent of the floodplain, as well as flood zones that a location falls in (i.e. 1% or 0.2% annual chance flood). Expected flood depths in the County vary and are not well defined. Flood durations in the County tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Geographical flood extent from the FEMA DFIRMs is shown in Table 4-59.

Table 4-59 Plumas County – Geographical Flood Hazard Extents in FEMA DFIRM Flood Zones

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance	86,311	4.95%	15,712	21.22%	70,599	4.23%
0.2% Annual Chance	1,456	0.08%	664	0.90%	792	0.05%
Other Areas	1,655,433	94.97%	57,674	77.89%	1,597,759	95.72%
Total	**1,743,200**	**100.00%**	**74,050**	**100.00%**	**1,669,150**	**100.00%**

Source: March 2, 2005 DFIRM

Past Occurrences

Disaster Declaration History

A list of state and federal disaster declarations for Plumas County from flooding, (including heavy rains and storms) is shown on Table 4-60.

Table 4-60 Plumas County – State and Federal Disaster Declaration from Flood 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	16	1950, 1955, 1958 (twice), 1963 (twice), 1964, 1969, 1970, 1980, 1986, 1992, 1995 (twice), 1996, 1997	15	1955, 1958, 1963, 1964, 1969, 1970, 1986, 1992, 1993, 1995 (twice), 1997, 2006, 2017 (twice)

Source: Cal OES, FEMA

NCDC Events

The NCDC tracks flooding events for the County. Events have been tracked for flooding since 1993. Table 4-61 shows events in Plumas County since 1993. Other heavy rain and storm events can be found in the Past Occurrences of the Severe Weather: Heavy Rains and Storms in Section 4.3.3. Information on events can be found below the table/

*Table 4-61 NCDC Flood Events in Plumas County 1993 to 9/30/2019**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Flash Flood	3	0	0	0	0	$0	$0
Flood	10	0	0	1	0	$3,140,000	$0
Total	**13**	**0**	**0**	**1**	**0**	**$3,140,000**	**$ 0**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, much of which fell outside of Plumas County

December 31, 2005 – Mainly rural flooding was reported in Plumas County. $1,000,000 in damages were reported. No injuries or deaths were reported.

March 2, 2009 – CHP closed the west bound lane of Highway 70 in the Rich Bar area due to a rockslide resulting from heavy rainfall on a burn area. No injuries or deaths were reported.

July 30, 2014 – Heavy rain fell on the west shore of Lake Almanor. Road flooding occurred on State Highway 89 on the west side of the Lake. No injuries or deaths were reported.

July 3, 2015 – Road washout reported on Peninsula Drive on the north shore of Lake Almanor. $100,000 in damages were reported. No injuries or deaths were reported.

January 7, 2017 – Flooding caused closure of Highway 70 near Cresta Dam on Feather River Canyon. This was due to heavy rain which necessitated the opening of the floodgates.

January 8 and 9, 2017 – The Middle Fork of the Feather River overflowed onto Highway 89 in Clio. The flooding caused a sinkhole in the road. Cal Trans estimated the damages at $40,000. The lowest lying areas of the Sierra Valley near the Middle Fork of the Feather River were inundated due to heavy rain runoff. As the valley drains very slowly, flooding of low-lying areas continued for an extended period of time with additional flooding in February. NOTE: no damage estimates were available. Northbound lane of Highway 89 closed due to 8 inches of water in the roadway. No injuries or deaths were reported.

February 7, 2017 – The Middle Fork of the Feather River saw record flooding (a record crest at Portola on the 10th) and caused extensive structural damage in Portola, Clio, and downstream to Blairsden. Highway 89 was closed near Clio due to water over the road. Many schools were closed on the 9th in the Portola area and along the Feather River. $2,000,000 in damages were reported for repairs to Highway 89 (per a CALTRANS report), so the actual flooding damage likely much higher. No injuries or deaths were reported.

Hazard Mitigation Planning Committee Events

Localized and regional flooding in Plumas County has been a continuous occurrence dating back to at least 1893 when Quincy experienced its first photographed flood, shown in Figure 4-91.

Figure 4-91 1893 Quincy Flooding

Source: Plumas County

Winter storms in 1986, 1995, 1997, 2017, and 2019 caused tremendous flood damage to properties and infrastructure throughout the Upper Feather River Watershed. Discharge values are from the historic USGS gage (#11401500) at the outlet of Indian Valley (1906-1993 period of record). Subsequent values form Plumas Corp and/or USGS extrapolation. Recent flood values of note: 1986 (36,600 cfs); 1995 (24,000 cfs), 1997 (46,600 cfs); 2017 (greater than 1986, less than 1997). At ~25,000 cfs Arlington bridge is impassible, along with Stampfli Ln. and North Valley Road. Taylorsville and Genesee are isolated. At <30,000 cfs Genesee is isolated from Taylorsville. Those communities have no medical services. Minor floods occurred in the 1990s in burn scar areas of the County. These were prevalent in the eastern margin by the escarpment.

1986

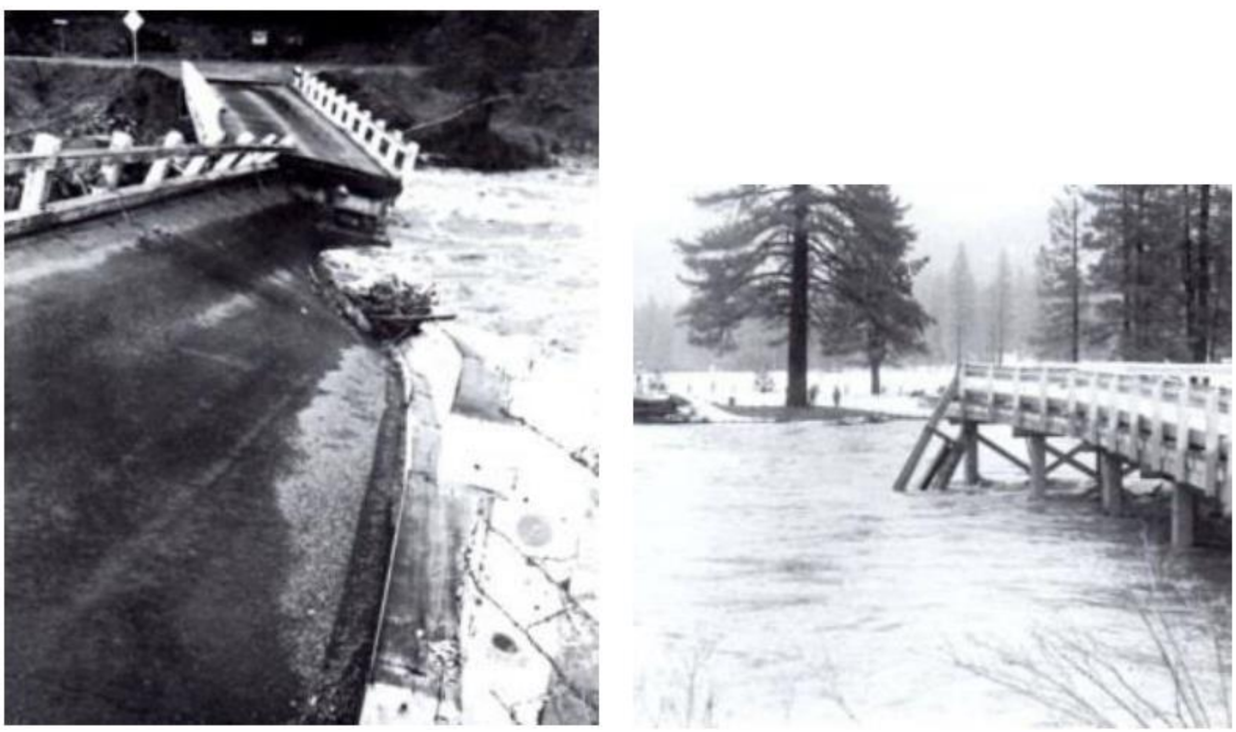
From February 8-20, 1986, a large storm lasting 13 days precipitated rain and snow across Northern California. Plumas County was located within the interior of the storm extent and experienced tremendous rainfall, causing the ground to saturate and allowed surface water to flow freely. As rain fell over the county filling creeks and drainage ditches it also flowed downhill through the Feather River system, incrementally adding more water to the lower elevation valleys and the river canyons. By the 11th day of the storm the capacity of the hydrologic system was exceeded and extensive damage was experienced throughout Plumas County. The most visually impressive damage was found in the North Fork Feather River Canyon, along CA-70 and the Railroad, due to the large volume of water that was funneled through the canyon. A member of the HMPC from Viera ranch noted that during this time, 22.08" of rain were recorded at their ranch. Quincy was effectively cut off. Highway 70 in Feather River Canyon was washed out.

The flood damage was extensive, as numerous bridges were severely damaged or destroyed, large sections of roadway and railroad were wiped out (see Figure 4-92), bridges were destroyed (see Figure 4-93 and Figure 4-108), many houses were flooded with over one foot of water, and debris was deposited in throughout Plumas County. Train service was disrupted for at least 3 days through the Feather River Canyon and several state highways were temporarily out of commission to public traffic for several weeks. In addition, many residential wells were flooded.

Figure 4-92 1986 Railroad Bed Flood Damages

Source: The Storm of '86 by Robert Moon, Feather River Publishing, Quincy, CA 1986

Figure 4-93 Bridges Destroyed by Flooding – Indian Creek Bridge (left) and Mohawk Valley Bridge (right)



Source: The Storm of '86 by Robert Moon, Feather River Publishing, Quincy, CA 1986

1995

Heavy rains caused flooding in the County.

Figure 4-94 Plumas County – 1995 Flooding at Arlington Bridge

Source: HMPC member Jim Wilcox

1997

Winter storms in late December 1996 through January 1997 poured tremendous amounts of rain throughout Plumas County. This was the biggest flood on record for the County. Such as in 1986, the ground became saturated and the river system overflowed with excess water. On January 2nd the State declared a disaster and on January 4th a Federal disaster was declared. The extent and severity of flooding and related damage exceeded the 1986 event throughout Plumas County, from the high-elevation valleys to the low-elevation river canyons. The type of damage experienced was similar to that in 1986. Examples can be seen in the following figures.

In the first image, the home was not flooded, but Indian Creek moved laterally several hundred feet in less than 24 hours to undermine the main structure and topple it into the channel. The remains of the garage followed a few days later. Homeowners reportedly had no flood insurance. The gravel bar on the left rapidly extended under sediment input from Little Grizzly Creek 1/3 mile upstream. The Indian Creek channel has radically shifted alignment in this area 3 times since 1977.

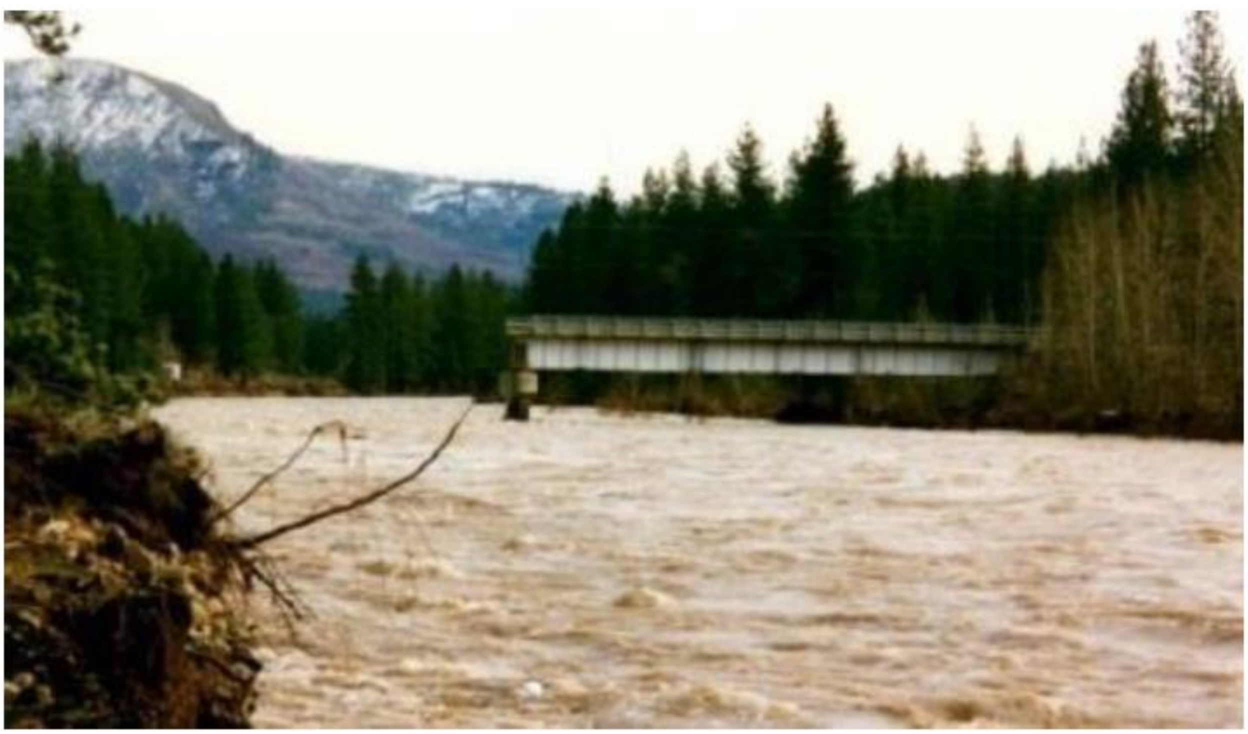
Figure 4-95 Erosion from Floodwaters Cause Home to fall into Indian Creek

Source: Feather River Bulletin, Wednesday January 29, 1997

Figure 4-96 Damage to Home in Genesee from 1997 Flood

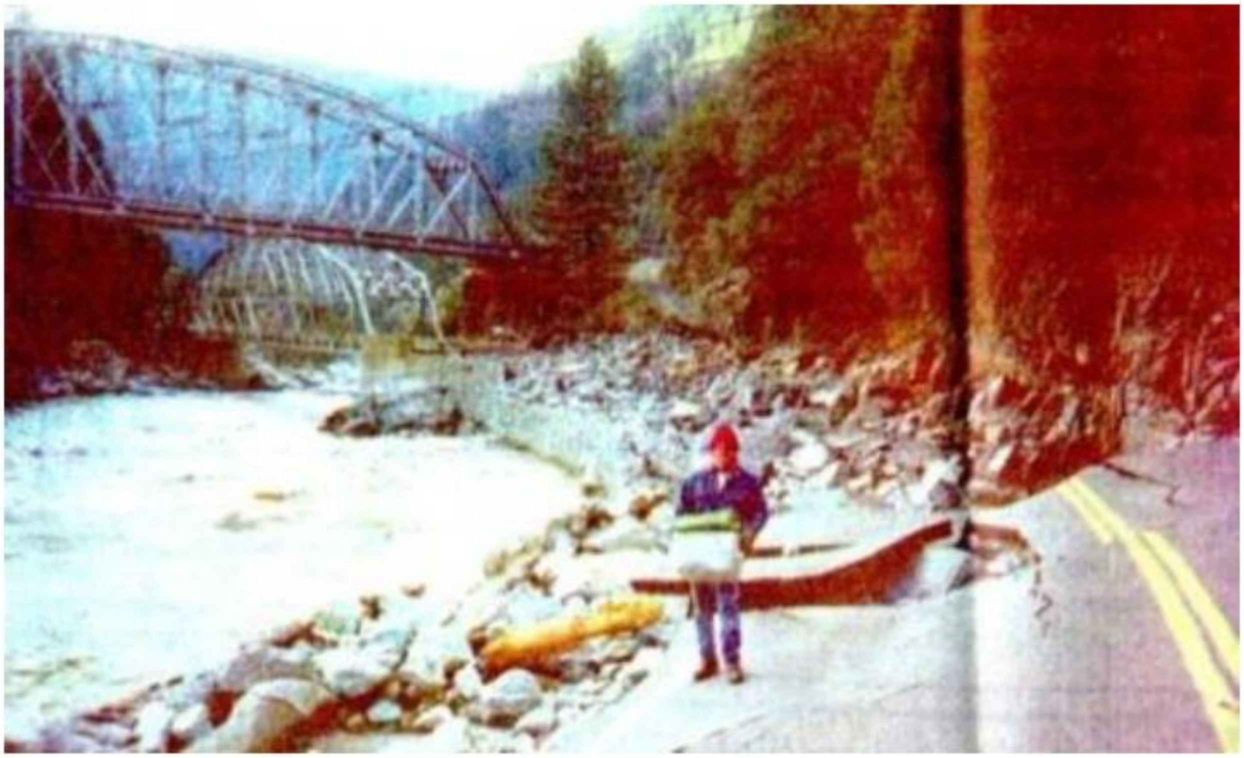
Source: Feather River Bulletin, Wednesday January 29, 1997

Figure 4-97 Sloat Bridge Damage from 1997 Flood



Source: Plumas County Road Department

Figure 4-98 Damage to CA-70 near Tobin



Source: Feather River Bulletin, Wednesday January 29, 1997

Figure 4-99 High Water Marks from 1986 and 1987 in North Fork Feather Canyon

Source: Plumas County

2017

January and February of 2017 brought heavy rains from atmospheric rivers that struck Plumas County, resulting in a federal disaster declaration (DR-4301).

Many damages occurred in the County. One area hit hard was the Plumas Eureka Community Services District. The District area saw flood damage to 26 condominiums, and two single family homes (see Figure 4-100). Erosion caused the loss of half a backyard requiring the owner to reinforce the riverbank bordering the property (see Figure 4-101). Erosion to roads and water main right of way, damage to sewer pumps, debris removal from fallen trees occurred. Sewer service was shut down for 12 hours. There was also a road closure to flooded areas for 12 hours.

Figure 4-100 Plumas County 2017 Flooding in the Plumas Eureka Community Services District

Source: Plumas Eureka Community Services District

Figure 4-101 Erosion to Backyard of Home during 2017 Floods (left – during flood, right – after flood)

Source: Plumas Eureka Community Services District

Private property damage in the District came from both flooding and from fallen trees. Amount unknown, but one property owner stated that flood damage related costs exceeded $120,000 of which he received $67,000 for his claim. The Distirct received $12,189 from damages sustained.

Additionally, the HMPC noted that there were issues with flooding for agriculture in 2017 and 2018. In the Sierra Valley and Beckwourth areas, rains caused a 30% decrease in hay production and caused a 25% loss in calves. It was thought that $200,000 in damages to hay and $19,000 in damages to calves was suffered in both 2017 and 2018, respectively. Other areas of the Sierra Valley suffered field erosion and additional hay losses. $1.6 million in hay was lost, and $230,000 in damages was suffered from field erosion.

Figure 4-102 2017 Flooding – Arlington Bridge

Source: Plumas County Agriculture Commissioner

Figure 4-103 2017 Road Flooding

Source: Plumas County Agriculture Commissioner

Figure 4-104 2017 Flooding – Flooded Meadow

Source: Plumas County Agriculture Commissioner

Figure 4-105 2017 Flooding

Source: Plumas County Agriculture Commissioner

The HMPC noted that there were washouts near Laporte and Thomspson Creek. These can be seen in Figure 4-106 and Figure 4-107.

Figure 4-106 Plumas County – LaPorte Road Washout

Source: Plumas County

Figure 4-107 Plumas County – Thompson Creek Washout

Source: Plumas County

Additionally, Plumas County Public Works kept a tally of damages from the 2017 storms:

- 2017 Storm Damage Debris Removal:
  - ✓ CR 507 Johnsville-Mccrea Road
  - ✓ CR 423 Big Creek Road
  - ✓ Lindan Channel next to CR QU30, Lindan Avenue
  - ✓ CR TV03, Thompson Street
  - ✓ CR 112, North Valley Rd. at Lights Creek (Br. No. 9C-0012)
  - ✓ CR 207, Arlington Road at Hough Creek
  - ✓ CR 206, Stampfli Lane Br. 9C-0053
  - ✓ CR 207C, Old Arlington Road
  - ✓ CR CM08, Wagon Road
  - ✓ CR 317, Rush Creek Road
  - ✓ CR 511, Quincy-Laporte Rd. (LaPorte - to Yuba Co. line)
  - ✓ CR 311, Section - Old Red Bluff Road, Br. 9C-0052
  - ✓ CR 414, Bucks Lake Road at Clear Creek
  - ✓ CR 517, Mt. Tomba Road.
  - ✓ CR 202, Greenville-Wolf Creek Rd.
  - ✓ CR 404A, Oakland Camp Road
  - ✓ CR 511, From the M.F.F.R. to Silver Tip
  - ✓ CR 511, From Silver Tip to Laporte
  - ✓ CR 219, Williams Valley Rd
  - ✓ CR 312, Chester-Warner Valley Road, Br. 9C-0050 at Warner Creek

- 2017 Storm Damage Unplug Culverts / Culvert Washouts:
  - ✓ CR 507 Johnsville-Mccrea Road
  - ✓ Mill Creek next to Maintenance yard
  - ✓ CR 423 Big Creek Road
  - ✓ CR 520, Little Bear Road at Bonta Creek
  - ✓ CR CM03, Main St. in Crescent Mills
  - ✓ CR 115, Clio-State 40A Road at Willow Creek
  - ✓ CR 306, Seneca Road at Davis Creek
  - ✓ CR 420, Blackhawk Road
  - ✓ CR 408, West's Ranch Road
  - ✓ CR 529, Gill Ranch Road
  - ✓ CR 308, Humboldt Road
  - ✓ CR 516, Mohawlk Vista Drive
  - ✓ CR 403, Mt. Hough-Crystal Lake Road
  - ✓ CR 532, Harrison Road
  - ✓ CR 507, Johnsville-McCrea Road
  - ✓ CR 301, Highlands Road

- 2017 Storm Damage Road Washouts:
  - ✓ CR 507 Johnsville-Mccrea Road
  - ✓ CR 420 Blackhawk

- ✓ CR 305, Prattville - Butt Reservoir Road
- ✓ CR 124, Rocky Point Road
- ✓ CR 103, Dotta Guidici Road
- ✓ CR 304, Rich Bar Rd.
- ✓ CR 417, Butterfly Valley - Twain Rd.
- ✓ CR 303A, Howells Road (February Storm)
- ✓ CR 510, Radio Hill Road
- ✓ CR 202A, Setzer Camp Road at Wolf Creek, Br. No, 9C-0131
- ✓ CR 306, Seneca Road at Owl Creek
- ✓ CR402A, Old State Highway
- ✓ CR 214, North Arm Road, Br 9C-0143 (Peters Creek)
- ✓ CR 118, Harriet Lane
- ✓ CR 107, Dyson Lane
- ✓ CR 108, Beckwourth-Loyalton Road
- ✓ CR 404, Chandler Road
- ✓ CR 206, Stampfli Lane (road - not the bridges)
- ✓ CR 303A, Howells Road (January Storm)

- ➢ 2017 Storm Damage Bank Failure / Streambank Erosion:
  - ✓ CR 409, Beskeen Lane
  - ✓ CR 509B, Sloat-Poplar Valley Road Bridge Rock Slope Bank Repair

2019

Indian Valley had snow on rain events that caused flooding.

Likelihood of Future Occurrence

1% Annual Chance Flood

Occasional— The 1% annual chance flood (100-year) is the flood that has a 1 percent chance of being equaled or exceeded in any given year. This, by definition, makes the likelihood of future occurrence occasional. However, the 100-year flood could occur more than once in a relatively short period of time.

0.2% Annual Chance Flood

Unlikely—The 0.2% annual chance flood (500-year) is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. This, by definition, makes the likelihood of future occurrence unlikely.

Climate Change and Flood

According to the CAS, climate change may affect flooding in Plumas County. While average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. It is possible that average soil moisture and runoff could decline, however, due to increasing temperature, evapotranspiration rates, and spacing between rainfall events. Reduced snowpack and increased number of intense rainfall events are likely to put additional pressure on water infrastructure which could increase the chance of flooding associated with breaches or failures of flood control structures such as levees and dams. Future precipitation projections were shown in Figure 4-24 in Section 4.3.3. Also according to the National Center for Atmospheric Research in Boulder, Colorado, Atmospheric Rivers are likely to grow more intense in coming decades, as climate changes warms the atmosphere enabling it to hold more water.

Vulnerability Assessment

Vulnerability—High

Flooding is a significant problem in Plumas County. Historically, the Plumas County Planning Area has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1% and 0.2% annual chance floodplains and in other localized areas. The vulnerability of the County to severe flooding is high as it can result in significant life safety and property damage.

Floods have been a part of Plumas County's historical past and will continue to be so in the County's future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Historically, much of the growth in the County has occurred adjacent to rivers or streams, resulting in significant damages to property, and losses from disruption of community activities during periods of flooding. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

The HMPC noted that often the discharge of water is less of an issue during flood events than the sediment and debris that comes with it.

Impacts

Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Schools may also be required to close or be placed on a delayed start schedule. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. A car will float in less than two feet of moving water and can be swept downstream into deeper waters. This is one reason floods kill more people trapped in vehicles than anywhere else. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short outs. Floodwaters can transport large objects downstream which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to crops, roads, foundations, and electrical circuits. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Where flooding occurs in populated areas, warning and evacuation will be of critical importance to reduce life and safety impacts from any type of flooding.

Health Hazards from Flooding

Certain health hazards are also common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where cattle and hogs are kept or their wastes are stored can contribute polluted waters to the receiving streams.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as e. coli and other disease-causing agents.

The second type of health problems arise after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If a city or county water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

Flood Hazard Assessment

This risk assessment for the Plumas County LHMP Update assessed the flood hazard specific to Plumas County. This included an evaluation of multiple flood hazards including the Special Flood Hazard Area

(SFHA) shown on the DFIRM; Repetitive Loss (RL) Areas; localized, stormwater flooding areas; other areas that have flooded in the past, but not identified on the DFIRM; other areas of shallow flooding identified through other studies and sources; levee failure flooding; dam failure flooding; and mudflow flooding especially in significant post-burn areas. This comprehensive flood risk assessment included an assessment of less-frequent flood hazards, areas likely to be flooded, and flood problems that are likely to get worse in the future as a result of changes in floodplain development and demographics, development in the watershed, and climate change. Existing studies, maps, historical data, and federal, state, and local community expertise and knowledge contributed to this current flood assessment for Plumas County. An evaluation of the success of completed and ongoing flood control projects and associated maintenance aspects contributed to this flood hazard assessment and the resulting flood mitigation strategy for the Plumas County Planning Area. This flood risk assessment for this LHMP Update also includes an assessment of future flooding conditions based on historic development in the floodplains and proposed future development as further described throughout this plan. The flood vulnerability assessment that follows focuses on the flood hazard based on FEMA DFIRMs.

Flood Analysis

The Plumas County Planning Area has mapped FEMA flood hazard areas. GIS was used to determine the possible impacts of flooding within the County and how the risk varies across the unincorporated County. The following methodology was followed in determining improved parcel counts and values at risk to the 1% annual chance flood event and 0.2% annual chance flood events.

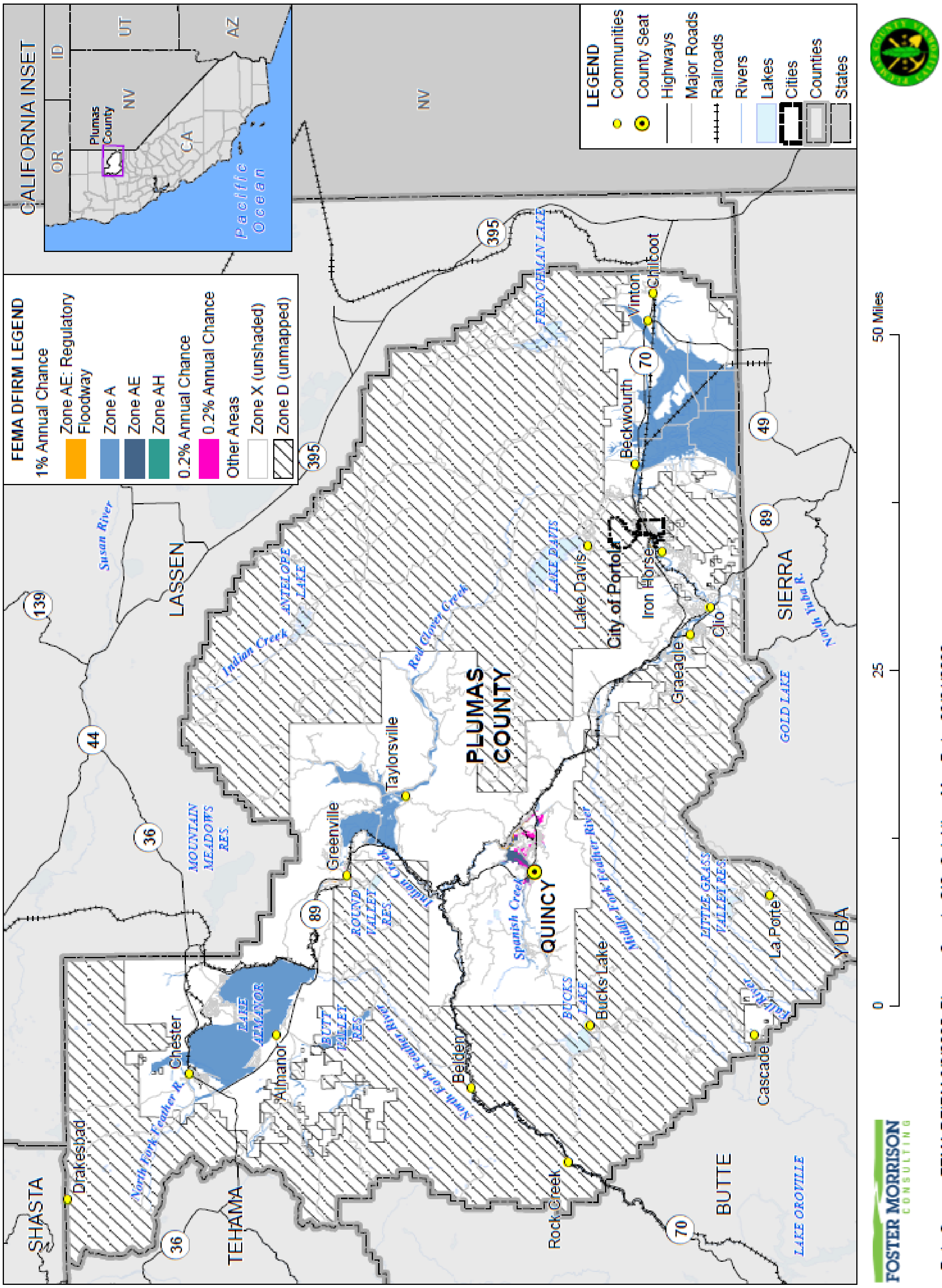
Plumas County has a FEMA effective DFIRM dated 3/2/2005, which was obtained from the National Flood Hazard Layer to perform the flood analysis. Each of the DFIRM flood zones that begins with the letter 'A' depict the Special Flood Hazard Area, or the 1% annual chance flood event (commonly referred to as the 100-year flood). Table 4-62 explains the difference between DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the County. The effective DFIRM maps for the Plumas County Planning Area are shown on Figure 4-108.

Table 4-62 Plumas County Planning Area – DFIRM Flood Hazard Zones

Flood Zone	Description
A	1% annual chance flood: No base flood elevations provided
AE	1% annual chance flood: Base flood elevations provided
AE Floodway	1% annual chance flood: Regulatory floodway; Base flood elevations provided
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood
D	Zone D designation is used for areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted.
X (unshaded)	No flood hazard

Source: FEMA

Figure 4-108 Plumas County – DFIRM Flood Zones



Data Source: FEMA DFIRM 3/2/2005, Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Values at Risk and Flood Loss Estimates Analysis

Quantifying the values at risk and estimating losses within mapped FEMA floodplains in the County is an important element in understanding the risk and vulnerability of the Plumas County Planning Area to the flood hazard.

Methodology

Plumas County's February 2020 Parcel and Assessor Data, obtained from Plumas County, was used as the basis for the county inventory of parcels, values, and acres. Plumas County has a FEMA DFIRM dated 3/2/2005 which was utilized to perform the flood analysis.

In some cases, there are parcels in multiple flood zones, such as Zone A, Zone X, or Shaded X. GIS was used to create a centroid, or point representing the center of the parcel polygon. DFIRM flood data was then overlaid on the parcel layer. For the purposes of this analysis, the flood zone that intersected a parcel centroid was assigned the flood zone for the entire parcel. The parcels were segregated and analyzed in this fashion for Plumas County. Once completed, the parcel boundary layer was joined to the centroid layer and values were transferred based on the identification number in the Assessors database and the GIS parcel layer.

Analysis on values at risk to floods in the County is provided for Plumas County in the below results section.

Limitations

It also should be noted that the resulting flood analysis estimates may actually be more or less than that presented in the below tables as the County may include structures located within the 1% or 0.2% annual chance floodplain that are elevated at or above the level of the base flood elevation, according to local floodplain development requirements. Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the floodplain due primarily to Proposition 13, and to a lesser extent, properties falling under the Williamson Act.

Flood Loss Estimate

The loss estimate for flood is based on the total of improved and contents value. Improved parcels include those with improved structure values identified in the Assessor's database. Only improved parcels and the value of their structure improvements were included in the flood loss analysis. The value of land is not included in the loss estimates as generally the land is not at loss to floods, just the value of improvements and structure contents. The land value is represented in the detailed flood tables, but are only present to show the value of the land associated with each flood zone.

The property use categories for the County (derived from zoning code descriptions) were used to develop estimated content replacement values (CRVs) that are potentially at loss from hazards, using FEMA Hazus methodologies as previously described in Section 4.3.1. The CRVs were added to the improved parcel values.

Once the potential value of affected parcels was calculated, a damage factor was applied to obtain loss estimates by flood zone. When a flood occurs, seldom does the event cause total loss of an area or building. Potential losses from flooding are related to a variety of factors including flood depth, flood velocity, building type, and construction. The percent of damage is primarily related to the flood depth. FEMA's flood benefit/cost module uses a simplified approach to model flood damage based on building type and flood depth. The values at risk in the flood analysis tables were refined by applying an average damage estimation of 20% of the total building value. The 20% damage estimate utilized FEMA's Flood Building Loss Table based on an assumed average flood depth of 2 feet. The end result of the flood hazard analysis is an inventory of the numbers, types, and values of parcels subject to the flood hazard.

Values at Risk and Flood Loss Estimates Results

The end result of the values at risk and flood loss estimates analysis is an inventory of the numbers, types, and values of parcels and estimated losses subject to the flood hazard by flood zone. Table 4-63 and Table 4-64 contain flood analysis results for Plumas County. These tables show the number of parcels and values at risk to the 1% and 0.2% annual chance event for Plumas County. Table 4-63 shows a summary of the value of improved parcels by 1% and 0.2% annual chance flood zones in the Planning Area. Table 4-64 shows the values in each flood zone for the Planning Area.

Table 4-63 Plumas County – Count and Value of Parcels by 1% and 0.2% Flood Zone*

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard	1,074	557	$83,853,658	$97,424,438	$610,506	$56,902,792
0.2% Annual Chance Flood Hazard**	865	722	$34,045,279	$171,252,912	$5,523,716	$149,981,027
Other Areas	22,467	12,457	$1,168,243,857	$2,164,414,428	$12,500,173	$1,187,677,283
Grand Total	24,406	13,736	$1,286,142,794	$2,433,091,778	$18,634,395	$1,394,561,101

Source: FEMA 3/2/2005 DFIRM, Plumas County February 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Table 4-64 Plumas County – Count and Value of Parcels by 1% and 0.2% Flood Zone by Property Use*

Flood Zone / Property Use /	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard							
Zone A							
Agricultural	178	48	$23,474,135	$4,174,666	$192,753	$4,174,666	$32,016,220
Commercial	21	12	$1,323,409	$3,013,201	$55,930	$3,013,201	$7,405,741

Flood Zone / Property Use /	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Federal Lands	5	0	$0	$0	$0	$0	$0
Government	44	0	$0	$0	$0	$0	$0
Industrial	15	6	$814,135	$517,278		$775,917	$2,107,330
Institutional	3	0	$0	$0	$0	$0	$0
Miscellaneous	16	0	$0	$0	$0	$0	$0
Recreational	14	9	$1,062,417	$1,021,456	$40,690	$1,021,456	$3,146,019
Residential	554	389	$48,938,889	$73,717,178	$171,782	$36,858,589	$159,686,438
ROW/Utilities	50	0	$0	$0	$0	$0	$0
Zone A Total	**900**	**464**	**$75,612,985**	**$82,443,779**	**$461,155**	**$45,843,829**	**$204,361,748**
Zone AE							
Agricultural	18	6	$1,663,325	$748,278	$116,430	$748,278	$3,276,311
Commercial	17	12	$1,950,417	$2,462,219	$22,670	$2,462,219	$6,897,525
Government	6		$0	$0	$0	$0	$0
Industrial	4	4	$356,557	$1,806,216	$0	$2,709,324	$4,872,097
Miscellaneous	1		$0	$0	$0	$0	$0
Residential	73	59	$3,470,562	$8,425,398	$10,251	$4,212,699	$16,118,910
ROW/Utilities	7	$0	$0	$0	$0	$0	$0
Zone AE Total	**126**	**81**	**$7,440,861**	**$13,442,111**	**$149,351**	**$10,132,520**	**$31,164,843**
Zone AE Floodway							
Agricultural	4	1	$186,417	$278,307	$0	$278,307	$743,031
Commercial	2	1	$32,168	$36,030	$0	$36,030	$104,228
Government	1	0	$0	$0	$0	$0	$0
Industrial	1	0	$3,050	$0	$0	$0	$3,050
Miscellaneous	1	0	$0	$0	$0	$0	$0
Residential	28	5	$266,865	$401,395	$0	$200,698	$868,958
ROW/Utilities	3	0	$0	$0	$0	$0	$0
Zone AE Floodway Total	**40**	**7**	**$488,500**	**$715,732**	**$0**	**$515,035**	**$1,719,267**
Zone AH							
Agricultural	1		$8,011	$0	$0	$0	$8,011
Government	1		$0	$0	$0	$0	$0
Residential	6	5	$303,301	$822,816	$0	$411,408	$1,537,525
Zone AH Total	**8**	**5**	**$311,312**	**$822,816**	**$0**	**$411,408**	**$1,545,536**
1% Annual Chance Flood Hazard Total	**1,074**	**557**	**$83,853,658**	**$97,424,438**	**$610,506**	**$56,902,792**	**$238,791,394**

Flood Zone / Property Use /	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
0.2% Annual Chance Flood Hazard**							
Agricultural	9	2	$1,119,037	$18,214		$18,214	$1,155,465
Commercial	95	79	$8,616,158	$59,674,019	$5,032,583	$59,674,019	$132,996,779
Government	8	0	$0	$0	$0	$0	$0
Industrial	18	9	$1,201,722	$33,840,138	$293,260	$50,760,207	$86,095,327
Institutional	4	3	$184,884	$1,336,633	$7,310	$1,336,633	$2,865,460
Miscellaneous	1	0	$0	$0	$0	$0	$0
Residential	695	629	$22,923,478	$76,383,908	$190,563	$38,191,954	$137,689,903
ROW/Utilities	35	0	$0	$0	$0	$0	$0
0.2% Annual Chance Flood Hazard Total	865	722	**$34,045,279**	**$171,252,912**	**$5,523,716**	**$149,981,027**	**$360,802,934**
Other Areas							
Zone X (unshaded)							
Agricultural	900	137	$43,752,919	$13,716,587	$1,984,756	$13,716,587	$73,170,849
Commercial	672	470	$52,261,790	$125,139,516	$4,261,892	$125,139,516	$306,802,714
Federal Lands	69	0	$0	$0	$0	$0	$0
Government	300	0	$40,471	$0	$0	$0	$40,471
Industrial	108	65	$7,302,295	$8,938,514	$21,284	$13,407,771	$29,669,864
Institutional	80	42	$1,699,516	$11,361,499	$72,595	$11,361,499	$24,495,109
Miscellaneous	52	0	$0	$0	$0	$0	$0
Recreational	194	76	$11,277,845	$17,415,056	$1,388,665	$17,415,056	$47,496,622
Residential	14,599	9,883	$906,178,994	$1,785,129,983	$3,504,013	$892,564,992	$3,587,377,982
ROW/Utilities	819	0					
Zone X (unshaded) Total	**17,793**	**10,673**	**$1,022,513,830**	**$1,961,701,155**	**$11,233,205**	**$1,073,605,421**	**$4,069,053,611**
Zone D							
Agricultural	875	84	$35,736,784	$4,930,856	$0	$4,930,856	$45,598,496
Commercial	60	35	$4,481,506	$8,565,968	$395,633	$8,565,968	$22,009,075
Federal Lands	140	0	$0	$0	$0	$0	$0
Government	230	0	$103,271	$0	$0	$0	$103,271
Industrial	1	0	$21,877	$0	$0	$0	$21,877
Miscellaneous	58	0	$8,119	$0	$0	$0	$8,119
Recreational	314	12	$1,775,646	$11,933,627	$590	$11,933,627	$25,643,490
Residential	2,850	1,653	$103,602,824	$177,282,822	$870,745	$88,641,411	$370,397,802
ROW/Utilities	146	0	$0	$0	$0	$0	$0

Flood Zone / Property Use /	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Zone D Total	4,674	1,784	$145,730,027	$202,713,273	$1,266,968	$114,071,862	$463,782,130
Other Areas Total	**22,467**	**12,457**	**$1,168,243,857**	**$2,164,414,428**	**$12,500,173**	**$1,187,677,283**	**$4,532,835,741**
Unincorporated Plumas County Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**
Grand Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**

Source: FEMA 3/2/2005 DFIRM, Plumas County February 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance floodplain, exclusive of the 1% annual chance floodplain. The 0.2% annual chance flood also includes all parcels in the 1% annual chance floodplain.

Table 4-65 shows a summary table of loss estimates by 1% and 0.2% annual chance flood zone for the Plumas County Planning Area. The loss ratio is the loss estimate divided by the total potential exposure (i.e., total of improved and contents value for all parcels located in the Planning Area) and displayed as a percentage of loss. FEMA considers loss ratios greater than 10% to be significant and an indicator that a community may have more difficulties recovering from a flood. The County should keep in mind that the loss ratio could increase with additional development in the 1% and 0.2% annual chance flood zone, unless development is elevated in accordance with the local floodplain management ordinance.

Table 4-65 Plumas County – Flood Loss Estimate

Flood Zone	Total Parcel Count*	Improved Parcel Count*	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance Flood Hazard	1,074	557	$83,853,658	$97,424,438	$610,506	$56,902,792	$154,937,736	$30,987,547	0.92%
0.2% Annual Chance Flood Hazard**	865	722	$34,045,279	$171,252,912	$5,523,716	$149,981,027	$326,757,655	$65,351,531	1.94%
Grand Total	**1,939**	**1279**	**$117,898,937**	**$268,677,350**	**$6,134,222**	**$206,883,819**	**$481,695,391**	**$96,339,078**	**2.86%**

Source: FEMA 3/2/2005 DFIRM, Plumas County February 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual flood zone, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood also includes all parcels in the 1% annual chance flood zone.

According to the information in Table 4-63 through Table 4-65, the Plumas County Planning Area has 557 improved parcels and roughly $155 million of structure and contents value in the 1% annual chance flood zone. There are an additional 722 improved parcels and roughly $327 million of structure and contents value in the 0.2% annual chance flood event. A loss ratio of 0.92% (1% annual chance) and 1.94% (0.2% annual chance) indicates that while the Plumas County Planning Area has values at risk in the floodplain, flood losses would be limited compared to the total built environment and the community would likely be able to recover adequately.

Flooded Acres

In addition to the centroid analysis used to obtain numbers of parcels and values at risk to flood hazards, parcel boundary analysis was performed to obtain total acres and flooded acres by flood zone for each parcel. The parcel layer was intersected with the FEMA DFIRM data to obtain the acres flooded. The following is an analysis of flooded acres in the County.

Methodology

GIS was used to calculate acres flooded by FEMA flood zones and property use categories. The Plumas County parcel layer and FEMA DFIRM were intersected, and each segment divided by the intersection of flood zone and parcels was calculated for acres. This process was conducted for 1% and 0.2% annual chance floodplain areas, with each segment being defined by zone type (A, AE, 0.2% Annual Chance, and X) and acres. The resulting data tables with flooded acreages were then imported into a database and linked back to the original parcels, including total acres by parcel number. Once this was completed, each parcel contained acreage values for flooded acre by zone type within the parcel. In the tables below, the 1% and 0.2% annual chance flood zones are summarized and then split out by property use, their total flooded acres, total improved acres, and percent of improved acres that are flooded.

Limitations

One limitation created by this type of analysis is that improvements are uniformly found throughout the parcel, while in reality, only portions of the parcel are improved, and improvements may or may not fall within the flood zone portion of a parcel; thus, areas of improvements flooded calculated through this method may be higher or lower than those actually seen in a similar real-world event.

The following tables represent a summary and detailed analysis of total acres for each FEMA DFIRM flood zone in the Planning Area. Table 4-66 gives summary information for the Planning Area by 1% and 0.2% annual chance flood zone for the entire Plumas County Planning Area. In all of these tables, the Other Areas are areas (Zone X Unshaded – areas outside mapped flood hazard areas) where there is no mapped flood hazard area.

Table 4-66 Plumas County– Flooded Acres Summary

Flood Zone / Property Use	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance Flood Hazard						
Zone A						
Agricultural	32,142	1.84%	11,168	15.08%	20,974	1.26%
Commercial	315	0.02%	234	0.32%	81	0.00%
Federal Lands	1,632	0.09%	0	0.00%	1,632	0.10%
Government	1,602	0.09%	0	0.00%	1,602	0.10%
Industrial	117	0.01%	49	0.07%	68	0.00%
Institutional	2	0.00%	0	0.00%	2	0.00%
Miscellaneous	10,762	0.62%	0	0.00%	10,762	0.64%
Recreational	246	0.01%	204	0.28%	42	0.00%
Residential	6,292	0.36%	3,279	4.43%	3,013	0.18%
ROW/Utilities	31,090	1.78%	0	0.00%	31,090	1.86%
Zone A Total	**84,200**	**4.83%**	**14,933**	**20.17%**	**69,267**	**4.15%**
Zone AE						
Agricultural	759	0.04%	295	0.40%	464	0.03%
Commercial	97	0.01%	40	0.05%	57	0.00%
Federal Lands	5	0.00%	0	0.00%	5	0.00%
Government	36	0.00%	0	0.00%	36	0.00%
Industrial	4	0.00%	3	0.00%	2	0.00%
Institutional	0	0.00%	0	0.00%	0	0.00%
Miscellaneous	31	0.00%	0	0.00%	31	0.00%
Recreational	0	0.00%	0	0.00%	0	0.00%
Residential	701	0.04%	319	0.43%	382	0.02%
ROW/Utilities	67	0.00%	0	0.00%	67	0.00%
Zone AE Total	**1,701**	**0.10%**	**656**	**0.89%**	**1,045**	**0.06%**
Zone AE Floodway						
Agricultural	179	0.01%	43	0.06%	136	0.01%
Commercial	11	0.00%	3	0.00%	8	0.00%
Federal Lands	20	0.00%	0	0.00%	20	0.00%
Government	13	0.00%	0	0.00%	13	0.00%
Industrial	8	0.00%	0	0.00%	8	0.00%
Institutional	0	0.00%	0	0.00%	0	0.00%
Miscellaneous	13	0.00%	0	0.00%	13	0.00%
Recreational	0	0.00%	0	0.00%	0	0.00%

Flood Zone / Property Use	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Residential	129	0.01%	66	0.09%	62	0.00%
ROW/Utilities	22	0.00%	0		22	0.00%
Zone AE Floodway Total	**395**	**0.02%**	**114**	**0.15%**	**281**	**0.02%**
Zone AH						
Agricultural	5	0.00%	0	0.00%	5	0.00%
Commercial	0	0.00%	0	0.00%	0	0.00%
Federal Lands	0	0.00%	0	0.00%	0	0.00%
Government	0	0.00%	0	0.00%	0	0.00%
Industrial	0	0.00%	0	0.00%	0	0.00%
Institutional	0	0.00%	0	0.00%	0	0.00%
Miscellaneous	0	0.00%	0	0.00%	0	0.00%
Recreational	0	0.00%	0	0.00%	0	0.00%
Residential	9	0.00%	9	0.01%	1	0.00%
ROW/Utilities	1	0.00%	0	0.00%	1	0.00%
Zone AH Total	**15**	**0.00%**	**9**	**0.01%**	**7**	**0.00%**
1% Annual Chance Flood Hazard Total	**86,311**	**4.95%**	**15,712**	**21.22%**	**70,599**	**4.23%**
0.2% Annual Chance Flood Hazard						
Zone X (shaded)						
Agricultural	328	0.02%	161	0.22%	167	0.01%
Commercial	194	0.01%	91	0.12%	103	0.01%
Federal Lands	1	0.00%	0	0.00%	1	0.00%
Government	92	0.01%	0	0.00%	92	0.01%
Industrial	36	0.00%	17	0.02%	19	0.00%
Institutional	7	0.00%	5	0.01%	2	0.00%
Miscellaneous	0	0.00%		0.00%	0	0.00%
Recreational	0	0.00%		0.00%	0	0.00%
Residential	677	0.04%	390	0.53%	287	0.02%
ROW/Utilities	121	0.01%		0.00%	121	0.01%
Zone X (shaded) Total	**1,456**	**0.08%**	**664**	**0.90%**	**792**	**0.05%**
0.2% Annual Chance Flood Hazard Total	**1,456**	**0.08%**	**664**	**0.90%**	**792**	**0.05%**

Flood Zone / Property Use	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Other Areas						
Zone X (unshaded)						
Agricultural	150,630	8.64%	15,045	20.32%	135,584	8.12%
Commercial	2,964	0.17%	1,789	2.42%	1,176	0.07%
Federal Lands	196,195	11.25%	0	0.00%	196,195	11.75%
Government	42,174	2.42%	0	0.00%	42,174	2.53%
Industrial	550	0.03%	246	0.33%	304	0.02%
Institutional	258	0.01%	42	0.06%	216	0.01%
Miscellaneous	11,895	0.68%	0	0.00%	11,895	0.71%
Recreational	1,526	0.09%	1,125	1.52%	401	0.02%
Residential	52,434	3.01%	26,152	35.32%	26,282	1.57%
ROW/Utilities	11,434	0.66%	0	0.00%	11,434	0.68%
Zone X (unshaded) Total	**470,060**	**26.97%**	**44,400**	**59.96%**	**425,660**	**25.50%**
Zone D						
Agricultural	124,641	7.15%	4,747	6.41%	119,894	7.18%
Commercial	543	0.03%	368	0.50%	176	0.01%
Federal Lands	785,943	45.09%	0	0.00%	785,943	47.09%
Government	230,894	13.25%	0	0.00%	230,894	13.83%
Industrial	114	0.01%	0	0.00%	114	0.01%
Institutional	0	0.00%	0	0.00%	0	
Miscellaneous	20,946	1.20%	0	0.00%	20,946	1.25%
Recreational	3,233	0.19%	269	0.36%	2,964	0.18%
Residential	17,332	0.99%	7,891	10.66%	9,441	0.57%
ROW/Utilities	1,727	0.10%	0	0.00%	1,727	0.10%
Zone D Total	**1,185,373**	**68.00%**	**13,274**	**17.93%**	**1,172,099**	**70.22%**
Other Areas Total	**1,655,433**	**94.97%**	**57,674**	**77.89%**	**1,597,759**	**95.72%**
Grand Total	**1,743,200**	**100.00%**	**74,050**	**100.00%**	**1,669,150**	**100.00%**

Source: FEMA DFIRM 3/2/2005, Plumas County February 2020 Parcel/Assessor's Data

Insurance Coverage, Claims Paid, and Repetitive Losses

Unincorporated Plumas County joined the NFIP on September 24, 1984. The County does not participate in the CRS. NFIP insurance data provided by CA DWR indicates that as of March 2, 2020, there were 140 policies in force in the unincorporated County, resulting in $32,883,100 of insurance in force. There have been 59 closed paid losses totaling $1,099,373.04. Of these losses,46 were parcels in A zones and 12 parcels were in B, C, or X zone, with 1 claim unknown. Of the 59 claims, 52 claims were associated with pre-FIRM structures and 6 with post-FIRM structures, with 1 claim unknown. There have been 4 repetitive loss (RL) structures, and 0 severe repetitive loss (SRL) structures in the County. There have been 9 substantial damage claims since 1978.

Based on this analysis of insurance coverage, Plumas County has values at risk to the 1% and 0.2% annual chance and greater floods. Of the 577 improved parcels within the 1% annual chance flood zone,88 (or 15.8 percent) of those parcels maintain flood insurance. This can be seen on Table 4-67.

Table 4-67 Plumas County – Percentage of Policy Holders to Improved Parcels in the 1% Annual Chance Floodplain

Jurisdiction	Improved Parcels in SFHA (1% Annual Chance) Floodplain*	Insurance Policies in the SFHA (1% Annual Chance) Floodplain	Percentage of 1% Annual Chance Floodplain Parcels Currently Insured
Unincorporated County	557	88	15.8%

Source: FEMA DFIRM 3/2/2005, Plumas County February 2020 Parcel/Assessor's Data

Population at Risk

A separate analysis was performed to determine populations that reside in flood zones. Using GIS, the DFIRM Flood dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the Census Bureau average household size; and tabulated by flood zone (see Table 4-68). According to this analysis, there is a population of 1,028 in the 1% annual chance flood zone, and 1,459 in the 0.2% annual chance flood zone.

Table 4-68 Plumas County – Residential Population at Risk to 1% and 0.2% Annual Chance Flooding

Jurisdiction	1% Annual Chance		0.2% Annual Chance*	
	Improved Residential Parcels*	Population at Risk	Improved Residential Parcels*	Population at Risk
Unincorporated Plumas County	443	1,028	629	1,459
Total	**443**	**1,028**	**629**	**1,459**

Source: FEMA DFIRM 3/2/2005, US Census Bureau Average Household Sizes: unincorporated Plumas County (2.32)

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Plumas County and all jurisdictions to determine critical facilities in the 1% and 0.2 annual chance floodplains. Using GIS, the DFIRM flood zones were overlayed on the critical facility GIS layer. Figure 4-109 shows critical facilities, as well as the DFIRM flood zones. Table 4-69 summarizes the critical facilities in the County by DFIRM flood zone.

Table 4-70 details critical facilities by facility type and count for the Planning Area. Details of critical facility definition, type, name and address by flood zone are listed in Appendix F.

Figure 4-109 Plumas County – Critical Facilities in DFIRM Flood Zones

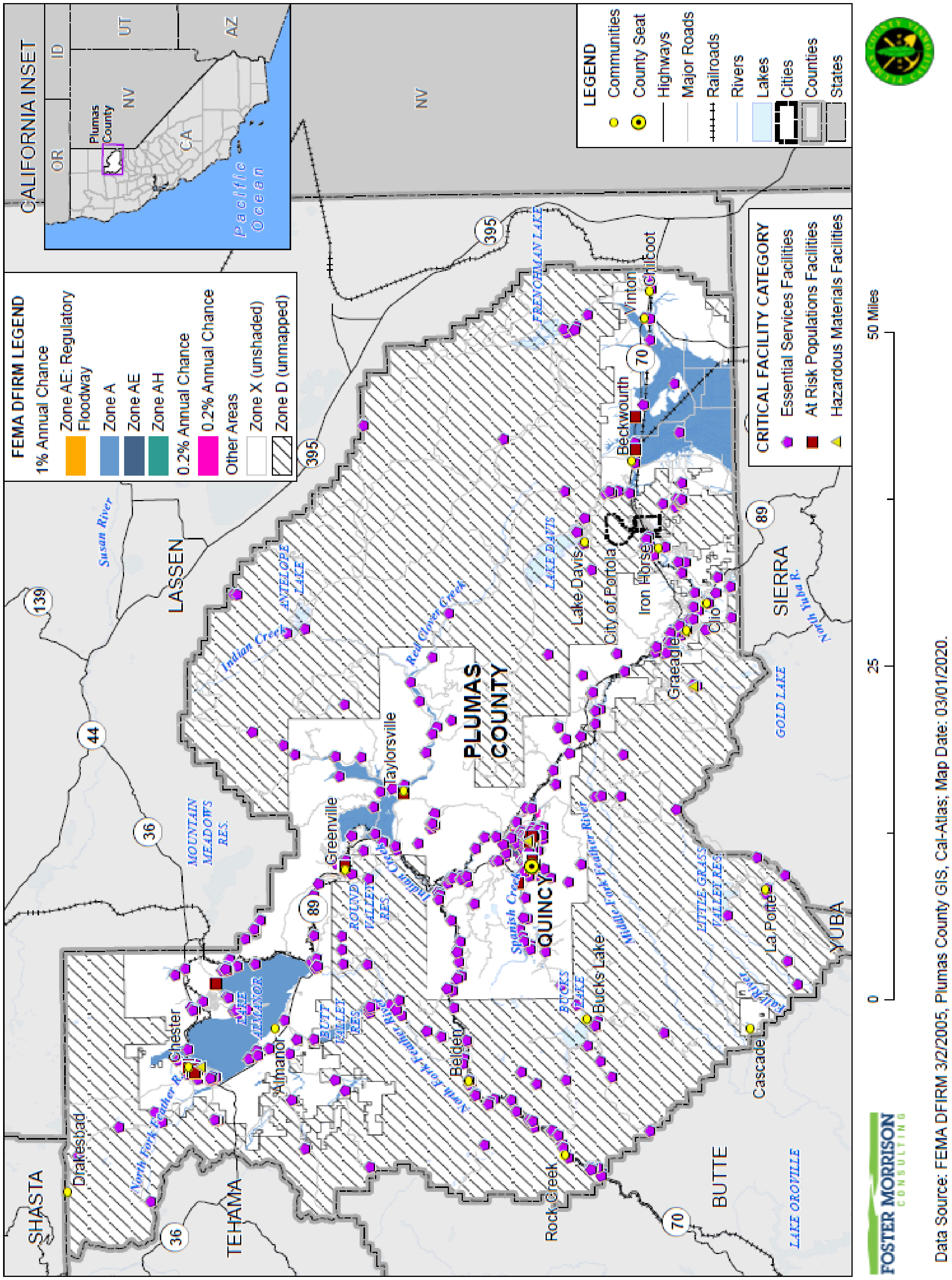


Table 4-69 Plumas County – Summary of Critical Facilities in DFIRM Flood Zones

Flood Zones	Critical Facility Category	Facility Count
1% Annual Chance Flood Hazard	Essential Services Facilities	81
	Total	**81**
0.2% Annual Chance Flood Hazard	Essential Services Facilities	25
	Hazardous Materials Facilities	1
	Total	**26**
Other Areas	Essential Services Facilities	667
	At Risk Populations Facilities	38
	Hazardous Materials Facilities	3
	Total	**708**
Grand Total		**815**

Source: Plumas County GIS, FEMA 3/2/2005 DFIRM

Table 4-70 Plumas County – Critical Facilities in DFIRM Flood Zones by Facility Category

Flood Zones	Critical Facility Category / Critical Facility Type	Facility Count
1% Annual Chance Flood Hazard		
Zone AE Floodway	**Essential Services Facilities**	
	Transportation Lifeline Systems	
	Bridge - State Hwy	1
	Bridge (Local) - Category A	2
	Bridge (Local) - Category C	3
	Transportation Lifeline Systems Total	6
	Essential Services Facilities Total	6
	Total	**6**
Zone AE	**Essential Services Facilities**	
	Communication Sites and Facilities	
	Fixed Microwave	2
	Land Mobile Private	2
	Communication Sites and Facilities Total	***4***
	Public Utility Plant and Substation Facilities	
	Electric Sub-Station	1
	Propane Station	3
	Wastewater Treatment Plant	1
	Water Treatment Plant	1
	Public Utility Plant and Substation Facilities Total	***6***
	Transportation Lifeline Systems	
	Bridge - State Hwy	1

Flood Zones	Critical Facility Category / Critical Facility Type	Facility Count
	Transportation Lifeline Systems Total	***1***
	Essential Services Facilities Total	**11**
	Total	**11**
Zone A	**Essential Services Facilities**	
	Communication Sites and Facilities	
	Fixed Microwave	4
	Land Mobile Commercial	1
	Land Mobile Private	15
	Communication Sites and Facilities Total	***20***
	Public Safety	
	Fire Station	3
	Public Safety Total	**3**
	Public Utility Plant and Substation Facilities	
	Community Services District	1
	Electric Sub-Station	1
	Power Plant	2
	Public Utility Plant and Substation Facilities Total	***4***
	Transportation Lifeline Systems	
	Airport	1
	Bridge - State Hwy	8
	Bridge (Local) - Category A	4
	Bridge (Local) - Category B	5
	Bridge (Local) - Category C	17
	Transportation Lifeline Systems Total	***35***
	Essential Services Facilities Total	**62**
	Total	**62**
Zone AH	**Essential Services Facilities**	
	Communication Sites and Facilities	
	Land Mobile Private	1
	Communication Sites and Facilities Total	1
	Emergency Medical	
	Wellness Center	1
	Emergency Medical Total	1
	Essential Services Facilities Total	**2**
	Total	**2**
1% Annual Chance Flood Hazard Total		**81**

Flood Zones	Critical Facility Category / Critical Facility Type	Facility Count
0.2% Annual Chance Flood Hazard		
Zone X (shaded)	**Essential Services Facilities**	
	Communication Sites and Facilities	
	Antenna Structure Registration	3
	Fixed Microwave	2
	Land Mobile Private	11
	Unknown	1
	Communication Sites and Facilities Total	***17***
	Public Safety	
	Fire Station	1
	Public Safety Total	***1***
	Public Utility Plant and Substation Facilities	
	Community Services District	1
	Electric Sub-Station	1
	Power Plant	1
	Propane Station	2
	Wastewater Treatment Plant	1
	Public Utility Plant and Substation Facilities Total	***6***
	Transportation Lifeline Systems	
	Airport	1
	Transportation Lifeline Systems Total	***1***
	Essential Services Facilities Total	**25**
	Hazardous Materials Facilities	
	Industrial	
	Timber Products	1
	Industrial Total	***1***
	Hazardous Materials Facilities Total	**1**
	Total	**26**
0.2% Annual Chance Flood Hazard Total		**26**
Other Areas		
Zone X (unshaded)	**Essential Services Facilities**	
	Communication Sites and Facilities	
	AM	1
	Antenna Structure Registration	24
	Cellular	2
	Fixed Microwave	63
	FM	11

Flood Zones	Critical Facility Category / Critical Facility Type	Facility Count
	Land Mobile Commercial	3
	Land Mobile Private	144
	Paging	2
	Repeater	4
	TV NTSC	1
	Unknown	2
	Communication Sites and Facilities Total	***257***
	Designated Emergency Shelter	
	Shelter	3
	Designated Emergency Shelter Total	***3***
	Emergency Medical	
	Clinic	3
	Home Health Agency/Hospice	1
	Hospital	2
	Pharmacy	4
	Wellness Center	2
	Emergency Medical Total	***12***
	Emergency Response	
	Fire Station	2
	Emergency Response Total	***2***
	Essential Government Operations	
	County Offices including Courts	1
	Plumas Co. Planning, Building, Engineering	1
	Plumas County Assessor	1
	Plumas County Child Support Services	1
	Plumas County Facility Services	1
	Plumas County Jail	1
	Plumas County Probation	1
	Plumas County Public Works	1
	Plumas County Public Works Yard	4
	Public, Behavioral & Envr. Health; Social Serv	1
	Essential Government Operations Total	***13***
	Public Safety	
	Fire Station	27
	Law Enforcement	4
	OES	1
	Public Health Dept.	1

Flood Zones	Critical Facility Category / Critical Facility Type	Facility Count
	Public Safety Total	***33***
	Public Utility Plant and Substation Facilities	
	Community Services District	13
	Electric Sub-Station	11
	Power Plant	2
	Propane Station	3
	Public Utility District	3
	Wastewater Treatment Plant	3
	Water Treatment Plant	6
	Public Utility Plant and Substation Facilities Total	***41***
	Transportation Lifeline Systems	
	Airport	2
	Bridge - State Hwy	14
	Bridge (Local) - Category A	5
	Bridge (Local) - Category B	5
	Bridge (Local) - Category C	5
	Heliport	4
	Transportation Lifeline Systems Total	***35***
	Essential Services Facilities Total	**396**
	At Risk Populations Facilities	
	Nursing, Congregate or Assisted Living	
	Assisted Living Facility	2
	Nursing	1
	Nursing, Congregate or Assisted Living Total	***3***
	School	
	Adult	2
	Combined	10
	Day Care Center	9
	Elementary	7
	Infant Center	1
	Middle	1
	Post Secondary	1
	Secondary	4
	School Total	35
	At Risk Populations Facilities Total	***38***
	Hazardous Materials Facilities	
	Unknown	

Flood Zones	Critical Facility Category / Critical Facility Type	Facility Count
	Community Services District	1
	Public Utility District	1
	Wastewater Treatment Plant	1
	Unknown Total	***3***
	Hazardous Materials Facilities Total	**3**
	Total	**437**
Zone D	**Essential Services Facilities**	
	Communication Sites and Facilities	
	Antenna Structure Registration	3
	Cellular	4
	Fixed Microwave	85
	FM	1
	Land Mobile Commercial	3
	Land Mobile Private	95
	Paging	1
	Repeater	2
	Unknown	1
	Communication Sites and Facilities Total	***195***
	Emergency Response	
	Fire Station	3
	Emergency Response Total	***3***
	Essential Government Operations	
	Plumas County Public Works Yard	1
	Essential Government Operations Total	***1***
	Public Safety	
	Fire Station	5
	Public Safety Total	***5***
	Public Utility Plant and Substation Facilities	
	Community Services District	2
	Electric Sub-Station	16
	Power Plant	7
	Water Treatment Plant	2
	Public Utility Plant and Substation Facilities Total	***27***
	Transportation Lifeline Systems	
	Bridge - State Hwy	15
	Bridge (Local) - Category A	7
	Bridge (Local) - Category B	7

Flood Zones	Critical Facility Category / Critical Facility Type	Facility Count
	Bridge (Local) - Category C	10
	Heliport	1
	Transportation Lifeline Systems Total	***40***
	Essential Services Facilities Total	**271**
	Total	**271**
Other Areas Total		**708**
Grand Total		**815**

Source: Plumas County GIS, FEMA 3/2/2005 DFIRM

Overall Community Impact

Floods and their impacts vary by location and severity of any given flood event and will likely only affect certain areas of the County during specific times. Natural areas, such as wetlands and riparian areas within the floodplain, often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Preserving and protecting these areas and associated functions are a vital component of sound floodplain management practices for Plumas County. Based on the risk assessment, it is evident that floods will continue to have potentially devastating economic impacts to certain areas of the County. However, many of the floods in the County are minor, localized flood events that are more of a nuisance than a disaster. Impacts that are not quantified, but can be anticipated in large future events, include:

- Injury and loss of life;
- Commercial and residential structural and property damage;
- Disruption of and damage to public infrastructure and services;
- Health hazards associated with mold and mildew, contamination of drinking water, etc.;
- Damage to roads/bridges resulting in loss of mobility;
- Significant economic impact (jobs, sales, tax revenue) to the community;
- Negative impact on commercial and residential property values; and
- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.
- Impact on the overall mental health of the community.

Future Development and Future Flood Conditions

This section provides an analysis of the flood hazard and proposed future development within the County based on FEMA DFIRMs and also discusses considerations in evaluating future flooding conditions.

Future Development: General Considerations

Communities that participate in the NFIP adopt regulations and codes that govern development in special flood hazard areas and enforce those requirements through their local floodplain management ordinances through the issuance of permits. Plumas County's floodplain management ordinance provides standards for development, subdivision of land, construction of buildings, and improvements and repairs to buildings that meet the minimum requirements of the NFIP.

The International Residential Code (IRC) and International Building Code (IBC), by reference to ASCE 24, include requirements that govern the design and construction of buildings and structures in flood hazard areas. FEMA has determined that the flood provisions of the I-Codes are consistent with the requirements of the NFIP (the I-Code requirements shown either meet or exceed NFIP requirements). ASCE 24, a design standard developed by the American Society of Civil Engineers, expands on the minimum NFIP requirements with more specificity, additional requirements, and some limitations.

With the adoption of the 2015, and later, International Codes, communities will be moving towards a more stringent approach to regulatory floodplain management, beyond the minimum requirements of the NFIP. The adoption and enforcement of disaster-resistant building codes is a core community action to promote effective mitigation. When communities ensure that new buildings and infrastructure are designed and constructed in accordance with national building codes and construction standards, they significantly increase local resilience now and in the future. With continued advancements in building codes, local ordinances should be reviewed and updated to meet and exceed standards as practicable to protect new development from future flood events and to further promote disaster resiliency.

One of the most effective ways to reduce vulnerability to potential flood damage is through careful land use planning that fully considers applicable flood management information and practices. Master planning will also be necessary to assure that open channel flood flow conveyances serving the smaller internal streams and drainage areas are adequately prepared to accommodate the flows. Preservation and maintenance of natural and riparian areas should also be an ongoing priority to realize the flood control benefits of the natural and beneficial functions of these areas. Also to be considered in reducing flooding in areas of existing and future development is to promote implementation of stormwater program elements and erosion and sediment controls, including the clearing of vegetation from natural and man-made drains that are critical to flood protection. Both native and invasive species can clog drains, and reduce flows of floodwaters, which slow that natural drainage process and can exacerbate flooding.

Future Development: GIS Analysis

Plumas County's February 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. The Plumas County Planning Department provided a table containing the assessor parcel numbers (APNs) for the 1,075 parcels representing the different future development projects or areas. Using the GIS parcel spatial file and the APNs, the future development projects were mapped.

For the flood analysis of future development areas, the parcel data was converted to a point layer using a centroid conversion process, in which each parcel was identified by a central point and linked to the Assessor's data. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts and acreage within each FEMA DFIRM flood zone. The County was separated into three areas. No future development areas intersected DFIRM flood zones in the north portion of the County, as such no map was created. Figure 4-110 shows the DFIRM flood zones and future development areas in the central portion of the County. Figure 4-111 shows the DFIRM flood zones and future development areas in the south portion of the County. Parcels and acreages in the DFIRM flood zones are summarized in Table 4-71, and detailed by detailed DFIRM area in Table 4-72.

Figure 4-110 Plumas County Central – Future Development Areas in FEMA DFIRM Flood Zones

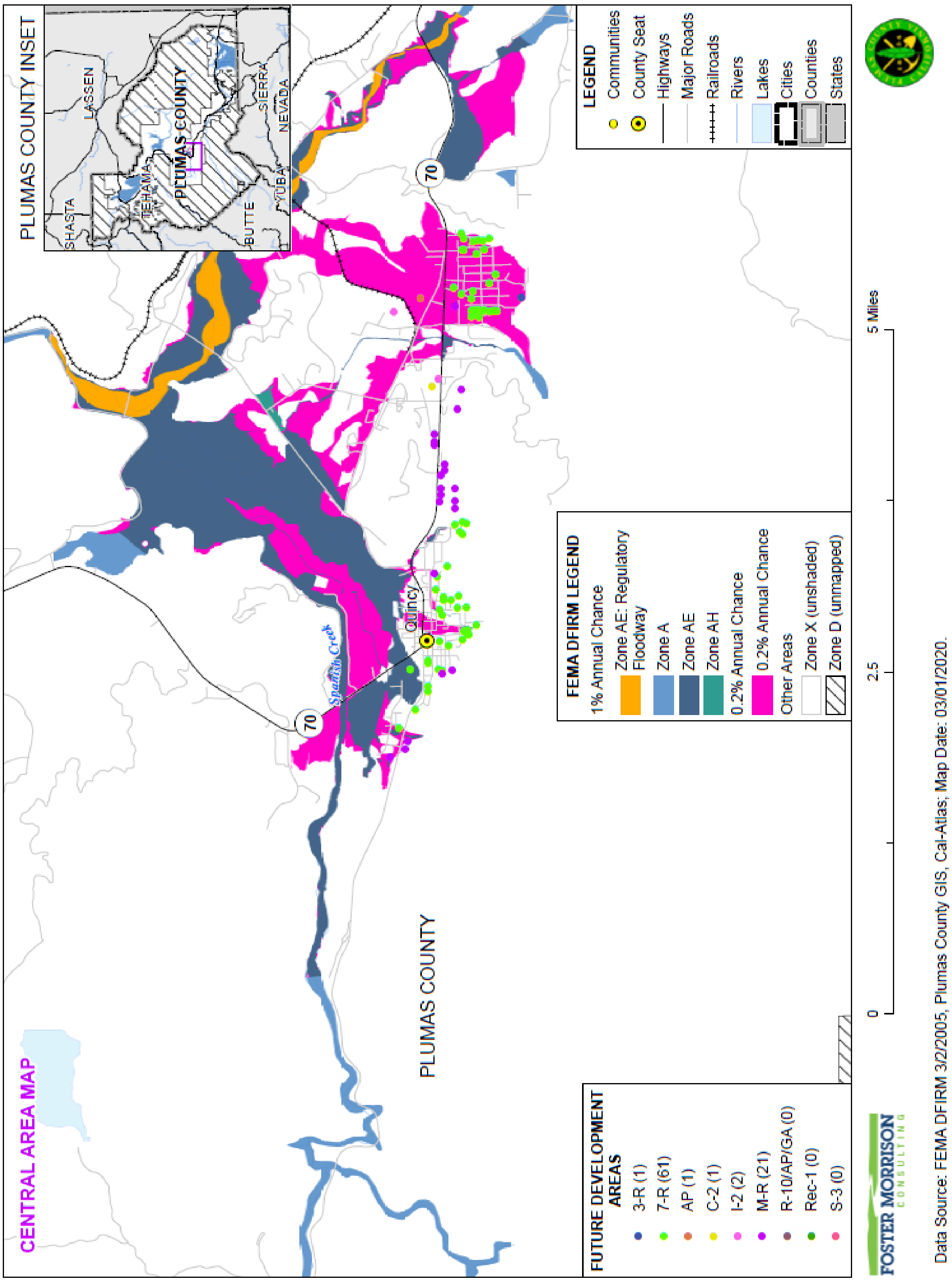


Figure 4-111 Plumas County South – Future Development Areas in FEMA DFIRM Flood Zones

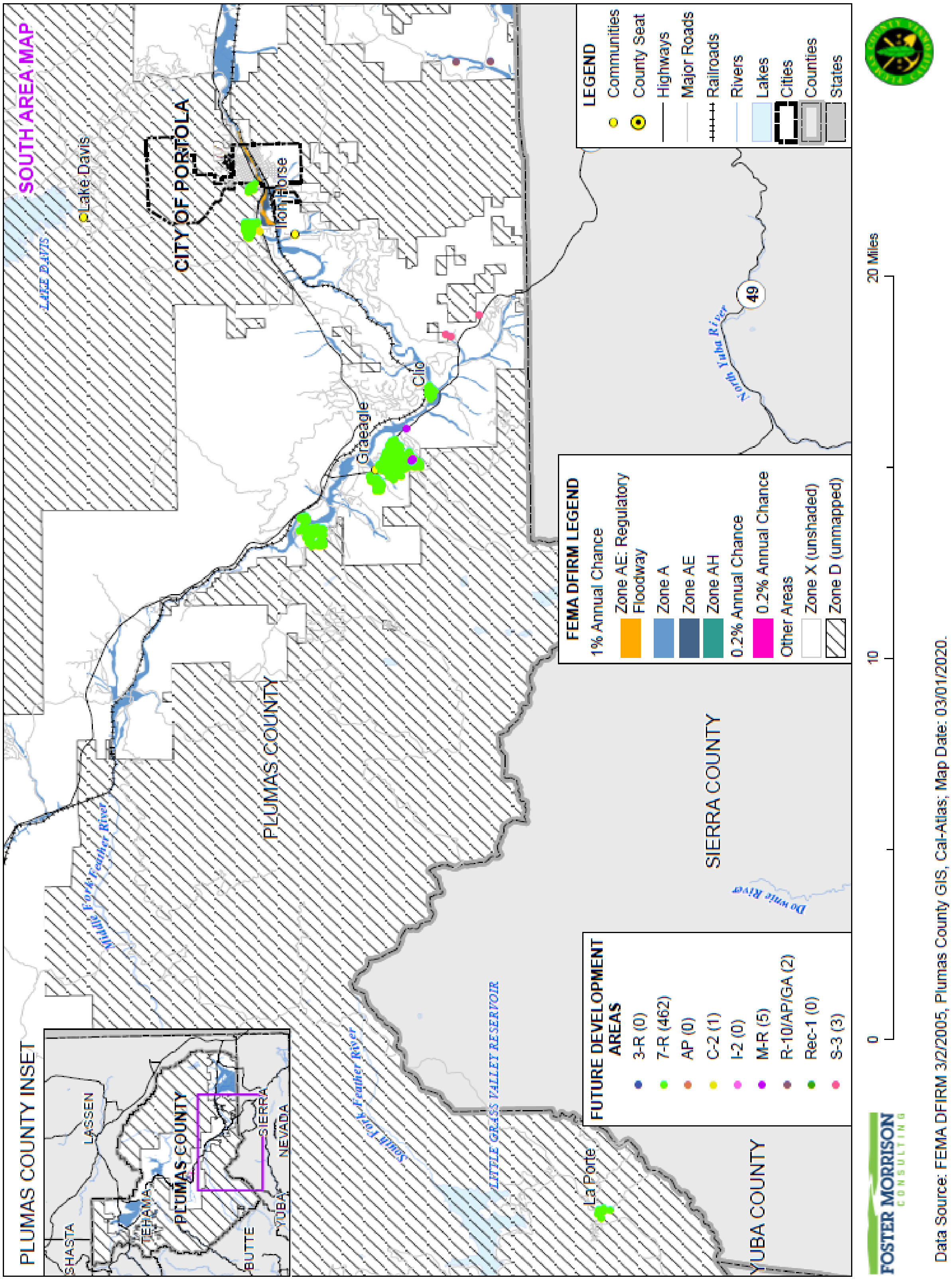


Table 4-71 Plumas County – Future Development Parcel and Acre Counts in Summary DFIRM Flood Zones

Map Area / Flood Zone/ Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
North Area			
1% Annual Chance Flood Hazard	4	3	3.160
Other Areas	511	191	323.349
North Area Total	**515**	**194**	**326.509**
Central Area			
1% Annual Chance Flood Hazard	1		1.032
0.2% Annual Chance Flood Hazard	32	12	24.085
Other Areas	54	15	69.986
Central Area Total	**87**	**27**	**95.103**
South Area			
1% Annual Chance Flood Hazard	10	2	6.328
Other Areas	463	180	1,405.309
South Area Total	**473**	**182**	**1,411.637**
Grand Total	**1,075**	**403**	**1,833.249**

Source: Plumas County GIS, FEMA DFIRM 3/2/2005

Table 4-72 Plumas County – Future Development Parcel and Acre Counts in Detailed DFIRM Flood Zones

Map Area / Flood Zone/ Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
North Area			
1% Annual Chance Flood Hazard			
7-R	4	3	3.160
1% Annual Chance Flood Hazard Total	**4**	**3**	**3.160**
Other Areas			
7-R	494	187	295.899
M-R	15	3	13.610
Rec-1	2	1	13.840
Other Areas Total	**511**	**191**	**323.349**
North Area Total	**515**	**194**	**326.509**
Central Area			
1% Annual Chance Flood Hazard			
7-R	1	0	1.032

Map Area / Flood Zone/ Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
1% Annual Chance Flood Hazard Total	**1**	**0**	**1.032**
0.2% Annual Chance Flood Hazard			
3-R	1	0	9.010
7-R	27	12	8.095
AP	1	0	4.010
M-R	3	0	2.970
0.2% Annual Chance Flood Hazard Total	**32**	**12**	**24.085**
Other Areas			
7-R	33	10	20.836
C-2	1	0	2.870
I-2	2	1	15.930
M-R	18	4	30.350
Other Areas Total	**54**	**15**	**69.986**
Central Area Total	**87**	**27**	**95.103**
South Area			
1% Annual Chance Flood Hazard			
7-R	10	2	6.328
1% Annual Chance Flood Hazard Total	**10**	**2**	**6.328**
Other Areas			
7-R	452	177	168.657
C-2	1	0	3.860
M-R	5	1	67.642
R-10	2	1	1,108.880
S-3	3	1	56.270
Other Areas Total	**463**	**180**	**1,405.309**
South Area Total	**473**	**182**	**1,411.637**
Grand Total	**1,075**	**403**	**1,833.249**

Source: Plumas County GIS, FEMA DFIRM 3/2/2005

Future Flood Conditions: The Effects of Climate Change

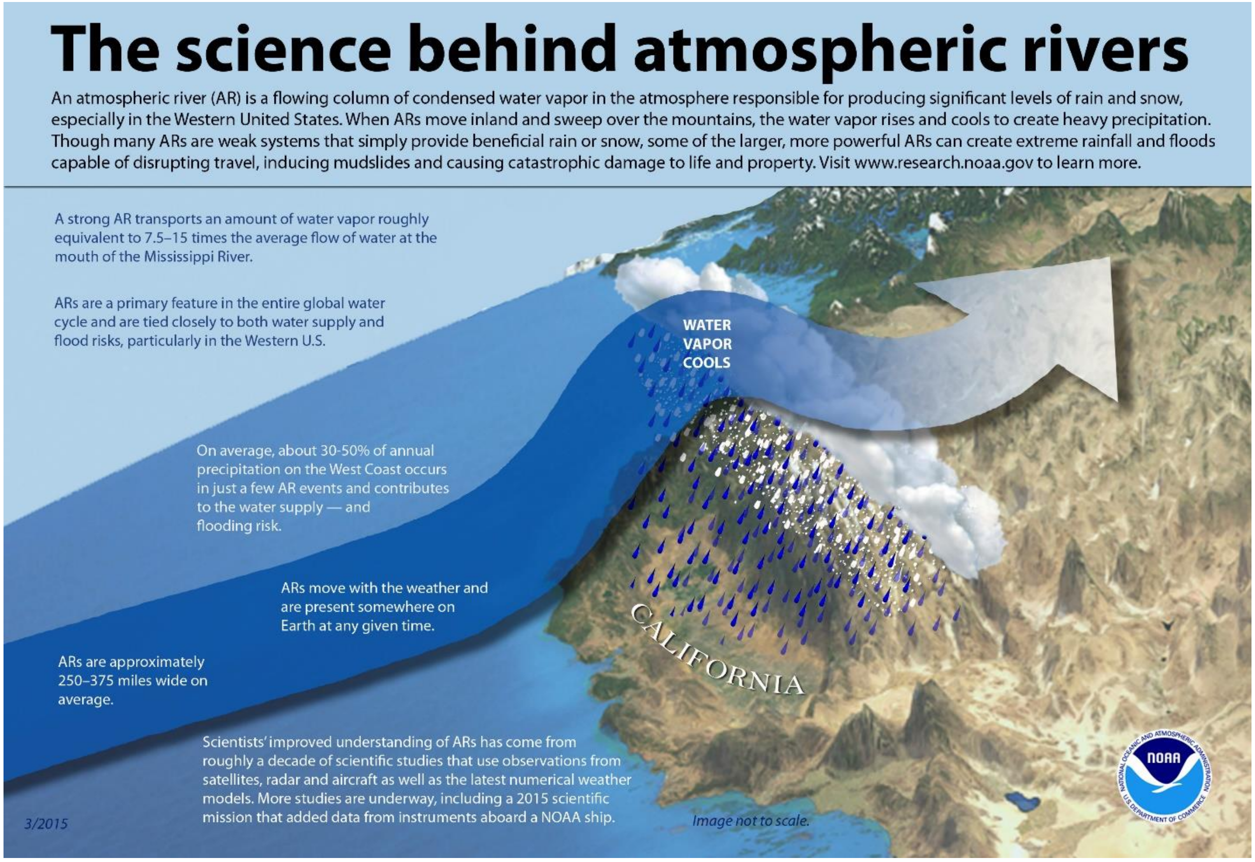
The effects of climate change on future flood conditions should also be considered. While the risk and associated short and long-term impacts of climate change are uncertain, experts in this field tend to agree that among the most significant impacts include those resulting from increased heat and precipitation events that cause increased frequency and magnitude of flooding. Changes associated with climate change and flooding could be significant given the higher elevations in the County where winter snow could turn to more significant rain events. Increases in damaging flood events will cause greater property damage, public health and safety concerns displacement, and loss of life. In addition, an increase in the magnitude and severity of flood events can lead to potential contamination of potable water and contamination of food crops given the agricultural industry in the County. Displacement of residents can include both temporary and long-term displacement, increase in insurance rates or restriction of coverage in vulnerable areas.

Plumas County will continue to study the risk and vulnerability associated with future flood conditions, both in terms of future growth areas and other considerations such as climate change, as they evaluate and implement their flood mitigation and adaptation strategy for the Plumas County Planning Area.

Future Flood Conditions: Atmospheric Rivers

Plumas County and the rest of Northern California can be affected by a phenomenon known as an atmospheric river. According to the NOAA, atmospheric rivers are relatively long, narrow regions in the atmosphere – like rivers in the sky – that transport most of the water vapor outside of the tropics. These columns of vapor move with the weather, carrying an amount of water vapor roughly equivalent to the average flow of water at the mouth of the Mississippi River. When the atmospheric rivers make landfall, they often release this water vapor in the form of rain or snow. This can be seen in Figure 4-112.

Figure 4-112 Atmospheric Rivers



Source: NOAA

Although atmospheric rivers come in many shapes and sizes, those that contain the largest amounts of water vapor and the strongest winds can create extreme rainfall and floods, often by stalling over watersheds vulnerable to flooding. These events can disrupt travel, induce mudslides and cause catastrophic damage to life and property. A well-known example is the "Pineapple Express," a strong atmospheric river that is capable of bringing moisture from the tropics near Hawaii over to the U.S. West Coast.

Not all atmospheric rivers cause damage; most are weak systems that often provide beneficial rain or snow that is crucial to the water supply. Atmospheric rivers are a key feature in the global water cycle and are closely tied to both water supply and flood risks — particularly in the western United States.

While atmospheric rivers are responsible for great quantities of rain that can produce flooding, they also contribute to beneficial increases in snowpack. A series of atmospheric rivers fueled the strong winter storms that battered the U.S. West Coast from western Washington to southern California from Dec. 10–22, 2010, producing 11 to 25 inches of rain in certain areas. These rivers also contributed to the snowpack in the Sierras, which received 75 percent of its annual snow by Dec. 22, the first full day of winter.

Future Flood Conditions: ARkStorm Scenario

Also to be considered in evaluating potential "worst case" future flood conditions, is the ARkStorm Scenario. Although much attention in California's focuses on the "Big One" as a high magnitude earthquake, there is the risk of another significant event in California – a massive, statewide winter storm. The last such storms occurred in the 19th century, outside the memory of current emergency managers, officials, and communities. However, massive storms are a recurring feature of the state, the source of rare but inevitable disasters. The USGS Multi Hazards Demonstration Project's (MHDP) developed a product called ARkStorm, which addressed massive U.S. West Coast storms analogous to those that devastated California in 1861-1862. Over the last decade, scientists have determined that the largest storms in California are the product of phenomena called Atmospheric Rivers, and so the MHDP storm scenario is called the ARkStorm, for Atmospheric River 1000 (a measure of the storm's size).

Scientific studies of offshore deposits in northern and southern California indicate that storms of this magnitude and larger have occurred about as often as large earthquakes on the southern San Andreas Fault. Such storms are projected to become more frequent and intense as a result of climate change. This scientific effort resulted in a plausible flood hazard scenario to be used as a planning and preparation tool by hazard mitigation and emergency response agencies.

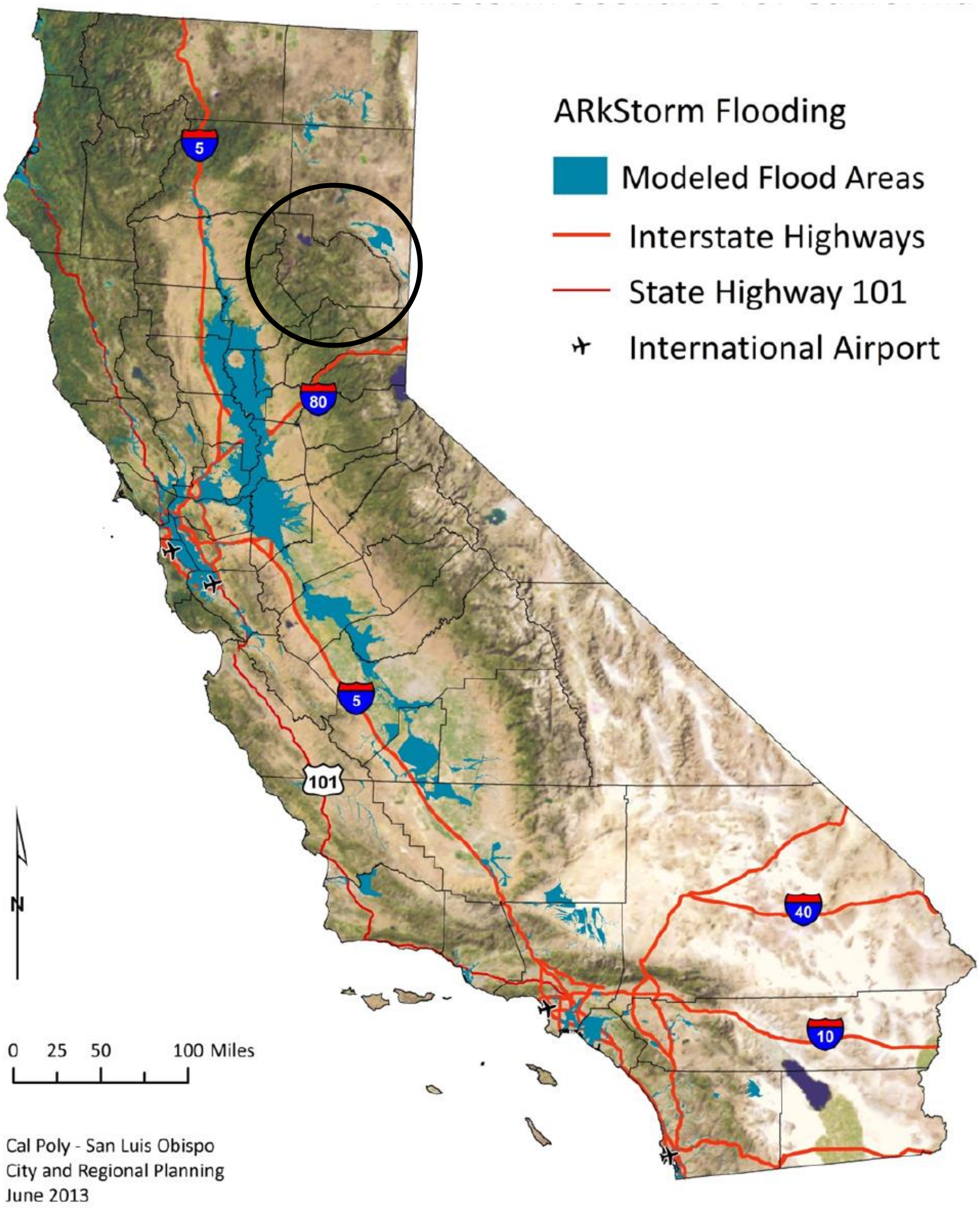
For the ARkStorm Scenario, experts designed a large, scientifically realistic meteorological event followed by an examination of the secondary hazards (e.g., landslides and flooding), physical damages to the intense winter storms of 1861-62 that left California's Central Valley impassible. Storms far larger than the ARkStorm, dubbed megastorms, have also hit California at least six times in the last two millennia.

The ARkStorm produces precipitation in many places exceeding levels experienced on average every 500 to 1,000 years. Extensive flooding in many cases overwhelms the state's flood protection system, which is at best designed to resist 100- to 200-year runoffs (many flood protection systems in the state were designed for smaller runoff events). The Central Valley experiences widespread flooding. Serious flooding also occurs in Orange County, Los Angeles County, San Diego, the San Francisco Bay Area, and other coastal communities. In some places, winds reach hurricane speeds, as high as 125 miles per hour. Hundreds of landslides occur, damaging roads, highways, and homes. Property damage exceeds $300 billion, most of it from flooding. Agricultural losses and other costs to repair lifelines, dewater flooded islands, and repair damage from landslides brings the total direct property loss to nearly $400 billion, of which only $20 to $30 billion would be recoverable through public and commercial insurance. Power, water, sewer, and other lifelines experience damage that takes weeks or months to restore. Flooding evacuation could involve over one million residents in the inland region and Delta counties.

A storm of ARkStorm's magnitude has important implications: 1) it raises serious questions about the ability of existing national, state, and local disaster policy to handle an event of this magnitude; 2) it emphasizes the choice between paying now to mitigate, or paying a lot more later to recover; 3) innovative financing solutions are likely to be needed to avoid fiscal crisis and adequately fund response and recovery costs; 4) responders and government managers at all levels could be encouraged to conduct self-assessments and devise table-top exercises to exercise their ability to address a similar event; 5) the scenario can be a reference point for application of FEMA and Cal OES guidance connecting federal, state, and local natural hazards mapping and mitigation planning under the NFIP and Disaster Mitigation Act of 2000; and 6) common messages to educate the public about the risk of such an extreme event could be developed and consistently communicated to facilitate policy formulation and transformation.

Figure 4-113 depicts an ARkStorm modeled scenario showing the potential for flooding primarily in the Central Valley as the result of a large storm. In Plumas County, the modeled scenario suggests the County does not fall within the impacted area of this ARkStorm model scenario.

Figure 4-113 Projected ARkStorm Flooding in California



Source: USGS ArkStorm

4.3.12. Flood: Localized Flooding

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Flooding occurs in areas other than the FEMA mapped floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the County during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration. Flooding is more severe when previous rainfall has created saturated ground conditions. Urban storm drainpipes and pump stations have a finite capacity. When rainfall exceeds this capacity, or the system is clogged, water accumulates in the street until it reaches a level of overland release. This type of flooding may occur when intense storms occur over areas of development.

Location and Extent

According to Plumas County, numerous parcels and roads throughout the County not included in the FEMA 1% and 0.2% annual chance floodplains are subject to flooding in heavy rains. In addition to flooding, damage to these areas during heavy storms includes pavement deterioration, washouts, mudslides, debris areas, and downed trees. The frequency and type of damage or flooding that occurs varies from year to year, depending on the quantity of runoff. There is no established scientific scale or measurement system for localized flooding. Localized flooding is generally measured by depth of flooding and the area affected. Localized flooding often happens quickly and has a short speed of onset. Localized flooding often has a short duration.

Localized flood areas within Plumas County can be organized by elevation within the Upper Feather River watershed, thus examining the impact of water as it travels downhill on its journey to the Central Valley. The primary areas at risk of loss from flooding are: Sierra Valley, Chester, Indian Valley, American Valley, and the North Fork Feather River Canyon.

Sierra Valley

The Sierra Valley is a large intermountain valley on the eastern edge of Plumas County. It has an area of 120,000 acres and is primarily located in Plumas County, but also extends southward into Sierra County. The valley has an average elevation of 4,850 feet and serves as the headwaters for the Middle Fork Feather River. The Sierra Valley has minimal topographic relief and flooding is generally shallow and low velocity. Figure 4-108 provides a summary of the primary localized flooding problems in the Sierra Valley. See Table 4-73 through Figure 4-117 for photos of localized flooding in the Sierra Valley.

Table 4-73 Sierra Valley Localized Flooding Issues

Area	Issues
Marble Hot Springs Road	Annual flooding in various locations from rain and irrigation 0.7 mile stretch east of the historic bridge experiences repeated flooding Closed in winter due to snow Primary evacuation route
Rocky Point Road (Old Highway 70)	Experiences shoulder and bank erosion and repeated flooding Will flood nearly up to road centerline during major events One or two homes have been damaged
Harriet Lane	Experiences sheet flow across road Often inundates nearby agricultural/ranch facilities, specifically around Island Ranch Road has sub-layer integrity issues and contains clay road base requiring constant repair Major corridor for Hay transportation
Dyson Lane	Experiences sheet flow and shallow flooding Flooded with entire valley in 1992 0.1 mile low spot across the valley drainage area Serves local population and as a bypass
Sloat Road	Flooding in Sloat is limited to little Long Valley Creek flooding SR70 during high flow events and high flows in the Middle Fork Feather River, which has flooded houses near Sloat Bridge crossing.

Source: Plumas County 2014 LHMP, HMPC

Figure 4-114 High Water Mark from 1992 Flood Event on Rocky Point Road

Source: Plumas County 2014 LHMP

Figure 4-115 Sierra Valley Marble Hot Springs Road – Localized Flood Area

Source: Plumas County 2014 LHMP

Figure 4-116 Rocky Point Road – Shoulder Erosion from Localized Flooding

Source: Plumas County 2014 LHMP

Figure 4-117 Harriet Lane – Pavement Deterioration from Localized Flooding

Source: Plumas County 2014 LHMP

Chester/Lake Almanor

Lake Almanor is a higher elevation alpine reservoir located in the northwestern portion of Plumas County. Chester is the largest community of several that surround the lake and is located at the inlet of the North Fork Feather River. The outflow of the North Fork Feather River is controlled by Canyon Dam at the southern edge of the lake. The dam and outflow rates are managed and maintained by PG&E. The Canyon dam spillway elevation is 4,505 FT and PG&E property ownership around the lake resides at the 4,500 FT. Currently, PG&E's FERC license allows lake levels to be operated at 4,494 FT. Flooding issues in this region are minimal due to the construction of the Chester Flood Control Channel, or ACE bypass, a large diversion channel from the North Fork Feather River upstream of Chester/Lake Almanor. The diversion channel allows river water to enter once it reaches a certain height and directs it around Chester into Lake Almanor. The bypass also has a secondary set-back levee system outside of the channel for extreme flooding events. The hydrography in the Lake Almanor area is important to understand as all water that flows through this region travels down into the Feather River Canyon that contains major road and rail transportation routes and a number of communities.

Indian Valley

Indian Valley is located in the north-central portion of Plumas County at an average elevation of 3,500 feet. It contains several developed communities and is also utilized for farming. Indian Valley is the meeting place of four creeks: Wolf Creek, Cooks Creek, Lights Creek, and Indian Creek. Indian Creek is the dominant stream reach as the other three creeks confluence with it, and then exits the valley past Arlington Bridge.

Indian Valley exhibits a number of flooding issues due to its flat topography and hydrography. Much of the water that flows through the Upper Feather River watershed makes its way through Indian Valley on its journey into the Feather River Canyon. Table 4-74 provides a summary of the primary localized flooding issues in Indian Valley: Figure 4-118 through Figure 4-122 provide photos and descriptions of localized Indian Valley flooding issues.

Table 4-74 Summary of Indian Valley Localized Flooding Issues

Area	Issues
Williams Creek @ North Valley Road	Road over culverts that drain water from upstream private land into the valley Road has been overtopped resulting from debris blockage in culverts Road Department uses logging equipment/poles to remove debris during high flows preventing flooding, which is a dangerous activity Major flooding in 1986 and 1997 Roadway serves large populations in Taylorsville and Diamond Valley and is heavily trafficked during winter due to its tendency to receive less snow and ice than alternative routes
Cassidy's Turn	Shows high water mark from 1997 flood
Stampfli Lane	Cross-valley road traveling E-W sits at low point in drainage area Annual flooding of 0.5-1.0 feet of water on roadway often renders road impassible Repeated flooding of residential structures Poor drainage, flooding is caused by saturation of adjacent agricultural fields
Mt. Hough Estates	Low-lying subdivision, portion of which has repeated flooding Houses appear to be slab-on-grade Typically during valley-flooding events Residents aware of impending flooding by the presence of water in neighboring fields
Old Wagon Road, Crescent Mills	Residential structure flooded repeatedly (5-6 times) High water mark 6 feet high in some locations House built at drain point for basin
Arlington Bridge (State# 09C-007)	Bridge overtopped by 3 feet during 1997 flood Flows often approach height of bridge deck Major drainage point for entire valley Sedimentation issues on downstream side Adding culverts may improve drainage
Genesee Road @ Little Grizzly Creek	Flooding can close road cutting off access for 15-20 homes

Source: Plumas County 2014 LHMP

Figure 4-118 Indian Valley Localized Flooding – North Valley Road crossing Williams Creek where Culverts often Clog with Debris

Source: Plumas County 2014 LHMP

Figure 4-119 Indian Valley Localized Flooding – Ponding area of Stampfli Lane has Poor Drainage and Floods Annually

Source: Plumas County 2014 LHMP

Figure 4-120 Indian Valley Localized Flooding – Low-lying area of Mt. Hough Estates Subdivision Subject to Flooding from Indian Valley Creeks.

Source: Plumas County 2014 LHMP

Figure 4-121 Indian Valley Localized Flooding – Residential Structure in Crescent Mills built at Drain Point of Basin Experiences Repeated Flooding

Source: Plumas County 2014 LHMP

Figure 4-122 Indian Valley Localized Flooding – Location along Genesee Road Where Flood Waters Can Cover Road and Cut Off Access

Source: Plumas County 2014 LHMP

American Valley

American Valley is located in the geographic center of Plumas County and sits at an average elevation of 3,500 feet. In American Valley, Greenhorn Creek confluences with Spanish Creek upstream near the Town of Quincy. A majority of the flooding issues are caused by localized drainage as opposed to valley-flooding events. The water in Spanish Creek that passes through American Valley confluences with Indian Creek flowing out of Indian Valley into the Feather River Canyon. Table 4-75 provides a summary of the primary localized flooding issues in American Valley. Figure 4-123 through Figure 4-132 provides photos and descriptions of American Valley localized flooding issues.

Table 4-75 American Valley Localized Flooding Issue Summary

Area	Issues
Les Schwab	Storm grate behind facility becomes clogged with debris causing water to overtop and flow into building Typically only floods with major events, not large storms; recalled events were in 1986, 1993, and 1997 Overtopping waters also flow into a nearby home and businesses further downhill
Lindan Avenue	The drainage ditch that runs behind the Lindan Avenue properties (west side of street) provides drainage for a large area of Quincy including the shopping center and housing developments to the south. The ditch doesn't have enough capacity to contain larger flood events, since it pre-dates all the construction of the shopping center and housing on the southeast side of Quincy.

Area	Issues
Paradise Grill	Water can overtop edges of earthen ditch Water flooding from behind Les Schwab will flow down street and into businesses in strip mall Historic flooding up to 2 feet of water in strip mall businesses
Hentschel	Storm drain on small creek gets clogged with debris and backs up, causing water to flow onto roadway and into the school and neighboring building across the street Grate is not easily accessible
Old Sewer Plant (at bike path)	Drainage path takes 90-degree turn into culverts underneath bike path Water drains poorly and overtops path
West's Ranch Road (at CA-70)	Road needs to be elevated and larger pipes installed
East Quincy Drains	Drainage problems at high water Pipes/drainage too small and becomes clogged with debris
Vieira's Field	Better/safer access and larger pipe
Chandler Road (West)	Beddell Ranch and Green Bridge areas often flood Easy fix is to elevate road and install culverts where needed
Oakland Camp Road	Floods from intersection with Chandler Road to Oakland Camp gate Easy fix is to elevate road and install culverts where needed
Gansner Creek	Storm grate on south side of West Main Street becomes clogged with debris causing water to overtop and flow across road Flood water flows down into hospital flooding the ambulance entrance, ER entrance, and X-ray doors Hospital flooded in 1986, 1993, and 1997
Mill Creek	Runs behind and alongside private property Small drain on private property can clog with debris During heavy rains and large-scale events water will bypass drain and flow down gravel road toward CA-70
Clear Creek	Located in Meadow Valley outside of American Valley Grate clogs with debris causing water to back up Water can back up high enough to swirl around the base of Meadow Valley Road potentially causing erosion and damage to roadway System is stressed several times annually
Oakland Camp at Spanish Creek	Oakland Camp Road floods regularly during high flow events when Spanish Creek flows over the low water crossing adjacent to the Oakland Camp Bridge. The concrete low water crossing is designed for high water to flow over

Source: Plumas County 2014 LHMP

Figure 4-123 American Valley Localized Flooding – Storm Grate behind Les Schwab Becomes Clogged with Debris Causing Flooding

Source: Plumas County 2014 LHMP

Figure 4-124 American Valley Localized Flooding – Strip Mall Containing Paradise Grill and other Businesses. Water can Overtop Earthen Ditch on Right, or Flow Down Street on Left when Storm Drain Floods behind Les Schwab

Source: Plumas County 2014 LHMP

Figure 4-125 American River Localized Flooding – Lindan Avenue in 2012

Source: Member of HMPC (Marty Walters)

Figure 4-126 American Valley Localized Flooding – Hentschel's Storm Grate, Small Grate for Localized Drainage Clogs with Debris and Causing Flooding over Roadway.

Source: Plumas County 2014 LHMP

Figure 4-127 American Valley Localized Flooding – Flood Water from Hentschel's Flows Across Street and into School.

Source: Plumas County 2014 LHMP

Figure 4-128 American Valley Localized Flooding – Water Overtops Drainage at Culverts Where Forced to take 90-degree Right Turn.

Source: Plumas County 2014 LHMP

Figure 4-129 American Valley Localized Flooding – View of Plumas District Hospital from Storm Grate along Gansner Creek. Apparent that Hospital is Down Slope from Culvert and Subject to Flooding from Overtopping Water.

Source: Plumas County 2014 LHMP

Figure 4-130 American Valley Localized Flooding – Plumas District Hospital downhill from West Main Street, Susceptible to Flooding from Waters Overtopping Storm Grate on Gansner Creek

Source: Plumas County 2014 LHMP

Figure 4-131 American Valley Localized Flooding – Small drain for Mill Creek can be Bypassed During Larger Storms Causing Water to Flow Down Adjacent Gravel Road.

Source: Plumas County 2014 LHMP

Figure 4-132 American Valley Localized Flooding – Culvert on Clear Creek in Meadow Valley Becomes Clogged with Debris. Rising and Swirling Water poses Erosion Issue that Could Jeopardize Roadway.

Source: Plumas County 2014 LHMP

Feather River Canyon

The Feather River Canyon is a narrow river valley occupied by the North Fork Feather River and East Branch North Fork Feather River. At its upstream end is the confluence of Indian Creek, flowing from Indian Valley, and Spanish Creek, flowing from American Valley; here is the beginning of the East Branch North Fork Feather River. The East Branch meets the North Fork Feather River, flowing from Lake Almanor, about two miles upstream from Belden.

The Feather River Canyon is occupied by CA-70 and the Union Pacific Railroad, which comprise the two major E-W transportation routes through Plumas County. The canyon is home to a number of small towns adjacent to the river banks, highway, and train tracks.

Flooding issues in the Canyon are primarily related to larger events involving the North Fork Feather River, such as the 1986 and 1997 floods. Typical damage is washouts to roadways or train tracks. Much of the precipitation that falls in Plumas County flows through the Canyon.

Past Occurrences

Disaster Declarations

There are no identified state or federal disaster declarations specifically related to localized flooding, as shown in Table 4-4. However, localized flooding was likely an issue during previous declarations for severe storms, heavy rains and floods.

NCDC Events

The past occurrences of localized flooding are included in the 1% and 0.2% annual chance flood hazard profile in Section 4.3.11.

Hazard Mitigation Planning Committee Events

The HMPC noted the following events:

- Each year there are flood issues thoughout the County due to stormwater. There is significant stormwater runoff that occurs throughout the County, and the County has very little stormwater infrastructure
- During large storms, such as those in 1986 and 1997, the entire Sierra Valley will fill with several feet of water.
- In February of 2017, heavy rains combined with previous heavy snow to cause localized flooding issues throughout the County. The heavy snow blocked the rain from getting into drainage ditches. Creeks also rose above their banks (discussed in Section 4.3.11). The Greenhorn Creek Community was partiulary hard hit. Greenhorn Ranch Road Greenhorn Creek CSD well-house #1 sustained water damage from Estray Creek rising above its banks and flooding the well-house. Greenhorn Ranch Rd. was closed until waters receded and the road could be repaired. Approximately 1 day. Flood damage to Greenhorn Creek CSD properties/buildings was covered by insurance. More information on some of the damages from this flood can be found in the Past Occurrences in Section 4.3.11.

Figure 4-133 2017 Localized Flooding at High Street in Quincy

Source: Plumas County Ag Commissioner

- The HMPC noted that there are yearly bottlenecks in Spanish Creek, for example at Oakland Camp, that create backups into American Valley to varying degrees.

Likelihood of Future Occurrence

Highly Likely—With respect to the localized, stormwater flood issues, the potential for flooding may increase as storm water is channelized due to land development. Such changes can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels.

Climate Change and Localized Flood

Even if average annual rainfall may decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century, increasing the likelihood of overwhelming stormwater systems built to historical rainfall averages. This makes localized flooding more likely.

Members of the HMPC noted that climate change is already affecting the County in low lying areas - American Valley and Indian Valley. Many of these areas are experiencing more rain on snow events, that can cause overloading of stormwater flow ditches.

Vulnerability Assessment

Vulnerability—Medium

Historically, the Plumas County Planning Area has been at risk to flooding primarily during the winter and spring months when stream systems in the County swell with heavy rainfall. Localized flooding also occurs throughout the Planning Area at various times throughout the year with several areas of primary concern unique to each community. Plumas County tracks localized flooding areas as shown above.

Impacts

Localized flooding can cause damage to roads, infrastructure and utilities, as well as to buildings in the County. Temporary road closures due to localized flooding can be a significant issue in the County. In addition to flooding and road closures, damage to these areas during heavy storms includes, pavement deterioration, washouts, landslides/mudslides, debris areas, and downed trees. Impacts to property and life safety from localized flooding would be more limited. Local community service districts have seen infiltration and inflow into sewer systems during heavy rain and localized flooding events.

Future Development

The risk of stormwater/localized flooding to future development can be minimized by accurate recordkeeping of repetitive localized storm activity. Mitigating the root causes of the localized stormwater flooding or choosing not to develop in areas that often are subject to localized flooding will reduce future risks of losses due to stormwater/localized flooding.

4.3.13. Landslides, Mudslides, and Debris Flows

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

According to the California Geological Survey, landslides refer to a wide variety of processes that result in the perceptible downward and outward movement of soil, rock, and vegetation under gravitational influence. Common names for landslide types include slump, rockslide, debris slide, lateral spreading, debris avalanche, earth flow, and soil creep. Landslides may be triggered by both natural and human-induced changes in the environment that result in slope instability.

The susceptibility of an area to landslides depends on many variables including steepness of slope, type of slope material, structure and physical properties of materials, water content, amount of vegetation, and proximity to areas undergoing rapid erosion or changes caused by human activities. These activities include mining, construction, and changes to surface drainage areas. Landslide events can be determined by the composition of materials and the speed of movement. A rockfall is dry and fast while a debris flow is wet and fast. Regardless of the speed of the slide, the materials within the slide, or the amount of water present in the movement, landslides are a serious natural hazard. Another type of landslide, debris flows, also occur in some areas of the County. These debris flows generally occur in the immediate vicinity of existing drainage swales or steep ravines. Debris flows occur when near surface soil in or near steeply sloping drainage swales becomes saturated during unusually heavy precipitation and begins to flow downslope at a rapid rate. Debris flows also occur in post-wildfire burn areas.

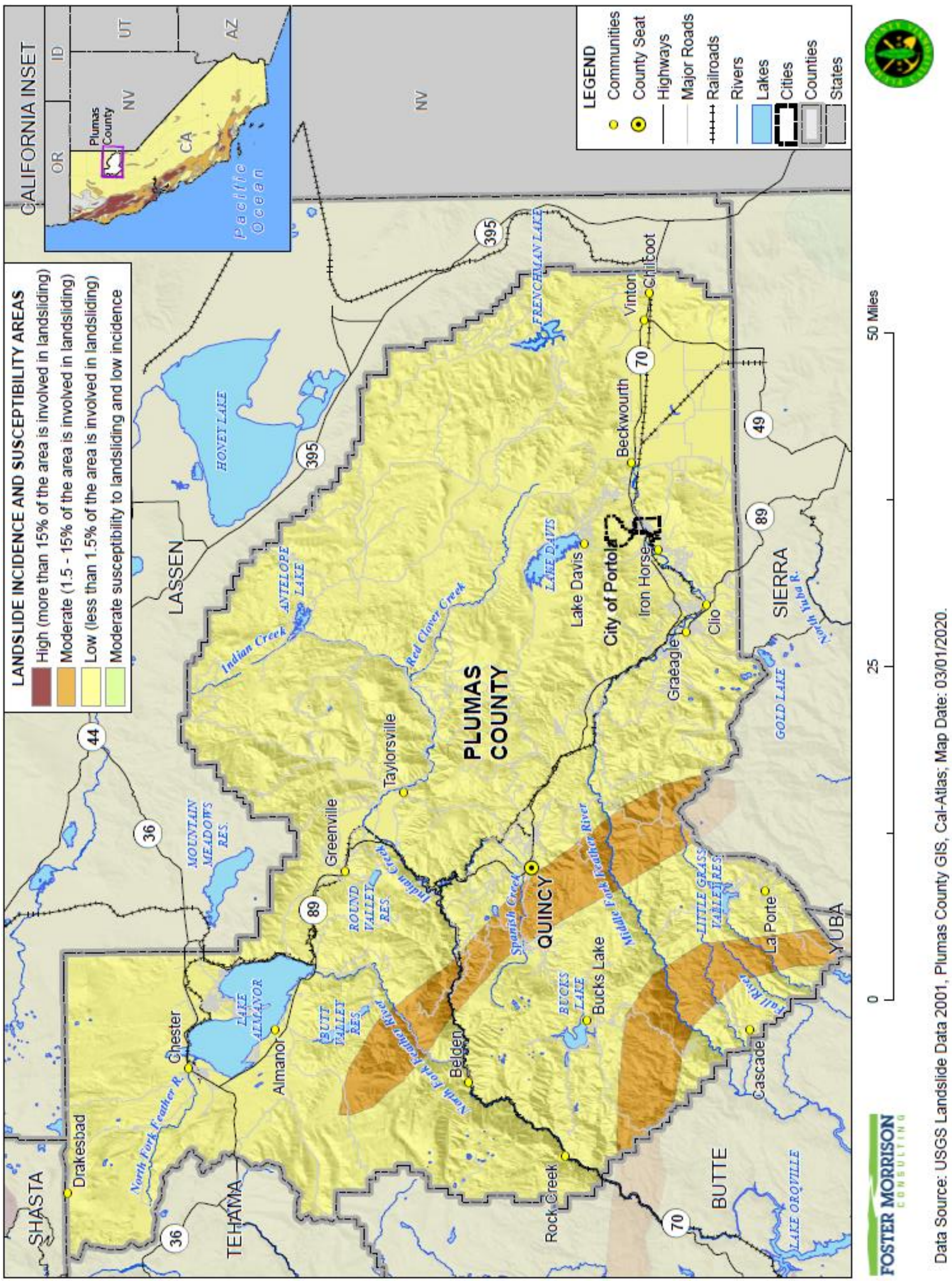
Landslides often accompany or follow other natural hazard events, such as floods, wildfires, or earthquakes. A discussion on the effects of wildfire on landslides is included in the wildfire profile in Section 4.3.18. Landslides can occur slowly or very suddenly and can damage and destroy structures, roads, utilities, and forested areas, and can cause injuries and death.

Soil erosion is another common form of soil instability. Erosion is a function of soil type, slope, rainfall intensity, and groundcover. It accounts for a loss in many dollars of valuable soil, is aesthetically displeasing, and often induces even greater rates of erosion and sedimentation. Sedimentation is simply the accumulation of soil as a result of erosion. Construction activities often contribute greatly to erosion and sedimentation. Besides being a pollutant in its own right, sediment acts as a transport medium for other pollutants, especially nutrients, pesticides, and heavy metals, which adhere to the eroded soil particles. As the sediment drains into watercourses, the combination of these pollutants adversely affects water quality.

Location and Extent

The 2035 Plumas County General Plan Public Health & Safety Element noted that areas with steep slopes in the County could be prone to landslides, mud slides and avalanches. Landslides, or ground failure, are dependent on slope, geology, rainfall, excavation or seismic activity. Mud slides are often caused by heavy rainfall. Areas that have recently been subject to wildfire are susceptible to mud slides. The USGS maps areas of landslide potential. Figure 4-134 shows the USGS Landslide Incidence and Susceptibility Areas in the County.

Figure 4-134 Landslide Incidence and Susceptibility Areas



The legend on Figure 4-134 shows the measurement system that the USGS uses to show the possible magnitude of landslides. It is a combination of slope class and rock strength. The speed of onset of landslide is often short, especially in post-wildfire burn scar areas, but it can also take years for a slope to fail. Landslide duration is usually short, though digging out and repairing landslide areas can take some time. In Plumas County, landslides generally occur where there is very little population or infrastructure. However, there are certain areas throughout the Plumas County Planning Area prone to landslides and where damages have occurred. Though not shown on the USGS map, the 2035 General Plan Public Health and Safety Element noted that the volcanic soils in the eastern portion of the Plumas National Forest are prone to landslides. It was also noted that areas concentrated along the North and Middle Forks of the Feather River are also susceptible to landslides, as well as post-wildfire fire areas.

Plumas County Public Works also noted areas of reoccurring slope failure on County Roads:

- Arlington Road
- Gold Lake Forest Highway
- Quincy-LaPorte Road
- Bucks Lake Road
- Big Creek Road
- North Valley Road
- Mill Creek at SR70

The 2001 Landslide Incidence and Susceptibility data was obtained for the Plumas County Planning Area. According to the landslide layer obtained by the USGS there landslide incidence ranges from low to moderate in the Planning Area. Geographical extents of the USGS landslide incidence and susceptibility areas in the Plumas County Planning Area are shown on Table 4-76.

Table 4-76 Plumas County Planning Area – Geographical Extents of Landslide Incidence and Susceptibility Areas

Landslide Incidence and Susceptibility	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
High	0	0.0%	0	0.0%	0	0.0%
Moderate	147,993	8.49%	1,258	1.70%	146,734	8.79%
Low	1,595,207	91.51%	72,792	98.30%	1,522,415	91.21%
Total	**1,743,200**	**100.00%**	**74,050**	**100.00%**	**1,669,150**	**100.00%**

Source: USGS

Past Occurrences

Disaster Declaration History

There have been no disaster declarations associated with landslides in Plumas County, as shown in Table 4-4.

NCDC Events

The NCDC contains no records for landslides in Plumas County.

Hazard Mitigation Planning Committee Events

The HMPC reported the following events of landslide in the County:

- **2006 –** A rockslide occurred on State Route 70 1.5 miles west of Pulga. No injuries or deaths occurred. Damages were unknown from this event.
- **2009** – A rockslide occurred on State Route 70 near Rich bar. Some injuries were reported, but details could not be recalled. Damages were unknown from this event.
- **2010** – A landslide occurred on the USFS Road (Scales Road). No injuries or deaths occurred. Damages were unknown from this event.
- **2010** – A rockslide occurred on State Route 70 between Greenville Way and Elephant Butte Tunnel. No injuries or deaths occurred. Damages were unknown from this event.
- **2013 –** A rockslide occurred. There was damage to County Road 411 5 miles west of State Route 70 at Quincy in the Bucks Lake area. No injuries or deaths occurred. Damages were unknown from this event.
- **2013** – Major slope failure has occurred on Johnsville Road / County Highway A14 approximately 4.6 miles west of the intersection of the intersection of SR89 at Blairsdale / Graeagle. The slope failure condition has been prevalent for more than 5 years, and is a result of weak soils, slop and water related erosion. This particular roadway is the only paved road that connects Graeagle to Johnsville. The only other transportation route connecting Johnsville is a dirt road which is essentially impassable in the winter. As a safety precaution, the roadway shoulder has been narrowed several times in order to avoid the on-site erosion issues. Slope saturation by water is a primary cause of landslide issue at this location.

Figure 4-135 Slope Failure near Johnsonville on County Highway A14

Source: Plumas County

- **2017** – A flood occurred in a canyon above Greenville in February. This caused multiple mudslide that blocked Highway 89. This road is an ingress and egress route for Indian Valley.

Likelihood of Future Occurrence

Likely—Based on data provided by the HMPC, landslides are naturally occurring events that will inevitably happen as long as gravity itself is a controlling factor upon the landscape. Since Plumas County's mountainous terrain in much of the County challenges gravity as it rapidly rises to upper elevations, much of the high-relief topography in the County can be identified as land with the potential for landslides. Much of that land though is in remote and undeveloped locales, which reduces the risk of this natural hazard. Given the nature of localized problems identified within the County, landslides will likely continue to impact the area when heavy precipitation occurs, as they have in the past.

Climate Change and Landslide and Debris Flows

According to the CAS, climate change may result in precipitation extremes (i.e., wetter wet periods and drier dry periods). More information on precipitation increases can be found in Section 4.3.3. While total average annual rainfall may decrease only slightly, rainfall is predicted to occur in fewer, more intense precipitation events. The combination of a generally drier climate in the future, which will increase the chance of drought and wildfires, and the occasional extreme downpour is likely to cause more mudslides, landslides, and debris flows.

Vulnerability Assessment

Vulnerability—Medium

Landslides in Plumas County include a wide variety of processes resulting in downward and outward movement of soil, rock, and vegetation. Although landslides are primarily associated with slopes greater than 15 percent, they can also occur in relatively flat areas and as cut-and-fill failures, river bluff failures, lateral spreading landslides, collapse of wine-waste piles, failures associated with quarries, and open-pit mines.

Although this hazard also includes related issues such as mudslides and debris flows, available mapped hazard data was limited to landslides; thus, the remainder of this section is focused on the landslide vulnerability.

Impacts

Impacts from landslides in the County can vary greatly. In unpopulated areas, landslides have little effect. However, if landslides occur in populated areas, damages can be sustained by buildings, critical facilities, infrastructure, and injuries, and in extreme cases deaths, can occur. Landslide can affect ingress and egress routes. Many locations in the County have limited ingress and egress routes. Cutting off one of these routes can cause multiple issues, from issues with elderly and those who are sick, to limiting emergency response to hazards from police, fire, and other County entities.

Values at Risk

Landslides can affect the built environment of Plumas County. GIS was used to analyze these possible effects. A methodology and the results of the analysis follow.

Methodology

The landslide incidence and susceptibility data are a digital version of U.S. Geological Survey Professional Paper 1183, Landslide Overview Map of the Conterminous United States dated 2001. The map and digital data delineate areas in the conterminous United States where large numbers of landslides have occurred and areas which are susceptible to landsliding.

The 2001 Landslide Incidence and Susceptibility data was obtained for the Plumas County Planning Area. According to the landslide layer obtained by the USGS there landslide incidence ranges from low to moderate in the County. Most of the County falls in the low, with small amounts in the falling in the moderate areas. The County's parcel layer was used as the basis for the inventory of all parcels within Plumas County. GIS was used to overlay the landslide hazard layer onto the parcel layer centroids, and where the landslide zones intersected a parcel centroid, it was assigned with that hazard zone for the entire parcel.

Values at Risk Results

The USGS landslide layer was overlaid with the Plumas County parcel layer in GIS to obtain results. Table 4-77 summarizes and Table 4-78 details and illustrates the potential estimated damages to Plumas County Planning Area from properties in the USGS Landslide Incidence and Susceptibility Area, including FEMA contents replacement values. Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the landslide incidence and susceptibility areas due primarily to Proposition 13 and to a lesser extent properties falling under the Williamson Act.

Table 4-77 Plumas County – County and Value of Parcels in Landslide Susceptibility Areas

Landslide Susceptibility and Incidence Area	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
High	0	0	$0	$0	$0	$0	$0
Moderate	287	108	$10,766,678	$12,339,625		$6,294,506	$29,400,809
Low	24,119	13,628	$1,275,376,116	$2,420,752,153	$18,634,395	$1,388,266,596	$5,103,029,260
Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**

Source: USGS, Plumas County February 2020 Parcel/Assessor's Data

Table 4-78 Plumas County – Count and Value of Parcels in Landslide Susceptibility and Incidence Areas by Property Use

Landslide Susceptibility and Incidence Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Moderate							
Agricultural	113	3	$3,336,325	$165,284	$0	$165,284	$3,666,893
Commercial	1	1	$60,712	$71,751	$0	$71,751	$204,214
Federal Lands	15	0	$0	$0	$0	$0	$0
Government	4	0	$39,680	$0	$0	$0	$39,680
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	3	0	$0	$0	$0	$0	$0
Recreational	1	1	$72,439	$12,351	$0	$12,351	$97,141
Residential	144	103	$7,257,522	$12,090,239	$0	$6,045,120	$25,392,881
ROW/Utilities	6	0	$0	$0	$0	$0	$0
Moderate Total	**287**	**108**	**$10,766,678**	**$12,339,625**	$0	**$6,294,506**	**$29,400,809**
Low							
Agricultural	1,872	275	$102,604,303	$23,701,624	$2,293,939	$23,701,624	$152,301,490

Landslide Susceptibility and Incidence Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Commercial	866	608	$68,604,736	$198,819,202	$9,768,708	$198,819,202	$476,011,848
Federal Lands	199	0	$0	$0	$0	$0	$0
Government	586	0	$104,062	$0	$0	$0	$104,062
Industrial	147	84	$9,699,636	$45,102,146	$314,544	$67,653,219	$122,769,545
Institutional	87	45	$1,884,400	$12,698,132	$79,905	$12,698,132	$27,360,569
Miscellaneous	126	0	$8,119	$0	$0	$0	$8,119
Recreational	521	96	$14,043,469	$30,357,788	$1,429,945	$30,357,788	$76,188,990
Residential	18,661	12,520	$1,078,427,391	$2,110,073,261	$4,747,354	$1,055,036,631	$4,248,284,637
ROW/Utilities	1,054	0	$0	$0	$0	$0	$0
Low Total	**24,119**	**13,628**	**$1,275,376,116**	**$2,420,752,153**	**$18,634,395**	**$1,388,266,596**	**$5,103,029,260**
Plumas County Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**
Grand Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**

Source: USGS, Plumas County February 2020 Parcel/Assessor's Data

It should be noted that maps and analysis represent analyses based on best available data. There have been past occurrences of landslides in areas not shown to be at risk to landslide. Generally, landslide risk maps detail areas prone to slope failure; the maps rarely include the runout areas where the failed slope will go. By way of example, a landslide on March 22, 2014, killed 43 people when it wiped out a rural neighborhood in Oso, northeast of Seattle. While the failed slope area was mapped as prone to landslides, the runout area was not. It was the runout area that resulted in devastating loss. Thus, mapping of landslide susceptible areas should be considered as one part of the equation. Damages to the area that could be inundated by such slope failure should also be considered by communities.

Populations at Risk

Those residential parcel centroids that intersect the landslide risk areas were counted and multiplied by the 2010 Census Bureau average household factors for Plumas County. This is shown in Table 4-79. According to this analysis, there is a total population of 239 residents in the Plumas County Planning Area are risk to moderate incidence or greater landslide.

Table 4-79 Plumas County –Residential Parcels and Population by Landslide Incidence and Susceptibility Areas

Landslide Incidence and Susceptibility Area	Improved Residential Parcels	Population at Risk
High	0	0
Moderate	103	239

Landslide Incidence and Susceptibility Area	Improved Residential Parcels	Population at Risk
Total	**103**	**239**

Source: USGS, US Census Bureau Average Household Sizes: and unincorporated Plumas County (2.32)

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Plumas County to determine critical facilities in the landslide potential areas. Using GIS, USGS Landslide Incidence and Susceptibility Areas were overlayed on the critical facility GIS layer. Figure 4-136 shows critical facilities, as well as the landslide potential areas. Table 4-80 summarized critical facilities in landslide potential areas. Table 4-81 details critical facilities by facility type and count in the moderate or higher landslide potential areas for the County. Details of critical facility definition, type, name and address by flood zone are listed in Appendix F.

Figure 4-136 Plumas County – Critical Facilities in Landslide Incidence and Debris Flow Areas

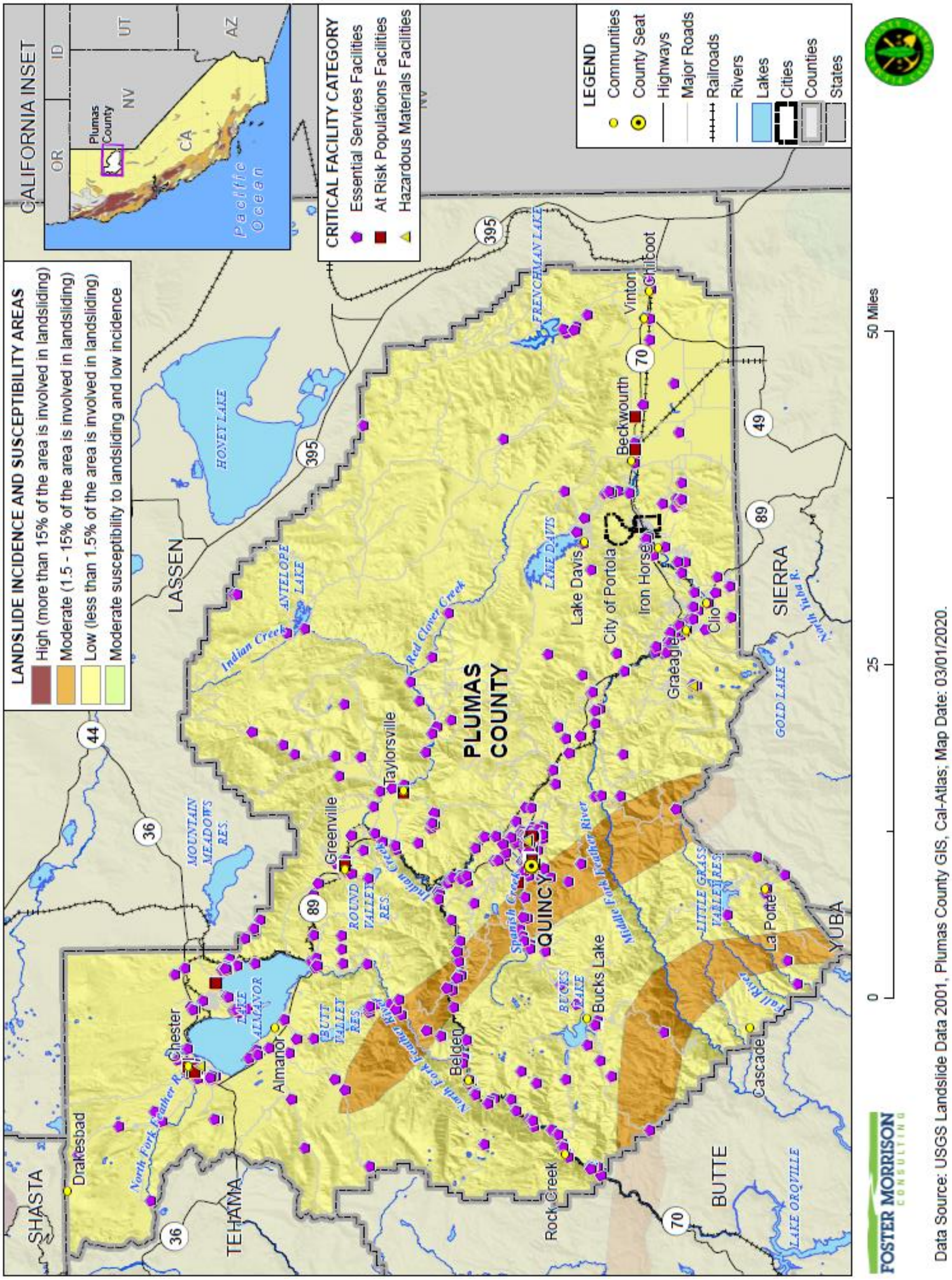


Table 4-80 Plumas County – Summary of Critical Facilities in Landslide Incidence and Susceptibility Areas

Landslide Susceptibility and Incidence Area	Critical Facility Category	Facility Count
Low	Essential Services Facilities	718
	At Risk Populations Facilities	38
	Hazardous Materials Facilities	4
	Total	**760**
Moderate	Essential Services Facilities	55
	Total	**55**
Grand Total		**815**

Source: Plumas County GIS, USGS

Table 4-81 Plumas County – Critical Facilities in Moderate or Higher Landslide Incidence and Susceptibility Areas by Facility Type

Landslide Susceptibility and Incidence Area	Critical Facility Category	Facility Count
Moderate	**Essential Services Facilities**	
	Communication Sites and Facilities	
	Antenna Structure Registration	2
	Cellular	1
	Fixed Microwave	20
	Land Mobile Private	15
	Repeater	1
	Communication Sites and Facilities Total	***39***
	Public Utility Plant and Substation Facilities	
	Community Services District	1
	Electric Sub-Station	5
	Power Plant	2
	Public Utility Plant and Substation Facilities Total	***8***
	Transportation Lifeline Systems	
	Bridge - State Hwy	1
	Bridge (Local) - Category A	2
	Bridge (Local) - Category B	2
	Bridge (Local) - Category C	3
	Transportation Lifeline Systems Total	***8***
	Essential Services Facilities Total	**55**
Moderate Total		**55**

Source: Plumas County GIS, USGS

Overall Community Impact

Landslides, debris flows, and mud flow impacts vary by location and severity of any given event and will likely only affect certain areas of the Planning Area during specific times. Based on the risk assessment, it is evident that landslides will continue to have potentially large economic impacts to certain areas of the County. However, many of the landslides in the Planning Area are minor, localized events that are more of a nuisance than a disaster. Impacts that are not quantified, but can be anticipated in large future events, include:

- Injury and loss of life;
- Commercial and residential structural and property damage;
- Disruption of and damage to public infrastructure, utilities, and services;
- Damage to roads/bridges resulting in loss of mobility;
- Significant economic impact (jobs, sales, tax revenue) to the community; and
- Negative impact on commercial and residential property values

Future Development

Although new growth and development corridors could fall in the area affected by moderate risk of landslide, given the small chance of a major landslide and the building codes and erosion ordinance in effect, development in the landslide areas will continue to occur.

GIS Analysis

Plumas County's February 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. The Plumas County Planning Department provided a table containing the assessor parcel numbers (APNs) for the 1,075 parcels representing the different future development projects or areas. Using the GIS parcel spatial file and the APNs, the future development projects were mapped.

For the landslide analysis of future development areas, the parcel data was converted to a point layer using a centroid conversion process, in which each parcel was identified by a central point and linked to the Assessor's data. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts and acreage within each landslide incidence and susceptibility area. The County was separated into three areas. Figure 4-137 shows the landslide incidence and susceptibility area and future development areas in the central portion of the County. Figure 4-138 shows the landslide incidence and susceptibility area and future development areas in the central portion of the County. Figure 4-139 shows the landslide incidence and susceptibility area and future development areas in the south portion of the County. Parcels and acreages in the landslide incidence and susceptibility areas are summarized in Table 4-71.

Figure 4-137 Plumas County North – Future Development Areas in Landslide Incidence and Susceptibility Areas

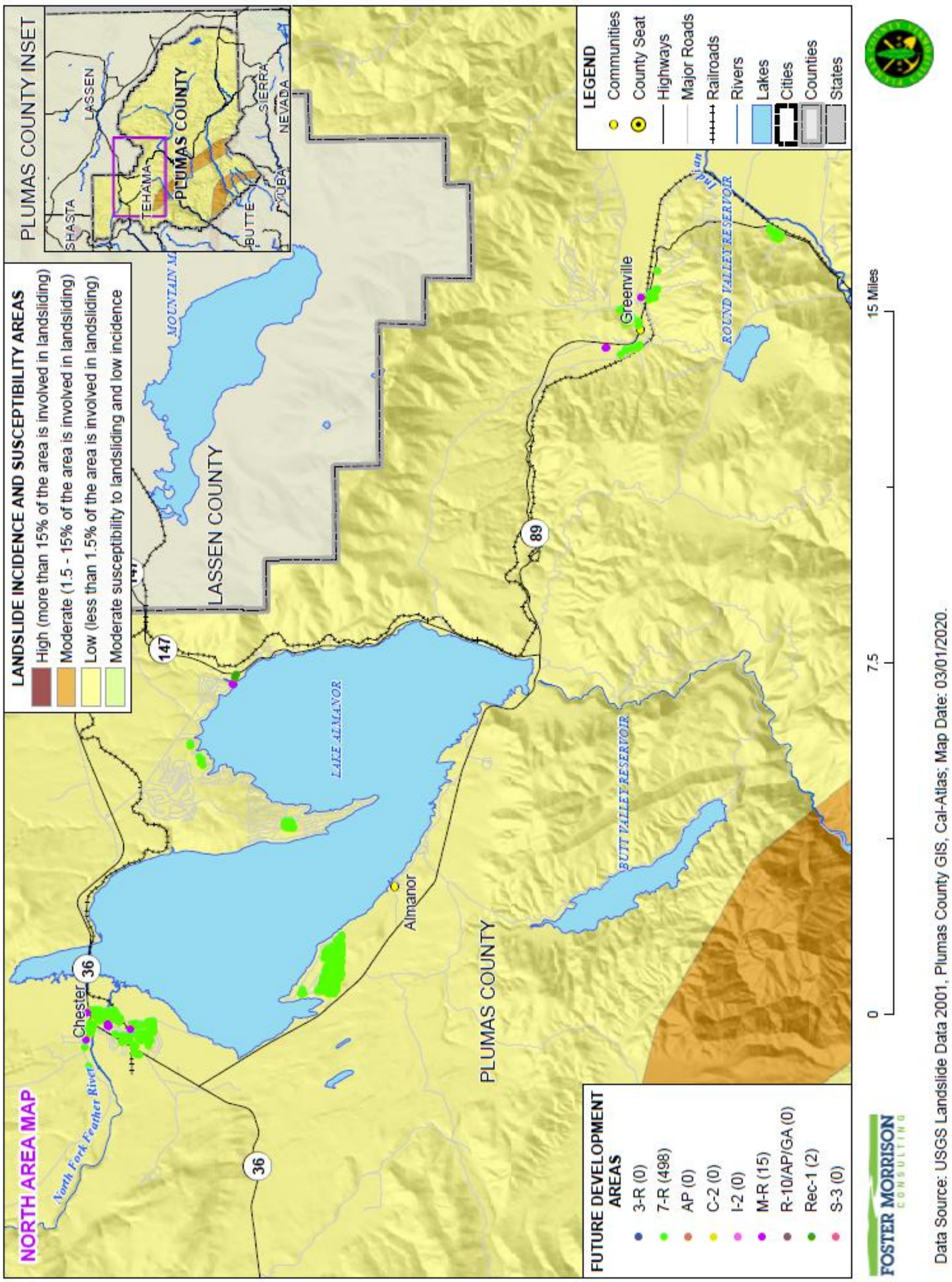


Figure 4-138 Plumas County Central – Future Development Areas in Landslide Incidence and Susceptibility Areas

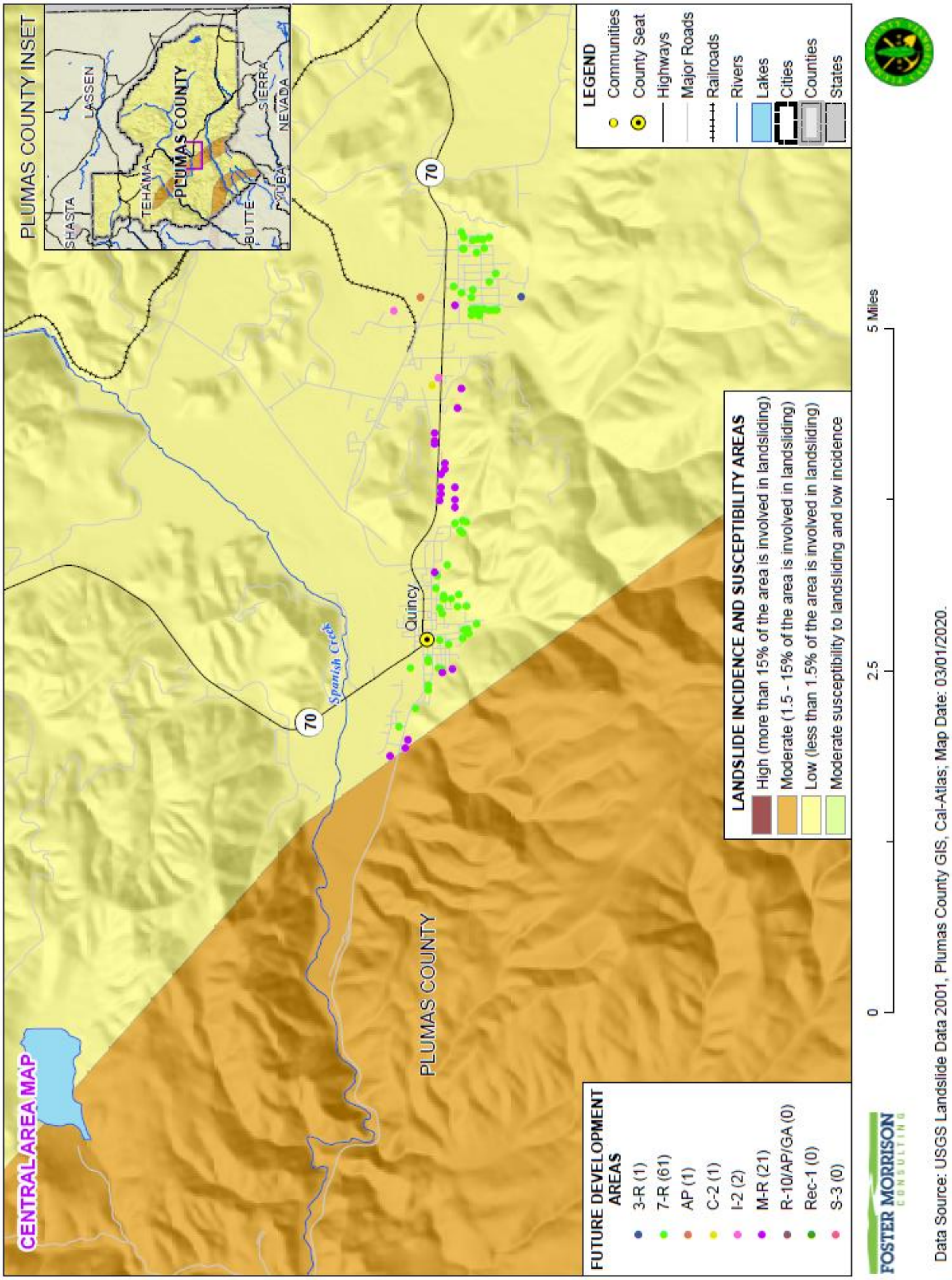


Figure 4-139 Plumas County South – Future Development Areas in Landslide Incidence and Susceptibility Areas

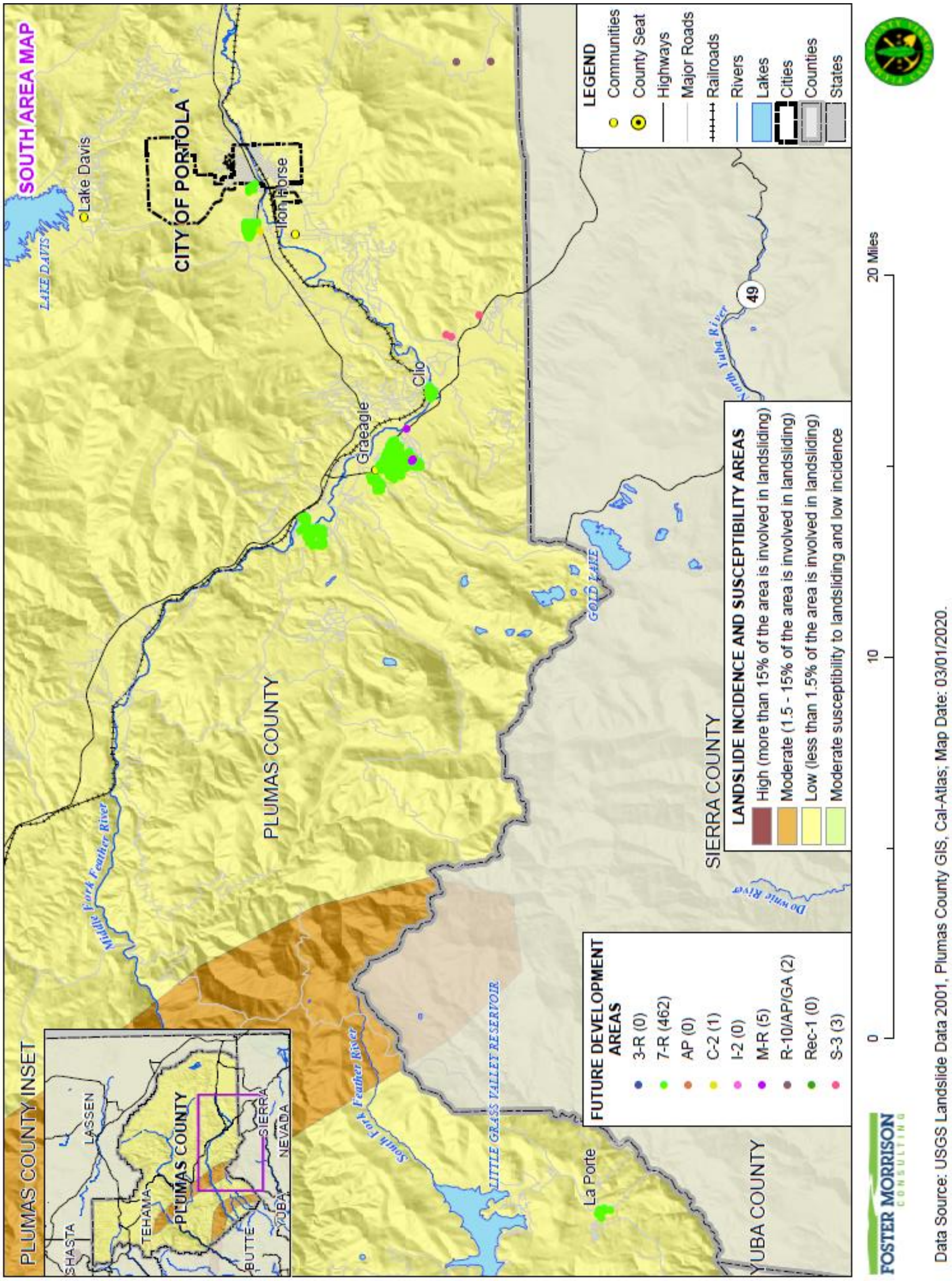


Table 4-82 Plumas County – Future Development Parcel and Acre Counts in Summary Landslide Susceptibility and Incidence Areas

Landslide Potential/Future Development	Total Parcel Count	Improved Parcel Count	Total Acres
Low			
3-R	1	0	9.010
7-R	1021	391	504.007
AP	1	0	4.010
C-2	2	0	6.730
I-2	2	1	15.930
M-R	41	8	114.572
R-10/AP/GA	2	1	1,108.880
Rec-1	2	1	13.840
S-3	3	1	56.270
Grand Total	**1,075**	**403**	**1,833.249**

Source: Plumas County GIS, USGS

4.3.14. Levee Failure

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

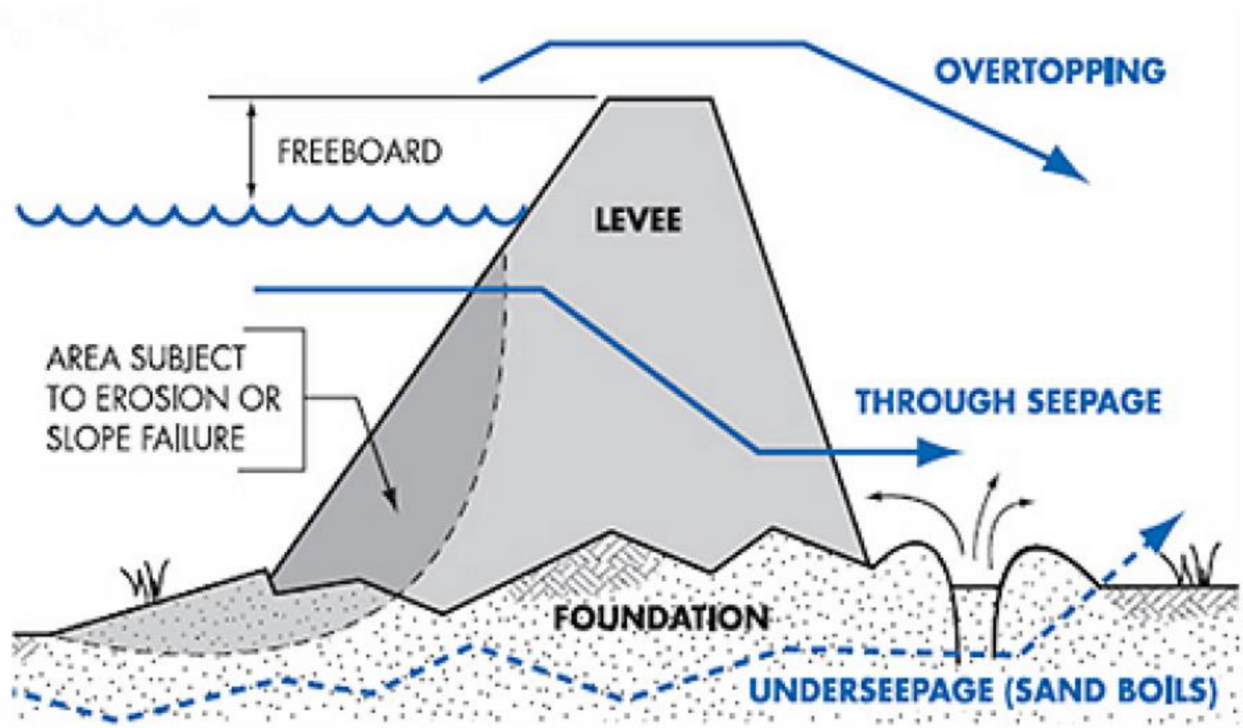
Hazard/Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made. A natural levee is formed when sediment settles on the stream bank, raising the level of the land around the stream.

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

Under-seepage refers to water flowing under the levee through the levee foundation materials, often emanating from the bottom of the landside slope and ground surface and extending landward from the landside toe of the levee. Through-seepage refers to water flowing through the levee prism directly, often emanating from the landside slope of the levee. Both conditions can lead to failure by several mechanisms, including excessive water pressures causing foundation heave and slope instabilities, slow progressing internal erosion, and piping leading to levee slumping. Rodents can burrow into and compromise the levee system. Erosion can also lead to levee failure. Figure 4-140 depicts the causes of levee failure.

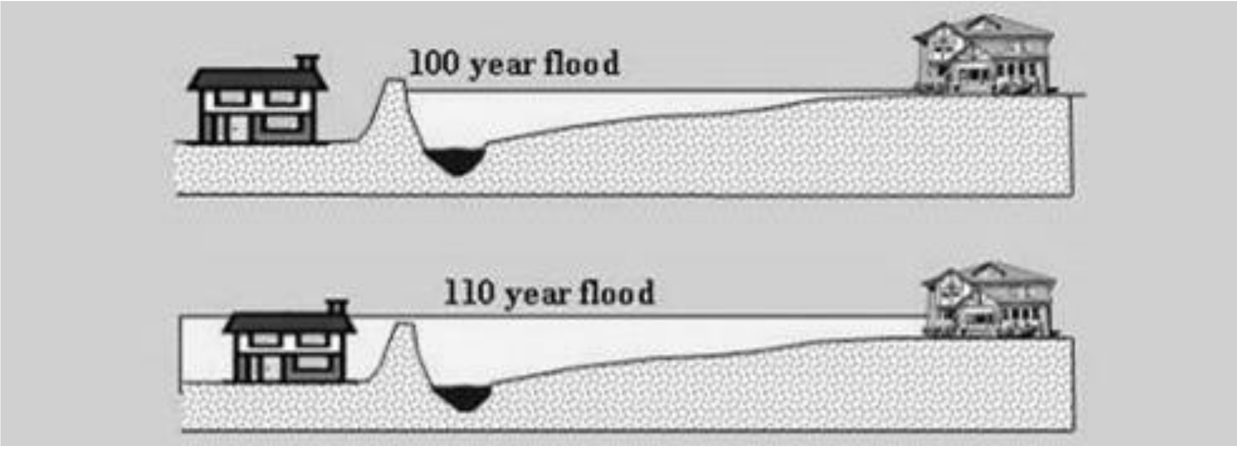
Figure 4-140 Potential Causes of Levee Failure



Source: USACE

Overtopping failure occurs when the flood water level rises above the crest of a levee. As shown in Figure 4-141, overtopping of levees can cause greater damage than a traditional flood due to the often lower topography behind the levee.

Figure 4-141 Flooding from Levee Overtopping



Source: Levees in History: The Levee Challenge. Dr. Gerald E. Galloway, Jr., P.E., Ph.D., Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.

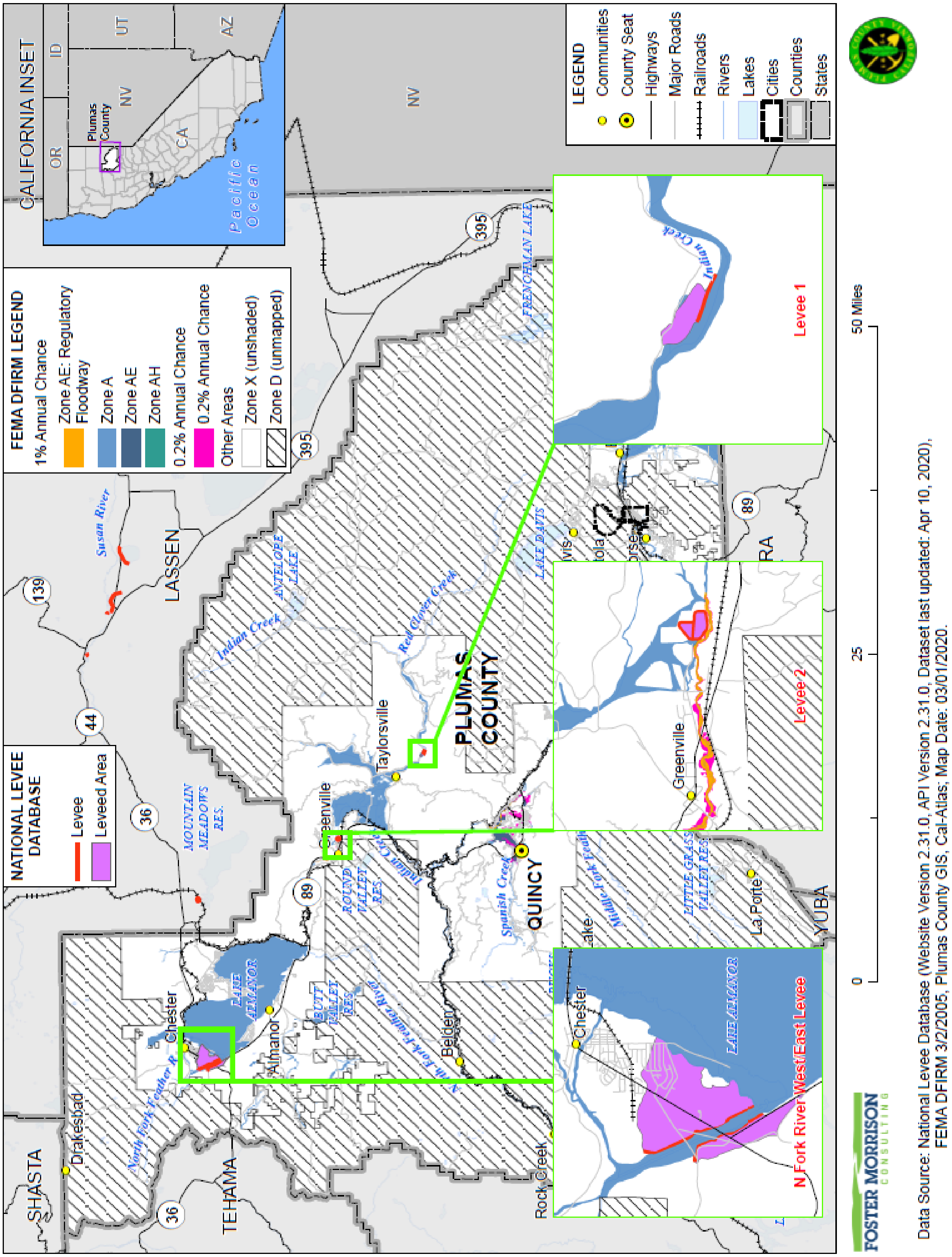
Location and Extent

A search of the National Levee Database identified 3 leveed areas in Plumas County. None of these 3 levees are certified as providing protection from the 1% annual chance or other flood. These levees include:

- Plumas County Levee 1 (near Taylorsville)
- Plumas County Levee 2 (near Greenville)
- North Fork Feather River at Chester (near Chester) – East and West levees

A map of the County is shown on Figure 4-142.

Figure 4-142 Plumas County – Levees and Locations



There is not a scientific scale or measurement system in place for levee failure. It us usually measured in area covered and depth of flooding. Maps showing inundation depths due to a levee failure in the County do not exist. The speed of onset is slow as the river rises, but if a levee fails the warning times are short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back.

Past Occurrences

Disaster Declaration History

There have been no disasters declarations related to levee failure in Plumas County, as shown on Table 4-5.

NCDC Events

There have been no NCDC levee failure events in Plumas County.

Hazard Mitigation Planning Committee Events

The HMPC noted the following levee events:

- During the Easter storm of **1952**, there was a avalanche that blocked a creek, causing it to back up and overtop Levee #2. Specific damages could not be recalled.
- In both **1986** and **1997** Levee #1 were overtopped and eroded. Both times it was fixed under a Natural Resource Conservation Service flood repair program. The levee protects ranch land, and some structures that are located below the river bed level in elevation. These structures are at risk from levee failure.

Likelihood of Future Occurrence

Unlikely – It is unlikely that levees in the County will fail. It is important to remember that no levee provides protection from events for which it was not designed: they are not fail-safe.

Climate Change and Levee Failure

In general, increased flood frequency in California is a predicted consequence of climate change. Mechanisms whereby climate change leads to an elevated flood risk include more extreme precipitation events and shifts in the seasonal timing of river flows. This threat may be particularly significant because recent estimates indicate the additional force exerted upon the levees is equivalent to the square of the water level rise. These extremes are most likely to occur during storm events, leading to more severe damage from waves and floods. Though this is tempered by the fact that there are so few levees in the County that would be affected. So, while climate change can increase flood frequency, in Plumas, it is unlikely to increase the potential for levee failure.

Vulnerability Assessment

Vulnerability—Medium

Levee failure flooding can occur as the result of partial or complete collapse of an impoundment, and often results from prolonged rainfall and flooding. The primary danger associated with dam or levee failure is the high velocity flooding of those properties downstream of the breach. Impacts from this include property damage, critical facility damage, and life safety issues. A levee failure can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to levee failures is generally confined to the areas subject to inundation downstream of the facility. Secondary losses would include loss of the multi-use functions of the facility and associated revenues that accompany those functions.

Vulnerability Analysis

The DFIRM shows no X Protected by Levee areas for the County. As such, no GIS analysis was performed on Plumas County Parcel and Assessor's Data. However, the National Levee Database has performed a basic analysis for each levee in the County. Information by levee follows. It is important to note, that although the National Levee Database identifies areas that the levee is protecting; these levee protected areas are not areas certified as providing protection against the 1% annual chance or other flood. It only represents those areas that the levee was designed to protect, but as they are not certified, they do not remove anyone within the protected area from the floodplain as represented in FEMA DFIRMs.

Plumas County Levee 1

Plumas County Levee 1 is located near Taylorsville. This levee is not accredited by FEMA as providing 1% annual chance flood protection. The levee is 0.37 miles long. Protected areas were not quantified by the National Levee Database. Ownership and maintenance agencies of this levee were not included in the National Levee Database. The HMPC noted that landowners maintain the levee. Protected areas can be seen on Figure 4-143.

Figure 4-143 Plumas County Levee 1 Protected Areas

Source: National Levee Database

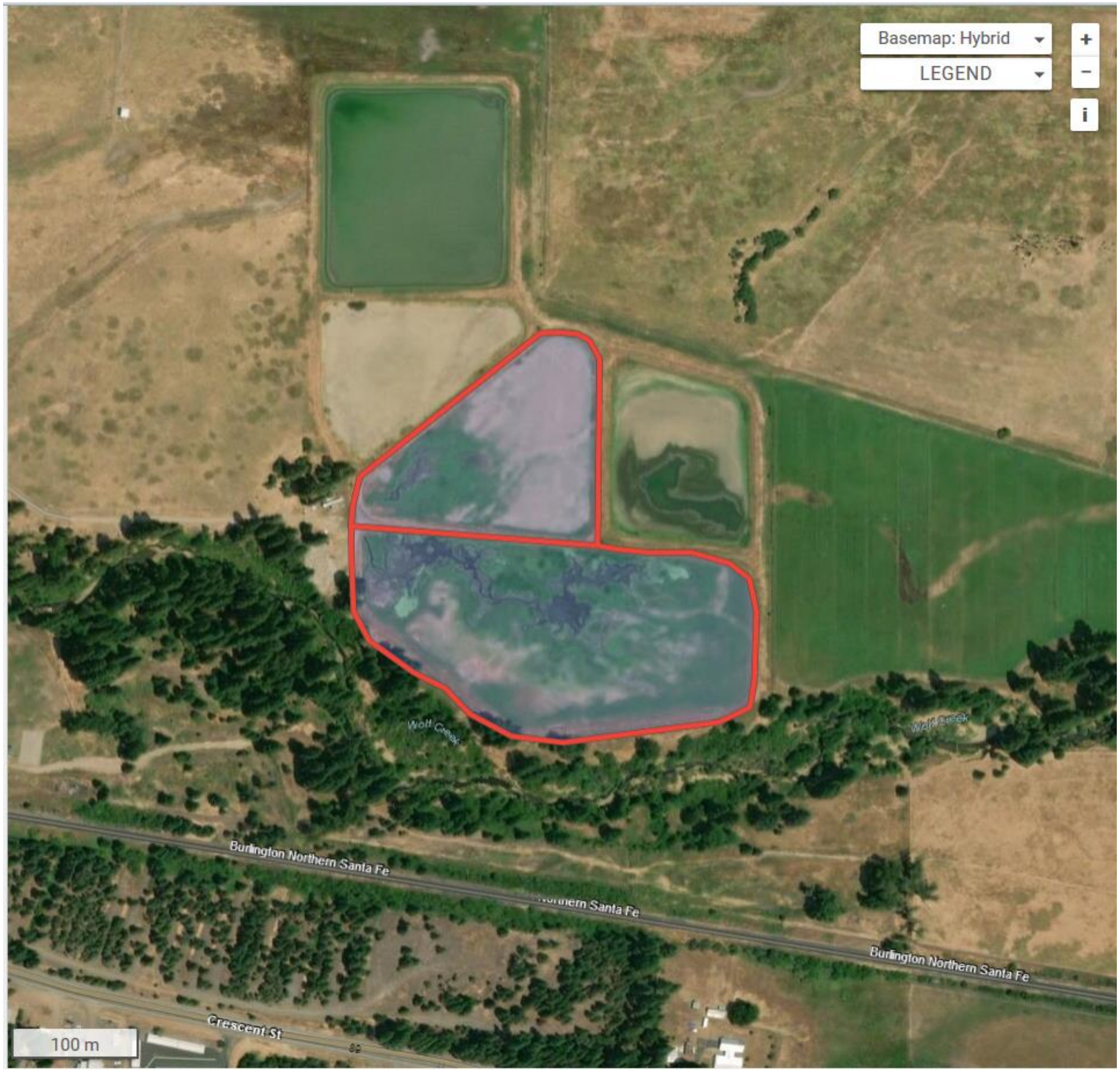
An assessment was performed on January 1, 2017 of this levee. That risk analysis showed the following:

- People at Risk 7
- Structures at Risk 3
- Property Value $1,230,000

Plumas County Levee 2

Plumas County Levee 2 is located near Greenville. This levee is not accredited by FEMA as providing 1% annual chance flood protection. The levee is 0.79 miles long. Protected areas were not quantified by the National Levee Database. Ownership and maintenance agencies of this levee were not included in the National Levee Database. The HMPC noted that landowners maintain the levee. Protected areas can be seen on Figure 4-144.

Figure 4-144 Plumas County Levee 2 Protected Areas



Source: National Levee Database

An assessment was performed on January 1, 2017 of this levee. That risk analysis showed the following:

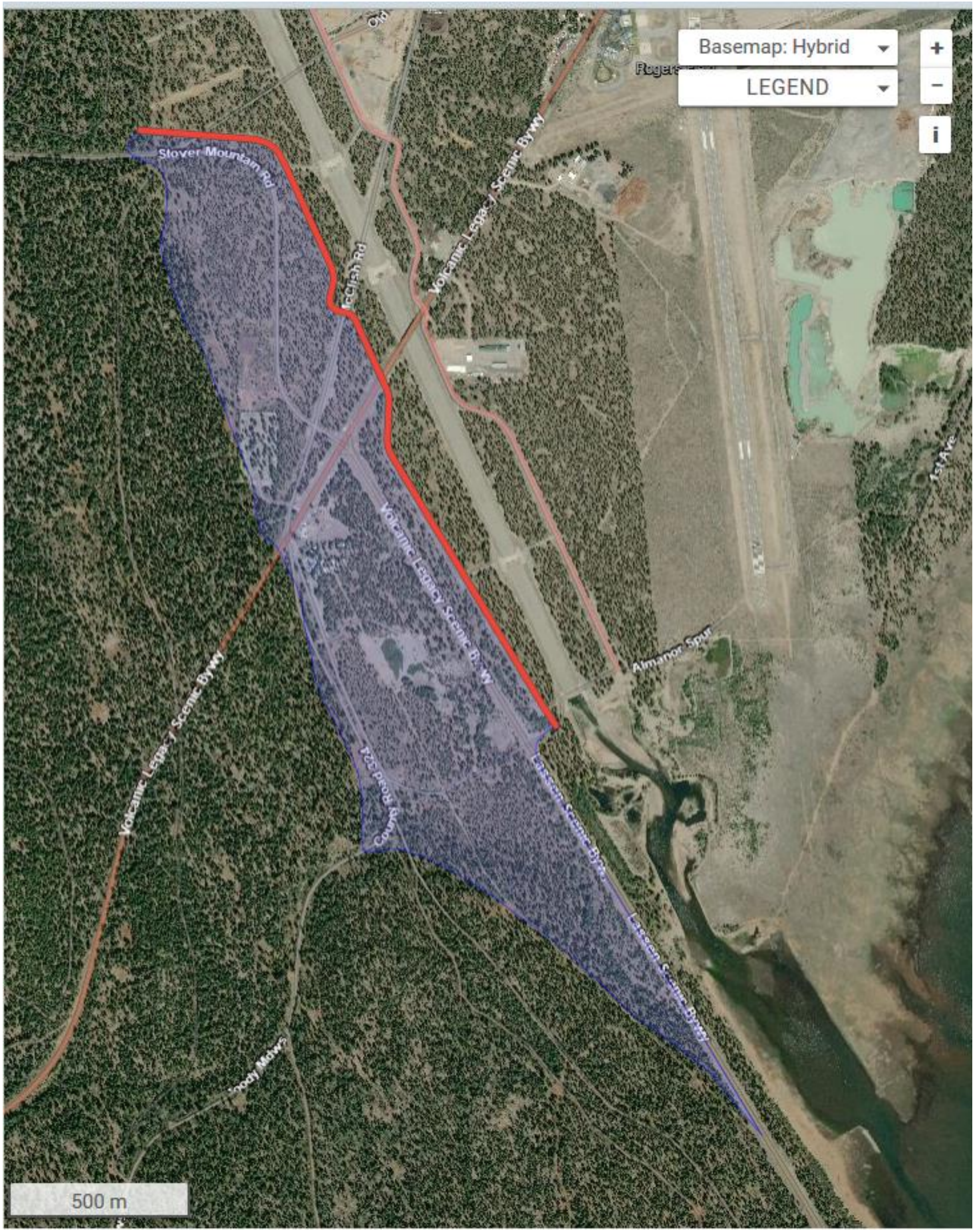
- People at Risk 0
- Structures at Risk 0
- Property Value $0

North Fork Feather River at Chester – West Levee

The North Fork River at Chester – West Levee is an earthen levee located along the west bank of the Chester Flood Control Ditch. The Chester Flood Control Ditch is a man-made, rock-lined channel that funnels excess water from North Fork Feather River to Lake Almanor, about 1.5 miles southwest of Chester, California. Water flows into the ditch after it is redirected by an upstream diversion dam. North Fork Feather River at Chester – West lowers the risk of flooding from the ditch. This levee is not accredited by FEMA as providing 1% annual chance flood protection.

The levee was constructed as part of the Feather River Project in 1976 to reduce the risk of flooding for Chester. According to the National Levee Database, this levee is locally maintained by the Plumas County Public Works. The Central Valley Flood Protection Board is it sponsor, and the California Department of Water Resources is charged with inspecting and helping maintain the levee. This levee is approximately 1.33 miles long, starting on Chester Ski Road, about half a mile north of Highway 36, and ending at Lake Almanor, east of Highway 89. The levee protects approximately 0.42 mi^2. Protected areas can be seen on Figure 4-145.

Figure 4-145 North Fork Feather River at Chester – West Levee Protected Areas



Source: National Levee Database

An assessment was performed on January 1, 2017 of this levee. That risk analysis showed the following:

- People at Risk 40
- Structures at Risk 8
- Property Value $560,000

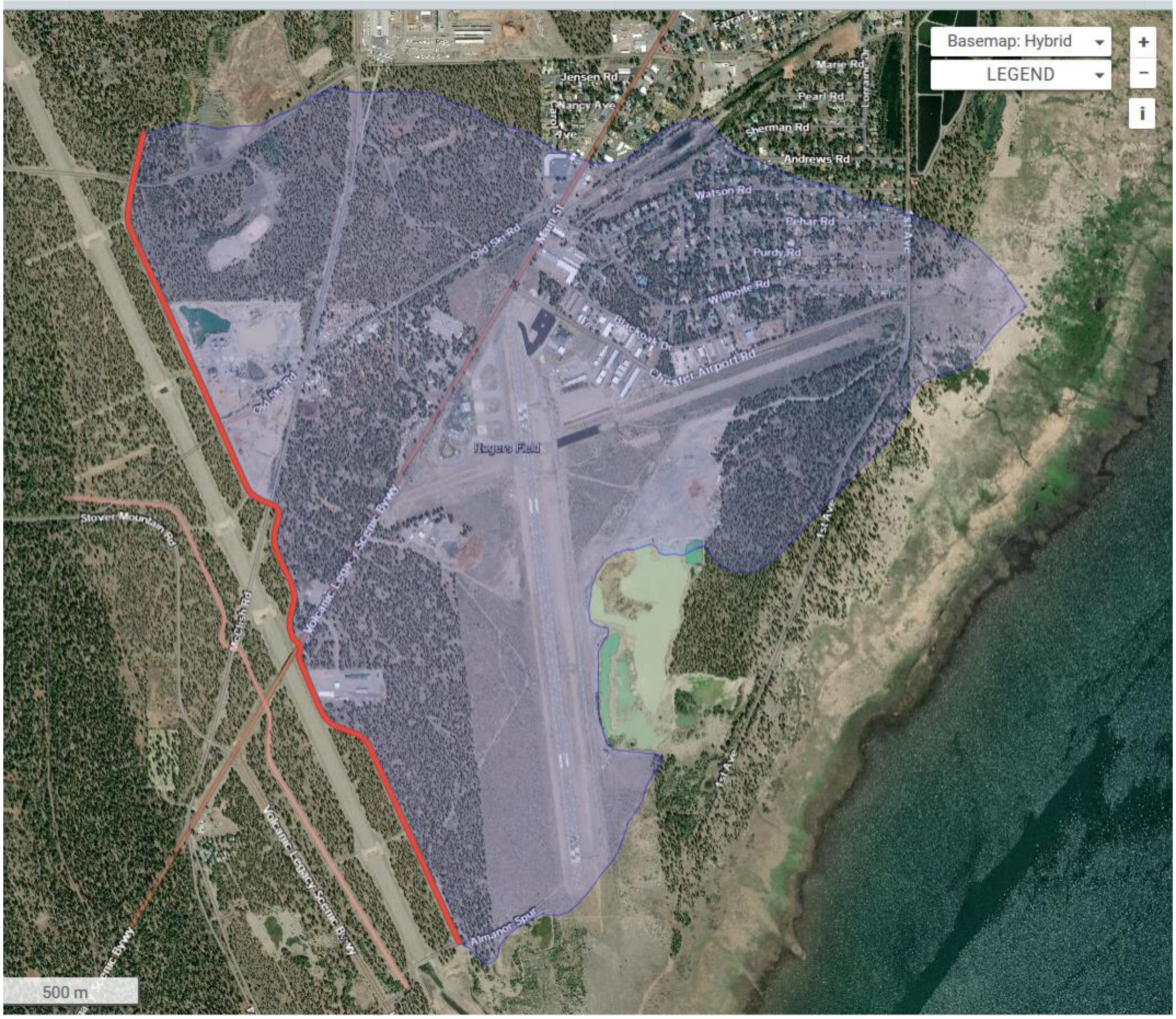
According to the National Levee Database, this levee is considered low risk based on the likelihood of the levee failing and the consequences to the people and property if it were to fail. Water has never risen up the side of this levee during a past flood event. Therefore, there is some uncertainty about how the levee will perform during a large storm. If water were to rise over the top of the levee, portions of the levee might erode, or be washed away. Large trees in the levee may allow water to seep through the levee and weaken the soils. If the levee were to fail, the land west of the levee could be flooded with up to 2 feet of water, including portions of Highway 36. There are currently no specific emergency warning systems in place for the area. However, there should be significant warning time before a flood and the population behind the levee is low. The levee has a high capacity for water and is expected to perform well overall. Evacuation routes are expected to be easily accessible for most of the people living behind the levee. The danger of a levee failure is also limited because there are no people living in the immediate vicinity of the levee.

North Fork Feather River at Chester East Levee

The North Fork River at Chester – East Levee is an earthen levee located along the east bank of the Chester Flood Control Ditch located roughly 1.5 miles southwest of Chester, California. The Chester Flood Control Ditch is a man-made, rock-lined channel that funnels excess water from North Fork Feather River to Lake Almanor. Water flows into the ditch after it is redirected by an upstream diversion dam. North Fork Feather River at Chester – East lowers the risk of flooding from the ditch for the people living in Chester. This levee is not accredited by FEMA as providing 1% annual chance flood protection.

The levee was constructed as part of the Feather River Project in in 1976. According to the National Levee Database, this levee is locally maintained by the Plumas County Public Works. The Central Valley Flood Protection Board is it sponsor, and the California Department of Water Resources is charged with inspecting and helping maintain the levee. The levee is approximately 1.89 miles long, and runs north to south, starting about 1 mile north of Highway 36 where it crosses the ditch, to Lake Almanor. The levee protects approximately 1.89 mi^2. Protected areas can be seen on Figure 4-146.

Figure 4-146 North Fork Feather River at Chester – East Levee Protected Areas



Source: National Levee Database

An assessment was performed on January 1, 2017 of this levee. That risk analysis showed the following:

- People at Risk 613
- Structures at Risk 344
- Property Value $75,900,000

This levee is considered low risk based on the likelihood of the levee failing and the consequences to the people and property if it were to fail. There has not yet been a rainstorm that caused water to rise that the very bottom of the levee. If water were to rise over the top of the levee, portions of the levee could be washed away. There is also a large open pit quarry that is very close to the base of the levee. During a heavy rainstorm, the water could seep through the area of the quarry and weaken the levee. However, if the levee were to break in this location, the water would fill the quarry first before flooding the area behind the levee. This would allow more time for people living in the leveed area to evacuate. Quarry operations would not be occurring during such a storm. Flood water would be less than 2 feet deep. There are currently no specific emergency warning systems in place for the area. Warning times may be longer than expected. However, the levee has a high capacity for water and is generally expected to perform well, even in the event of a failure, though there is some uncertainty because it has never been tested by a flood. Evacuation routes are expected to be clear for most of the people living behind the levee. The danger of a levee failure is also limited since there are no people living in the immediate area of the levee.

Impacts

Levee failure flooding and associated impacts would vary depending on which structure fails and the nature and extent of the failure and associated flooding. This flooding can present a threat to life and property, including buildings, their contents, and their use. Large flood events can affect lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, agricultural industry, and the local and regional economies.

Future Development

With limited levees in the unincorporated County, future development will likely not be affected by this hazard. Should levees be built, future development built in the levee areas would be subject to the building standards in the Plumas County Floodplain Ordinance.

4.3.15. Pandemic

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. It is important to realize that this LHMP Update does not examine pandemic contingency plans, but instead focuses on examining the risk of a normal hazard occurrence.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe a pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the County is at risk, as pandemic is a regional, national, or international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

Disaster Declaration History

There has been one state and federal disaster declaration due to pandemic, as shown in Table 4-83.

Table 4-83 Plumas County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

NCDC Events

The NCDC does not track pandemic.

WHO Events

The 20th century saw three outbreaks of pandemic flu.

- The **1918-1919 Influenza Pandemic (H1N1),** (aka the Spanish Flu**),** is the catastrophe against which all modern pandemics are measured. It is estimated that approximately 20 to 40 percent of the worldwide population became ill and that over 50 million people died. Approximately 675,000 deaths from the flu occurred in the U.S. alone.
- The **February 1957-1958 Influenza Pandemic (H2N2)** (aka the Asian Flu) was first identified in the Far East. Immunity to this strain was rare in people less than 65 years of age, and a pandemic was predicted. In preparation, vaccine production began in late May 1957, and health officials increased surveillance for flu outbreaks. Unlike the virus that caused the 1918 pandemic, the 1957 pandemic virus was quickly identified, due to advances in scientific technology. Vaccine was available in limited supply by August 1957. The virus came to the U.S. quietly, with a series of small outbreaks over the summer of 1957. When U.S. children went back to school in the fall, they spread the disease in classrooms and brought it home to their families. Infection rates were highest among school children, young adults, and pregnant women in October 1957. Most influenza-and pneumonia-related deaths occurred between September 1957 and March 1958. The elderly had the highest rates of death. By December 1957, the worst seemed to be over. However, during January and February 1958, there was another wave of illness among the elderly. This is an example of the potential "second wave" of infections that can develop during a pandemic. The disease infects one group of people first, infections

appear to decrease and then infections increase in a different part of the population. Although the Asian flu pandemic was not as devastating as the 1918-1919 flu, about 69,800 people in the U.S. died.

- The **1968 Influenza Pandemic (H3N2)** was first detected in Hong Kong (aka the Hong Kong Flu). The first cases in the U.S. were detected as early as September of that year, but illness did not become widespread in the U.S. until December. Deaths from this virus peaked in December 1968 and January 1969. Those over the age of 65 were most likely to die. The same virus returned in 1970 and 1972. The number of deaths between September 1968 and March 1969 for this pandemic was 33,800, making it the mildest pandemic in the 20th century.

To date, the 21st century has seen two acknowledged pandemics.

- **2009 Swine Flu (H1N1**)— 2009 H1N1 (sometimes called "swine flu") was a new influenza virus causing illness in people. This virus was originally referred to as "swine flu" because laboratory testing showed that many of the genes in this new virus were very similar to influenza viruses that normally occur in pigs (swine) in North America. But further study showed that this virus was very different from what normally circulates in North American pigs. It had two genes from flu viruses that normally circulate in pigs in Europe and Asia and bird (avian) genes and human genes. Scientists call this a "quadruple reassortant" virus. This virus spread from person-to-person worldwide, probably in much the same way that regular seasonal influenza viruses spread. On June 11, 2009, the World Health Organization (WHO) signaled that a pandemic of 2009 H1N1 flu was underway. It was first detected in the United States in early 2009 and spread to the world later that year. About 70 percent of people who were hospitalized with this 2009 H1N1 virus had one or more medical conditions previously recognized as placing people at "high risk" of serious seasonal flu-related complications. This included pregnancy, diabetes, heart disease, asthma, and kidney disease. Young children were also at high risk of serious complications from 2009 H1N1, just as they are from seasonal flu. And while people 65 and older were the least likely to be infected with 2009 H1N1 flu, if they got sick, they were also at "high risk" of developing serious complications from their illness. Some studies estimated that 11 to 21 percent of the global population at the time—or around 700 million to 1.4 billion people (of a total 6.8 billion)—contracted the illness. This was more than the number of people infected by the Spanish flu pandemic, but only resulted in about 150,000 to 575,000 fatalities for the 2009 pandemic. A follow-up study done in September 2010 showed that the risk of serious illness resulting from the 2009 H1N1 flu was no higher than that of the yearly seasonal flu. For comparison, the WHO estimates that 250,000 to 500,000 people die of seasonal flu annually.
- **2019/2020** COVID 19 – During the creation of this LHMP Update, the world was under various forms of lockdown due to COVID-19 (known also as coronavirus). Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recently discovered coronavirus causes coronavirus disease COVID-19. COVID-19 is the infectious disease caused by the most recently discovered coronavirus. This new virus and disease were unknown before the outbreak began in Wuhan, China, in December 2019. The most common symptoms of COVID-19 are fever, tiredness, and dry cough. Some patients may have aches and pains, nasal congestion, runny nose, sore throat or diarrhea. These symptoms are usually mild and begin gradually. Some people become infected but don't develop any symptoms and don't feel unwell. Most people (about 80%) recover from the disease without needing special treatment. Around 1 out of every 6 people who gets COVID-19 becomes seriously ill and develops difficulty breathing. Older people, and those

with underlying medical problems like high blood pressure, heart problems or diabetes, are more likely to develop serious illness. People with fever, cough and difficulty breathing should seek medical attention.

HMPC Events

As of early August 2020, Plumas County had 33 total positive cases of coronavirus. Only one was active at that time. The County PUSD currently has 4 committees conducting plans specific to our schools reopening this fall due to COVID-19

Likelihood of Future Occurrence

Likely – The calculation for future occurrence of pandemic must first be considered in light of circumstances. The diseases are naturally occurring in the populations that reside in the County. In addition, this Plan is not examining the pandemic potential of these diseases, but instead examines when these diseases manifest in severe injury or fatalities among humans. Given these assumptions and the five outbreaks since 1900, the likelihood of future occurrence is considered likely.

Climate Change and Pandemic

According to the WHO, there are three categories of research into the linkages between climatic conditions and infectious disease transmission. The first examines evidence from the recent past of associations between climate variability and infectious disease occurrence. The second looks at early indicators of already-emerging infectious disease impacts of long-term climate change. The third uses the above evidence to create predictive models to estimate the future burden of infectious disease under projected climate change scenarios.

Historical Evidence

There is much evidence of associations between climatic conditions and infectious diseases. Malaria is of great public health concern, and seems likely to be the vector-borne disease most sensitive to long-term climate change. Malaria varies seasonally in highly endemic areas. The link between malaria and extreme climatic events has long been studied in India, for example. Early last century, the river-irrigated Punjab region experienced periodic malaria epidemics. Excessive monsoon rainfall and high humidity was identified early on as a major influence, enhancing mosquito breeding and survival. Recent analyses have shown that the malaria epidemic risk increases around five-fold in the year after an El Niño event.

Early impacts of climate change

These include several infectious diseases, health impacts of temperature extremes and impacts of extreme climatic and weather events.

Predictive Modeling

The main types of models used to forecast future climatic influences on infectious diseases include statistical, process-based, and landscape-based models. These three types of model address somewhat different questions.

Statistical models require, first, the derivation of a statistical (empirical) relationship between the current geographic distribution of the disease and the current location-specific climatic conditions. This describes the climatic influence on the actual distribution of the disease, given prevailing levels of human intervention (disease control, environmental management, etc.). By then applying this statistical equation to future climate scenarios, the actual distribution of the disease in future is estimated, assuming unchanged levels of human intervention within any particular climatic zone. These models have been applied to climate change impacts on malaria, dengue fever and, within the USA, encephalitis. For malaria some models have shown net increases in malaria over the coming halfcentury, and others little change.

Process-based (mathematical) models use equations that express the scientifically documented relationship between climatic variables and biological parameters – e.g., vector breeding, survival, and biting rates, and parasite incubation rates. In their simplest form, such models express, via a set of equations, how a given configuration of climate variables would affect vector and parasite biology and, therefore, disease transmission. Such models address the question: "If climatic conditions alone change, how would this change the potential transmission of the disease?" Using more complex "horizontal integration", the conditioning effects of human interventions and social contexts can also be incorporated.

This modelling method has been used particularly for malaria and dengue fever (4). The malaria modelling shows that small temperature increases can greatly affect transmission potential. Globally, temperature increases of 2-3ºC would increase the number of people who, in climatic terms, are at risk of malaria by around 3- 5%, i.e. several hundred million. Further, the seasonal duration of malaria would increase in many currently endemic areas.

Since climate also acts by influencing habitats, landscape-based modeling is also useful. This entails combining the climate-based models described above with the rapidly-developing use of spatial analytical methods, to study the effects of both climatic and other environmental factors (e.g. different vegetation types – often measured, in the model development stage, by ground-based or remote sensors). This type of modelling has been applied to estimate how future climate-induced changes in ground cover and surface water in Africa would affect mosquitoes and tsetse flies and, hence, malaria and African sleeping sickness.

Conclusion

Changes in infectious disease transmission patterns are a likely major consequence of climate change. We need to learn more about the underlying complex causal relationships, and apply this information to the prediction of future impacts, using more complete, better validated, integrated, models.

Vulnerability Assessment

Vulnerability—High

Pandemic has and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat pandemic flu. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of pandemic flu by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the County. Pandemic can have varying levels of impact to the citizens of the County, depending on the nature of the pandemic.

Impacts

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) an unemployment rose significantly. Supply chains for food can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the County could increase exposure to pandemic flu, and increase the ability of each disease to be transmitted among the population of the County. If the median age of County residents continues to increase, vulnerability to pandemic diseases may increase, due to the fact that these diseases are often more deadly to senior citizens.

4.3.16. Tree Mortality

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard. Much of this section was provided by the University of California Cooperative Extension Forest and Natural Resources Program for Plumas and Sierra Counties.

Hazard/Problem Description

One of the many vulnerabilities of drought in Plumas County is the increased risk of widespread tree mortality events that pose hazards to people, homes, and community infrastructure, create a regional economic burden to mitigate, and contribute to future fuel loads in forests surrounding communities. During extended drought, tree mortality is driven by a build-up in endemic bark beetle populations and exacerbated by latent populations of a suite of native insects and disease. Non-native forest pests (insects and/or pathogens) can also contribute to tree mortality events.

The most common driver of tree morality are forest pests in the bark beetle category. Bark beetles mine the inner bark (the phloem-cambial region) on twigs, branches, or trunks of trees and shrubs. Bark beetles frequently attack trees weakened by drought, disease, injuries, or other factors that may stress the tree. Bark beetles can contribute to the decline and eventual death of trees; however only a few aggressive beetle species are known to be the sole cause of tree mortality. The three most common bark beetles that actively contribute to mortality in Plumas County include the fir engraver (*Scoyltus ventralis*), the western pine beetle (*Dendroctonus brevicomis*) and the mountain pine beetle (*Dendroctonus ponderosae*); though documented damage has also occurred from less prevalent or aggressive species such as the Jeffrey pine beetle (*Dendroctonus jeffreyii*), the Douglas-fir beetle (*Dendroctonus pseudotsugae*), Douglas-fir engraver beetle, (*Scolytus unispinosus*), the Red Turpentine beetle (*Dendroctonus valens*) or the Ips species. Bark beetle mortality and the scope and scale of mortality is closely linked with two common factors: high stand densities of trees and extended drought (Fettig et al. 2012) – both of which are common occurrences in the forests of Plumas County.

Commonly tree mortality incidences have been within endemic background levels and highly localized and dispersed in nature; however, in the past two decades, larger more widespread tree mortality events have occurred in various parts of California creating land management challenges that have notable socio-economic impacts to mountain communities. Forests with high densities of trees are particularly vulnerable during extended drought where endemic bark beetle populations can explode to epidemic proportions in a short amount of time, as recently experienced during the 2012-2016 tree mortality event in the central and southern Sierra Nevada counties (see Figure 4-147).

Figure 4-147 Examples of widespread tree mortality induced by drought in the southern Sierra Nevada. Wildland urban intermix forested community in Fresno county in a) May 2015 and b) February 2016.

Source: CAL FIRE

In addition to bark beetles, many tree mortality factors include a complex of pathogens and insects. For example, various types of fungal root diseases and trunk rots can create water stress on trees that contribute to susceptibility to bark beetle mortality. Annosus root disease (*Heterobasidion occidentale)* is a common root disease that is found throughout the county. Outbreaks of forest defoliator insects have also occurred throughout the county. Over the last decade both the sawfly (*Neodiprion*) and the Douglas-fir Tussock Moth (DFTM) (*Orgyia pseudotsugae*) have occurred in white fir forests of Plumas County. While defoliation events are not huge drivers of mortality, these incidents have contributed to localized areas of concern. Notably two defoliation events of sawfly and DFTM in the La Porte and Bucks Lake communities contributed to localized mortality patches. These defoliation events make true fir forest stands more vulnerable to fir engraver bark beetle mortality (see Figure 4-148).

Figure 4-148 Tree mortality as the result of pathogen and insect complexes.

Source: University of California

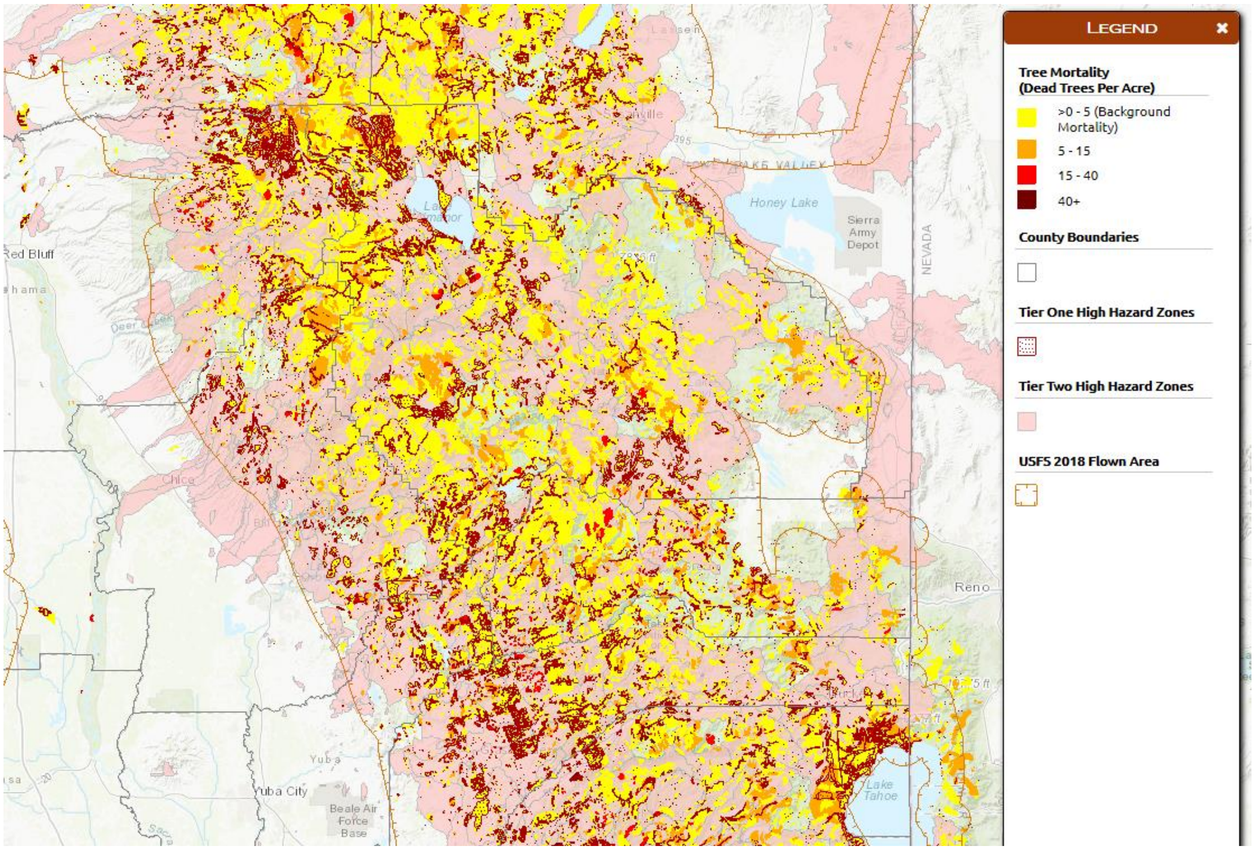
Sierra Nevada mixed conifer forests evolved with and are adapted to periodic drought; however high stand densities – in combination with periodic drought and pest/pathogen complexes – make trees particularly susceptible to larger scale mortality events. Widespread mortality events contribute to hazardous fuel accumulations which, in turn, contribute to elevated wildfire hazard (Stephens et al 2018). Elevated tree mortality within striking distance of homes, roads, and community infrastructure also contribute to operational complexities and economic burden on rural forested counties.

Location and Extent

Onset of tree mortality events can be relatively fast as seen in Figure 4-126; however conditions – such as high stand densities – that lead to tree mortality accumulate slowly over time. Many areas in Plumas County have seen increases in tree mortality. The County has mapped these areas, and that map is shown in Figure 4-149. Shown are results of 2012-2018 aerial tree-mortality surveys. Using a color legend, the map shows a scale of:

- Deep burgundy depicting areas with more than 40 dead trees per acre
- Red depicting 15 - 40 dead trees per acre
- Orange depicting 5 -15 dead trees per acre
- Yellow depicting 5 or less dead trees per acre

Figure 4-149 Plumas County – Tree Mortality Areas



Source: CAL FIRE, map retrieved 1/17/2020

In the past decade, mortality has increased in the northern portion of Plumas County as well as the Lakes Basin area. During the past statewide tree mortality event, much of Plumas county was designated as Tier 2 High mortality hazard on the watershed scale along with numerous Tier 1 High hazard "hot spots".

Past Occurrences

Disaster Declaration History

On October 30, 2015, Governor Brown proclaimed a State of Emergency and included provisions to expedite the removal and disposal of dead and dying hazardous trees. As a result, costs related to identification, removal, and disposal of dead and dying trees caused from drought conditions may be eligible for California Disaster Assistance Act (CDAA) reimbursement.

Plumas County created a Tree Mortality task force which was a loosely organized coalition of parties from local, state, and federal agencies and non-governmental organizations such as the Plumas County Fire Safe Council. Much of the task force was focused on identification and monitoring of areas of tree mortality concern.

NCDC Events

The NCDC does not track tree mortality events in Plumas County.

Hazard Mitigation Planning Committee Events

Widespread tree mortality events have occurred in Plumas County primarily due to unnaturally high tree densities and drought episodes that facilitate a build-up of endemic bark beetle populations. Tree mortality events have also occurred from defoliation insects, plant diseases and from introduction of non-native forest pests. The HMPC noted that there have been a number of tree mortality events in Plumas County. Notable events include:

- Douglas-fir tussock moth outbreak in the 1980's
- Late 1980's/Early 1990's mortality of white fir across the Tahoe and Plumas National Forests
- 2012-2018 Drought Related Tree Mortality Event in both pine and fir
- 2014-2016 Sawfly and Douglas-fir tussock moth outbreak

The HMPC noted other events that occurred outside of Plumas County. Past tree mortality events in the northern Sierra Nevada have been well documented in scientific literature (Macomber and Woodcock 1994; Ferrell et al 1994; Guarin and Taylor 2005; Preisler et al 2017). Over the past two decades tree mortality events in California forests have impacted numerous forested communities with widespread and large scale economic and social impacts. Examples include:

- Bark beetle outbreak in Southern California: San Bernadino and Lake Arrowhead 2003-2006
- Bark Beetle outbreak in the central and southern Sierra Nevada 2010-2018
- Sudden Oak Death in the Northern California Coast Range 2001-ongoing
- Golden Spotted Oak Borer mortality of Black Oak in Southern California

Likelihood of Future Occurrence

Likely – There have been four (multi-year) tree mortality events in the County since 1980. Given the past events, the lingering drought conditions in California, and the heavily wooded nature of much of the County, tree mortality is considered likely in the future.

Climate Change and Tree Mortality

Tree mortality events are inevitable, particularly considering the climate change predictions for Plumas County. Trends suggest that the northern Sierra Nevada may become generally warmer and wetter, with longer periods of prolonged summer drought (Merriam et al. 2013)

While warmer and wetter weather patterns may increase forest growth, warmer temperatures – in combination with longer periods of prolonged summer drought – will likely increase forest insect and disease outbreaks and the occurrence of high severity fire. High-intensity wildfires, drought, and declining forest health are some effects of climate change that are worsening the threats to forests and reducing forest productivity.

Hotter and drier weather alter forest hydrology and water balance available to forest communities. Increased temperatures alter the timing of snowmelt, affecting the seasonal availability of water with earlier dry conditions which then provides fuel to earlier and hotter fires from stressed trees and shrubs. Drought also reduces trees' ability to produce sap, which protects them from destructive insects and diseases. Research (Tepley et al 2017; Fellows and Goulden 2008) has found that large trees may be most susceptible to climate driven mortality – which the authors suggested can also be compounded by high stand densities of small trees due to fire suppression. Others (Van Mantgem et all 2009) suggest that "regional warming and consequent increases in water deficits are likely contributors to the increase in mortality rates," and suggest that exogenous warming trends may be more of a driver of mortality, particularly in large diameter trees, than increasing stand density. Nonetheless, research indicates that warming climate is driving changes in forest structure.

Battles et al. (2008) evaluated the impacts of climate change on the mixed-conifer region in California and provide insight to forest health concerns and management implications for forest managers. This study and others (Allen et al 2015) found that changes in climate could "exacerbate forest health concerns" by increasing weakened tree susceptibility to mortality as a result of fire, disease epidemics and insect outbreaks and potentially enabling forest insects and disease to expand ranges or increase potential for widespread damage (Battles et al 2008; Allen et al 2015). These predictions were realized the following decade in the central and southern Sierra Nevada wherein vast stretches of ponderosa pine forest were decimated in a drought driven epidemic. Other research (Stephens et al 2018) suggest that landscape level tree mortality may drive extreme fire behavior and high severity of future fire events in these forests – emphasizing that tree morality events have 2nd and 3rd order consequences for Plumas county communities.

The implications of climate change suggest useful strategies for communities and land managers can employ include: 1) creating resistant forest structures, 2) creating resilient forest landscapes, and 3) consider re-aligning vegetation communities to be more adapted to climate change. (Millar et al 2007 & Stephens et al 2010)

Forest management strategies that increase species diversity, promote heterogeneity, and create lower density stands would be effective in providing "structures that are more resilient to catastrophic events like fire and (insect) epidemics" (Battles et al 2008). Prescribed fire, and its potential repeated use may help reduce stand densities which promote increased resilience to climate change driven drought conditions (Van Mantgem 2009).

Vulnerability Assessment

Vulnerability—Medium

Dead trees are a hazard to the general public and forest visitors, but the risk of injury, death, property damage or infrastructure damages varies depending how the hazard interacts with potential targets. Dead trees within the wildland urban intermix or wildland urban interface or urban areas therefore pose a greater risk to due to their proximity to residents, businesses, and road, power, and communication infrastructure.

Dead trees may fall or deteriorate in their entirety or in part – either mechanism has the potential for injury, death, or inflicting severe damage to targets. As the time since tree mortality increases, so does the deterioration of wood and the potential for tree failure. During the 2012-2018 drought, the state of California Tree Mortality Task force designated multiple Tier 1 and Tier 2 High Hazard Zones where tree morality posed an elevated risk to human health, properties, and resource values. A number of Plumas County areas were designated during this event and the majority of Plumas County watersheds were designated as Tier 2 high hazard zones because of the significant levels of tree mortality. These areas were shown on Figure 4-149.

Plumas County is unique in that many residential and business areas of the community are in the wildland urban interface/intermix with the forest. Trees in these interface/intermix areas are particularly vulnerable to insect and/or drought driven mortality because of the additional stressors that urban environments impose on trees (ie. Soil compaction, altered hydrology, physical damage, heat islands etc.). This exacerbates the occurrence of tree mortality within the populated settings of the County.

Impacts

Tree mortality affects industrial and non-industrial timber land owners by reducing inventory and degrading timber quality and yield from forest properties. As seen in the central and southern Sierras during the 2012-2018 tree mortality event, the glut of dead timber creates an oversupply beyond what sawmills can handle and process, thereby reducing or eliminating the value of dead trees for salvage. In these cases, tree mortality can create economic hardship on forest landowners of all sizes as they try to mitigate safety hazards posed by standing dead and deteriorating trees and development of future fuel accumulations – which leads to increase fire risk.

During tree mortality events, the cost of removing dead trees far exceeds the salvage value of the tree. This can create an undue burden on forest landowners of all sizes, particularly for residential areas where there are many complexities in removing trees such as power infrastructure, homes, water lines, and other assets that need to be protected.

Future Development

Development standards in California take wildfire into account; however, there are no standards developed for reducing the risk of tree mortality. Areas of Very High Fire Hazard Severity have increased scrutiny regarding development standards and siting. An increase in tree mortality may increase the fire risk and be a factor in development in areas of high tree morality and wildfire risk as an increase in dead and dry fuels may increase the wildfire risk in the future. Future development could consider mitigating tree hazards within infrastructure (i.e. power and road corridors) to mitigate potential for dead tree hazards in the future.

4.3.17. Volcano

Hazard Profile

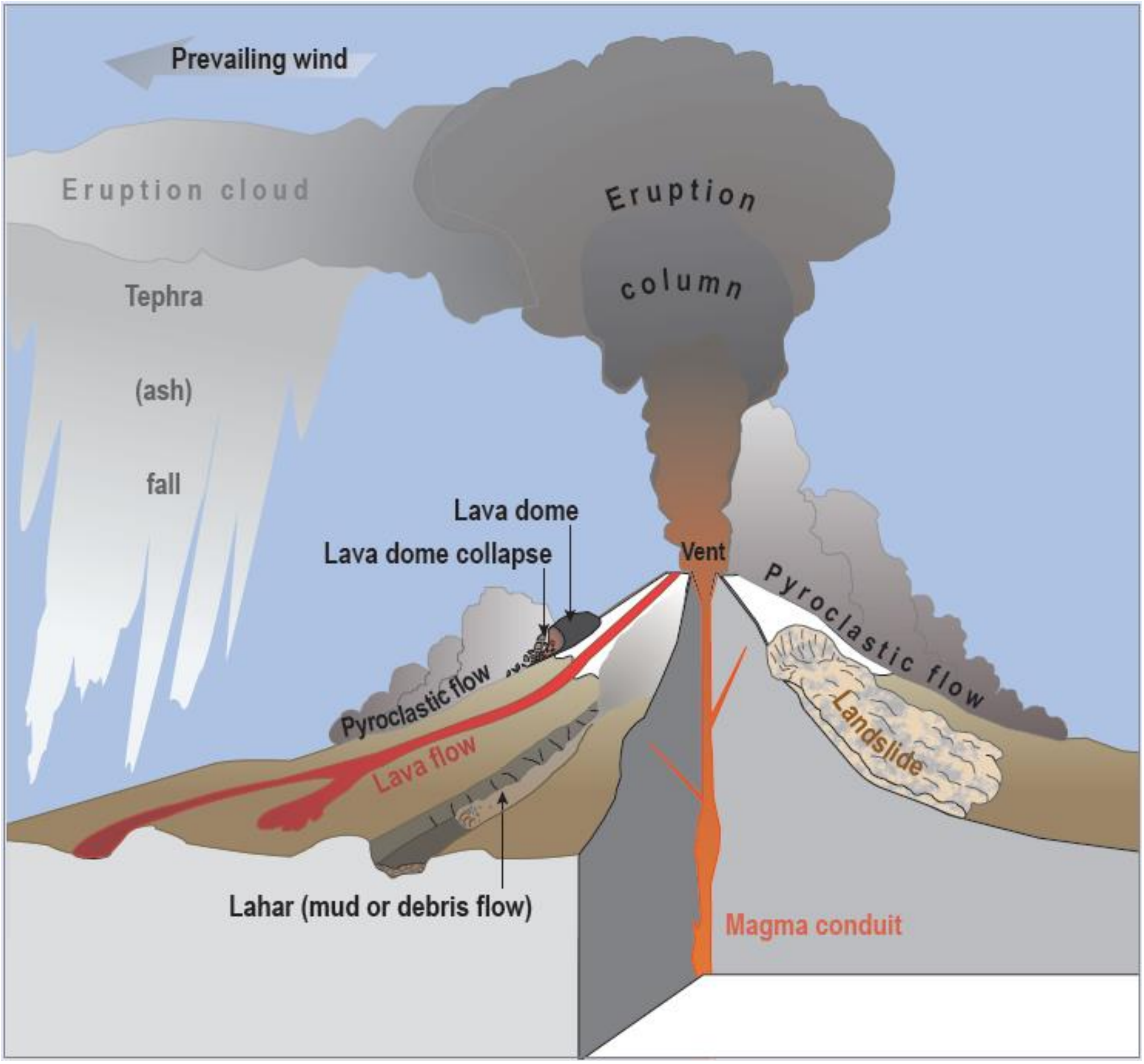
This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

The California State Hazard Mitigation Plan identifies volcanoes as one of the hazards that can adversely impact the State. However, there have been few losses in California from volcanic eruptions.

As shown in Figure 4-150, active volcanoes pose a variety of natural hazards. Explosive eruptions blast lava fragments and gas into the air with tremendous force. The finest particles (ash) billow upward, forming an eruption column that can attain stratospheric heights in minutes. Simultaneously, searing volcanic gas laden with ash and coarse chunks of lava may sweep down the flanks of the volcano as a pyroclastic flow. Ash in the eruption cloud, carried by the prevailing winds, is an aviation hazard and may remain suspended for hundreds of miles before settling to the ground as ash fall. During less energetic effusive eruptions, hot, fluid lava may issue from the volcano as lava flows that can cover many miles in a single day. Alternatively, a sluggish plug of cooler, partially solidified lava may push up at the vent during an effusive eruption, creating a lava dome. A growing lava dome may become so steep that it collapses, violently releasing pyroclastic flows potentially as hazardous as those produced during explosive eruptions.

Figure 4-150 Volcanoes and Associated Hazards

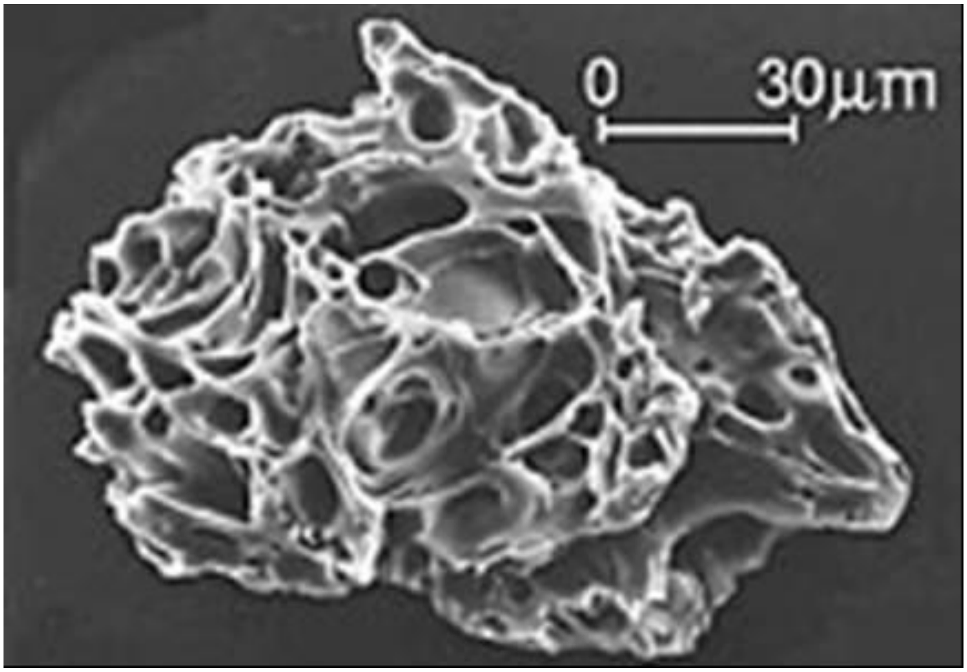


Source: USGS Publication 2014-3120

During and after an explosive or effusive eruption, loose volcanic debris on the flanks of the volcano can be mobilized by heavy rainfall or melting snow and ice, forming powerful floods of mud and rock (lahars) resembling rivers of wet concrete. These can rush down valleys and stream channels as one of the most destructive types of volcano hazards.

The USGS notes specific characteristics of volcanic ash. Volcanic ash is composed of small jagged pieces of rocks, minerals, and volcanic glass the size of sand and silt, as shown in Figure 4-151. Very small ash particles can be less than 0.001 millimeters across. Volcanic ash is not the product of combustion, like the soft fluffy material created by burning wood, leaves, or paper. Volcanic ash is hard, does not dissolve in water, is extremely abrasive and mildly corrosive, and conducts electricity when wet.

Figure 4-151 Ash Particle from 1980 Mt. St Helens Eruption Magnified 200 Times



Source: US Geological Survey: Volcanic Ash: Effect & Mitigation Strategies.

Volcanic ash is formed during explosive volcanic eruptions. Explosive eruptions occur when gases dissolved in molten rock (magma) expand and escape violently into the air, and also when water is heated by magma and abruptly flashes into steam. The force of the escaping gas violently shatters solid rocks. Expanding gas also shreds magma and blasts it into the air, where it solidifies into fragments of volcanic rock and glass. Once in the air, wind can blow the tiny ash particles tens to thousands of miles away from the volcano.

The average grain-size of rock fragments and volcanic ash erupted from an exploding volcanic vent varies greatly among different eruptions and during a single explosive eruption that lasts hours to days. Heavier, large-sized rock fragments typically fall back to the ground on or close to the volcano and progressively smaller and lighter fragments are blown farther from the volcano by wind. Volcanic ash, the smallest particles (2 mm in diameter or smaller), can travel hundreds to thousands of kilometers downwind from a volcano depending on wind speed, volume of ash erupted, and height of the eruption column.

The size of ash particles that fall to the ground generally decreases exponentially with increasing distance from a volcano. Also, the range in grain size of volcanic ash typically diminishes downwind from a volcano (becoming progressively smaller). At specific locations, however, the distribution of ash particle sizes can vary widely.

The USGS has ranked the volcanic threat at all U.S. volcanoes using volcano age, types of potential hazards, and estimates of the societal exposure to those hazards. Sixteen volcanoes are on California's watch list to monitor. Research suggests that partially molten rock (magma) lies beneath seven of these volcanoes—Medicine Lake Volcano, Mount Shasta, Lassen Volcanic Center, Clear Lake Volcanic Field, the Long Valley Volcanic Region, Coso Volcanic Field, and Salton Buttes. At these volcanoes, earthquakes (seismicity), hot springs, volcanic gas emissions, and (or) ground movement (deformation) attest to their restless nature. Information on the Lassen Volcanic Center threat is shown in Table 4-84.

Table 4-84 Volcano Threat near Plumas County

Volcano	Lassen Volcanic Center
Threat	Very High Threat
	Lassen Volcanic National Park, located about 50 miles east of Redding, showcases the dynamic history of this area and draws more than 350,000 visitors each year. Lassen Peak erupted violently in the early twentieth century.

Source: USGS Fact Sheet 2014-3120

Though the table above shows the threat as very high, given the likelihood of future occurrences, the HMPC still thinks the vulnerability to this hazard is low.

Location and Extent

Of the approximately 20 volcanoes in the State, only a few are active and pose a threat. Of these, Lassen Peak is the closet potential threat to Plumas County. Figure 4-152 shows volcanoes in or near California and their location relative to the Plumas County.

Figure 4-152 Active Volcanoes in California and in the Plumas County Area

Source: 2018 State of California Hazard Mitigation Plan

According to the USGS, Lassen Volcanic Center lies in Lassen Volcanic National Park 55 mi east of Redding. The park draws over 350,000 visitors each year with its spectacular volcanic landscapes. Lassen Volcanic Center is located at the southern edge of the Cascade Range, which is bounded on the west by the Sacramento Valley and the Klamath Mountains, on the south by the Sierra Nevada, and on the east by the

Basin and Range geologic provinces. Volcanism in the Lassen segment is a result of subduction of the Juan de Fuca oceanic plate eastward beneath the North American continental plate.

Volcano extent is traditionally measured in magma production and ashfall. Maps showing ashfall or magma affected areas have not been created for the Lassen Volcanics Area. However, the USGS noted that basaltic eruptions may build cinder cones as high as a few hundred meters (around 1,000 ft) and blanket many square kilometers with ash a few centimeters to meters thick. However, these eruptions would not typically impact human life if they occurred at Lassen volcanic center, because they are relatively nonviolent. More devastating ash eruptions occur when dacite magma charged with volcanic gases reaches the surface. In this case, an explosive vertical column of gas and ash may rise several kilometers into the atmosphere. Fallout from the eruption column can blanket areas within a few kilometers of the vent with a thick layer of tephra and high-altitude winds may carry finer ash tens to hundreds of kilometers from the volcano and pose a hazard to aircraft.

Past Occurrences

Disaster Declarations

There have been no federal or state disaster declarations related to volcano, as shown on Table 4-4.

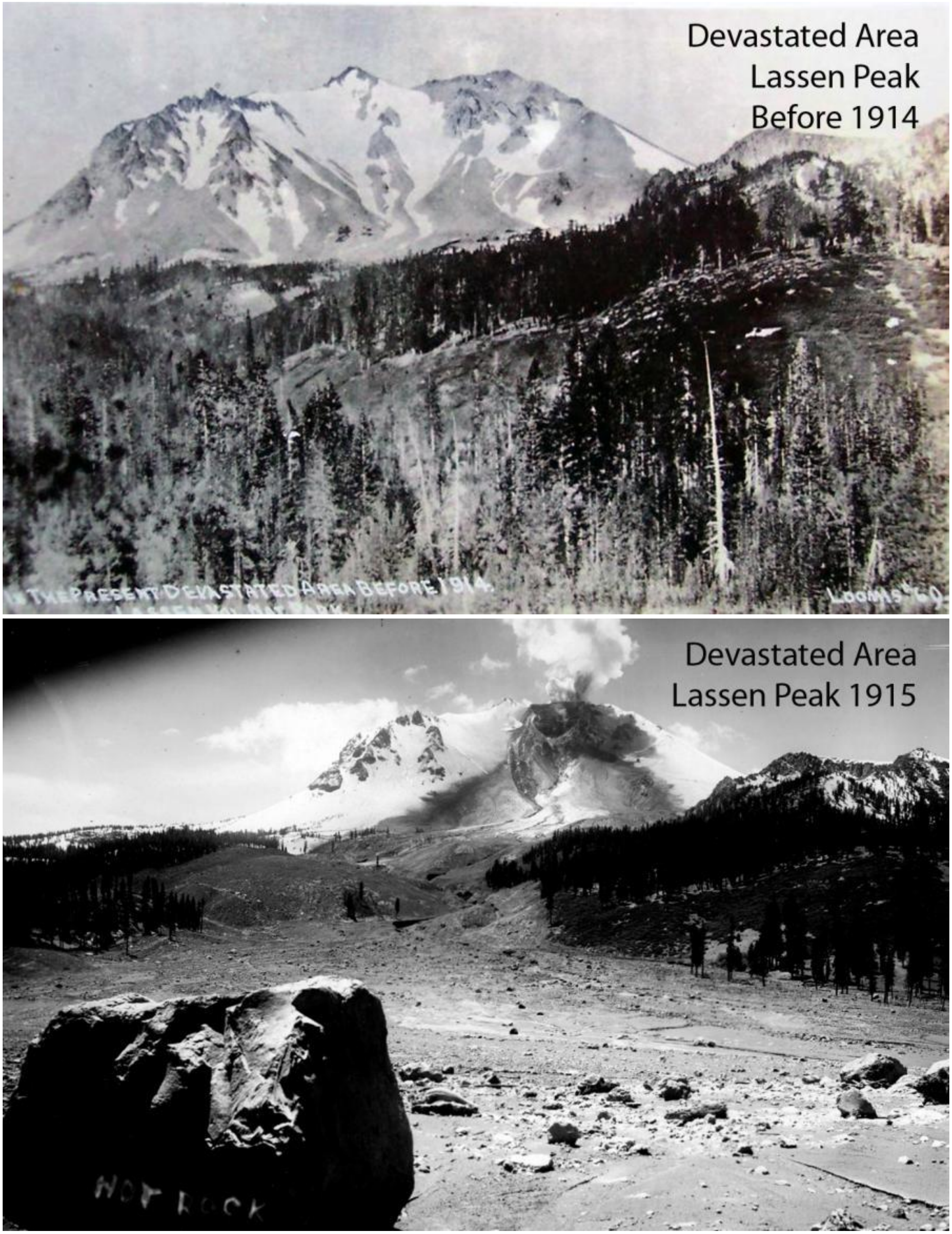
NCDC Events

The NCDC does not track volcanic activity.

USGS Events

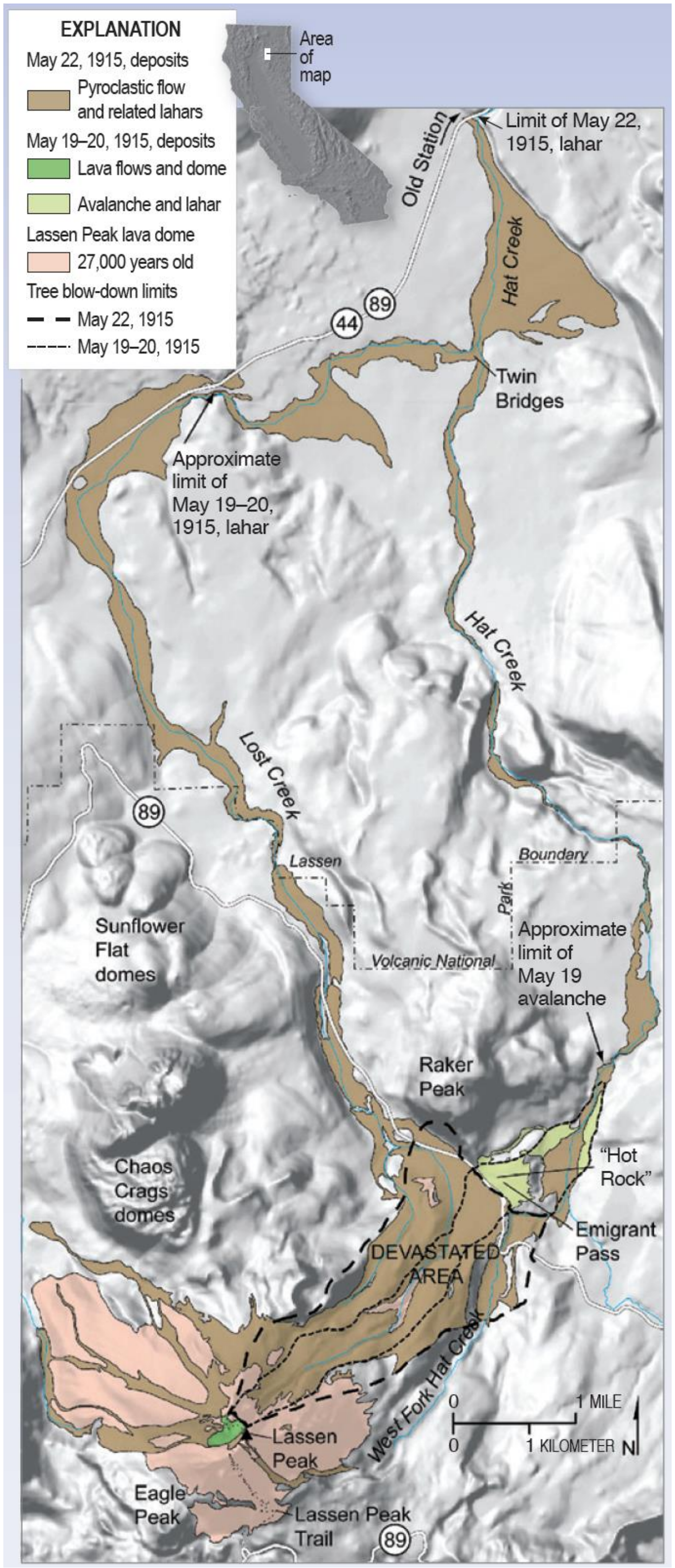
Within the last 825,000 years, hundreds of explosive eruptions came from vents scattered over approximately 200 mi^2. Surrounding Lassen Volcanic Center, over fifty effusive (non-explosive) eruptions have occurred in the last 100,000 years. The area has been relatively quiet for the last 25,000 years with three notable exceptions—the Chaos Crags eruption (1,100 years ago), the eruption of Cinder Cone (1666 A.D.), and the Lassen Peak eruption (A.D. 1914 to 1917). The Lassen Peak eruption consisted mostly of sporadic steam blasts. In May of 1915, however, partially molten rock oozing from the vent began building a precarious lava dome. The dome collapsed on May 19 sending an avalanche of hot rock down the north flank of the volcano. Three days later, a vertical column of ash exploded from the vent reaching altitudes of 30,000 feet. The ash column spawned a high-speed ground flow of hot gas and fragmented lava. Ash from the top of the column drifted downwind 200 miles to the east, as far as Winnemucca, NV. On both days, melting snow fueled mudflows, flooding drainages 20-30 miles away. Before and after pictures are shown on Figure 4-153, while Figure 4-154 shows the extent of damages due to the eruption.

Figure 4-153 1915 Lassen Volcano Eruption



Source: USGS

Figure 4-154 Deposits from Lassen Peak May 1915 Eruptions



Source: USGS – A Sight "Fearfully Grans" – Eruptions of Lassen Peak California, 1914 to 1917

The older Chaos Crags eruption was similar in style, but considerably larger in magnitude. Lassen Volcanic Center hosts a vigorous geothermal system, numerous hot springs, steam vents, and boiling mud pots. Volcanic earthquakes are common, although most are too small to be felt. Non-volcanic earthquakes along regional faults also occur—earthquake swarms in 1936, 1945-1947, and 1950 included several events above magnitude 4.0, with the two largest registering 5.0 and 5.5. Ground surveys show localized subsidence of the volcano, probably due to motion on regional faults.

Hazard Mitigation Planning Committee Events

The HMPC noted no volcanic events.

Likelihood of Future Occurrences

Unlikely—According to the USGS, volcanoes in the Lassen area tend to erupt infrequently, and may be inactive for periods lasting centuries or even millennia. The most recent eruptions in the Lassen area were the relatively small events that occurred at Lassen Peak between 1914 and 1917. The most recent large eruption produced Chaos Crags about 1,100 years ago. Such large eruptions in the Lassen area have an average recurrence interval of about 10,000 years. However, the geologic history of the Lassen area indicates that volcanism there is episodic, having periods of relatively frequent eruptions separated by long quiet intervals. For example, the last large event before Chaos Crags eruption was the one that built Lassen Peak 27,000 years.

Climate Change and Volcano

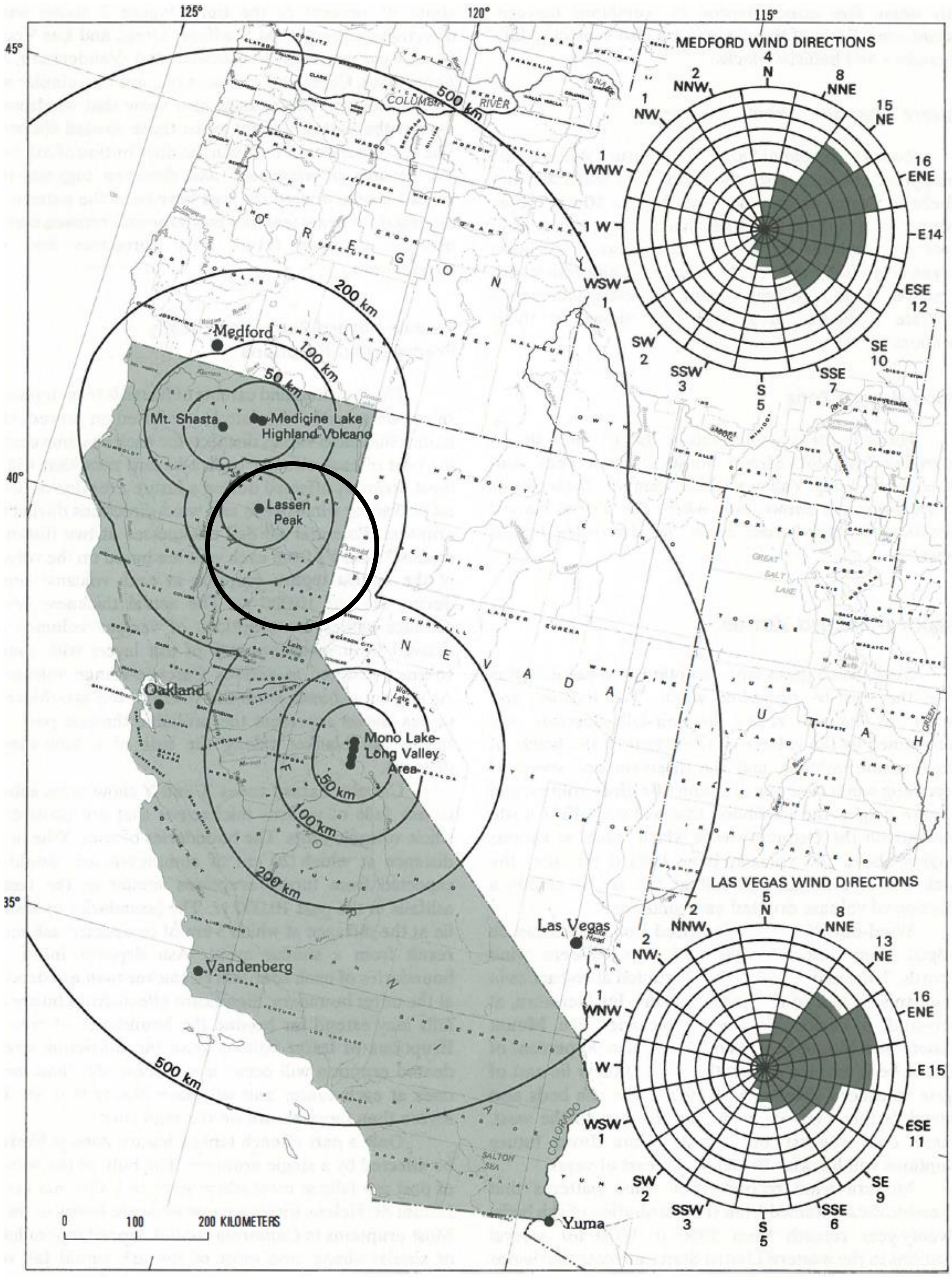
Climate change is unlikely to influence volcanic eruptions.

Vulnerability Assessment

Vulnerability—Low

Populations living near volcanoes are most vulnerable to volcanic eruptions and lava flows, although volcanic ash can travel and affect populations many miles away and cause problems for aviation. The USGS, in Bulletin 1847, described the nature and probable distribution of potentially hazardous volcanic phenomena and their threat to people and property. It included hazard zonation maps that depicted areas relatively likely to be affected by future eruptions in California. Affected areas fall in Plumas County. This is shown on Figure 4-155.

Figure 4-155 Potential Ashfall Areas for California Volcanoes



Source: USGS Bulletin 1847

Low-level volcanic unrest can persist for decades or even hundreds of years without an eruption. Although steady, low-level unrest is normal for many young volcanoes, rapidly accelerating unrest is cause for concern. At California's most threatening volcanoes, monitoring sensors are in place to continuously track levels of unrest. Such monitoring is necessary to determine the baseline, or background level, of activity at a volcano to help volcanologists know what is normal. An uptick in unrest may be a sign of increased volcanic threat.

Impacts

The impact of coarse air fall is limited to the immediate area of the volcanic vent. Structures may be damaged by accumulation of falling lava fragments or burnt by their high heat. Wildfires may be ignited by coarse ash. Although generally non-lethal, fine ash fall is the most widespread and disruptive volcanic hazard. People exposed to fine ash commonly experience various eye, nose, and throat symptoms. Short-term exposures are not known to pose a significant health hazard. Long-term health effects have not been demonstrated conclusively. Ash deposited downwind of the volcano covers everything like a snowfall, but also infiltrates cracks and openings in machinery, buildings, and electronics. Falling ash can obscure sunlight, reducing visibility to zero. When wet, it can make paved surfaces slippery and impassable. Fine ash is abrasive, damaging surfaces and moving parts of machinery, vehicles, and aircraft. Life-threatening and costly damage can occur to aircraft that fly through fine ash clouds. Newly fallen volcanic ash may result in short-term physical and chemical changes in water quality. Close to the volcano, heavy ash fall may cause roofs to collapse, wastewater systems to clog, and power systems to shut down. In agricultural areas, fine ash can damage crops, and sicken livestock. Resuspension of ash by human activity and wind cause continuing disruption to daily life.

Future Development

Future development in the County may be at risk to volcanic activity; however, future development is at no greater risk to volcanic activity than current development. Further, given the uncertainties with regard to volcanic activity, it is unlikely that future development activities would be constrained in any manner.

4.3.18. Wildfire

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Plumas County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

California is recognized as one of the most fire-prone and consequently fire-adapted landscapes in the world. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural and aboriginal ignition sources, has created conditions for extensive wildfires. Wildland fire is an ongoing concern for the Plumas County Planning Area. Generally, the fire season extends from early spring through late fall of each year during the hotter, dryer months. However, in recent years, wildfire season is more of a year around event. Fire conditions arise from a combination of high temperatures, low moisture content in the air and fuel, an accumulation of vegetation, and high winds.

Location and Extent

Wildfire risk in Plumas County varies by location. According to the 2014 LHMP, the areas with the highest risk of wildfire are spread throughout the County and are generally located in areas with greater fuel loads resulting from denser forestation. The area that has seen the highest number of fires is the Feather River Canyon along the CA-70 corridor due to the high volume of auto and rail traffic, and also its accessibility to the population increases its risk for human-triggered fires. It is more relevant to identify areas of lower fire hazard, which are the larger valleys such as Indian, American, and Sierra, and also the high elevation peaks that receive the most precipitation. Wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Wildland Urban Interface

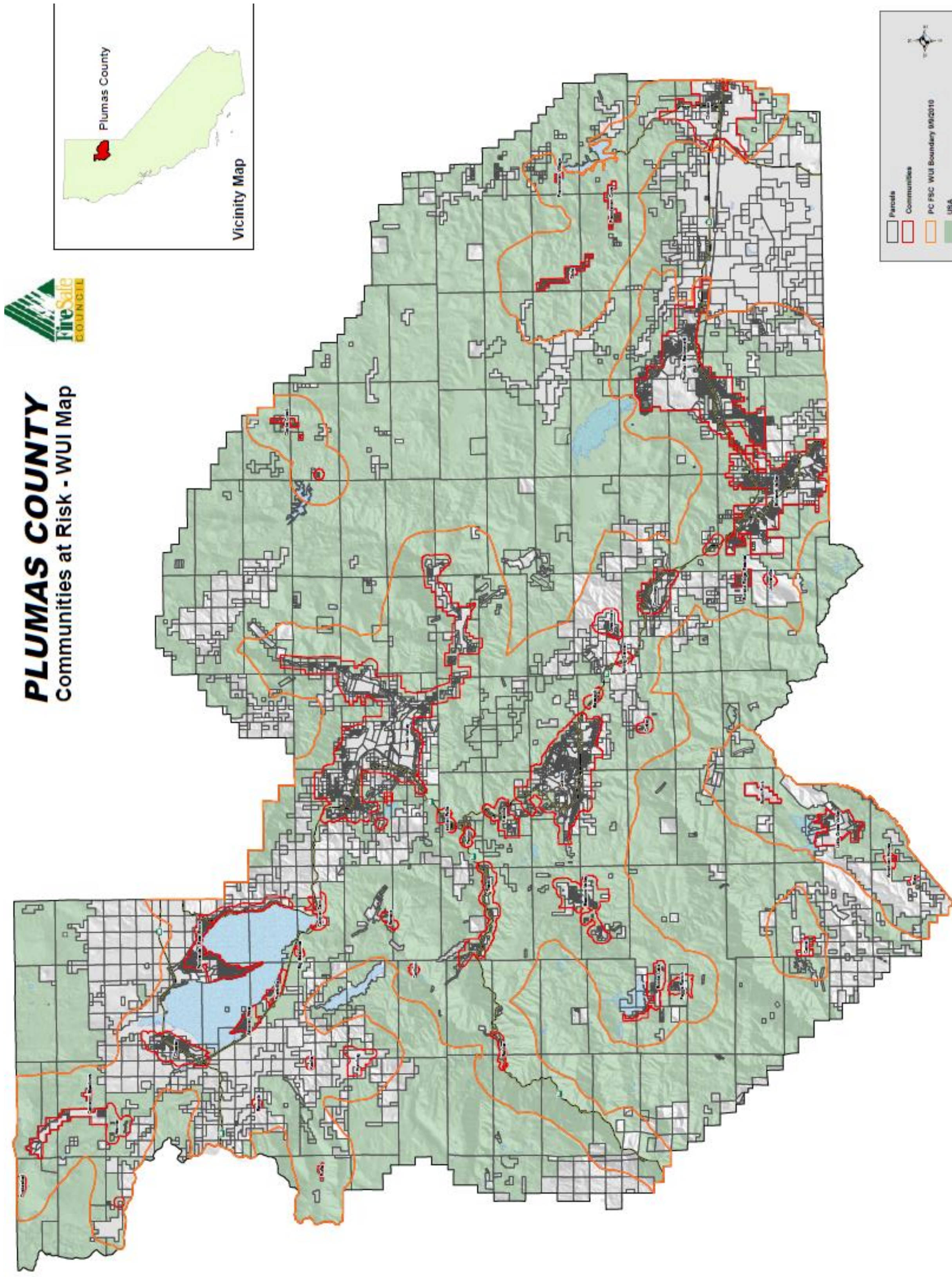
Throughout California, communities are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. While wildfire risk is predominantly associated with wildland urban interface (WUI) areas, significant wildfires can also occur in heavily populated areas. The WUI is a general term that applies to development adjacent to landscapes that support wildland fire. The WUI defines the community development into the foothills and mountainous areas of California. The WUI describes those communities that are mixed in with grass, brush and timbered covered lands (wildland). These are areas where wildland fire once burned only vegetation but now burns homes as well. The WUI for Plumas County consists of communities at risk as well as the area around the communities that pose a fire threat.

There are two types of WUI environments. The first is the true urban interface where development abruptly meets wildland. The second WUI environment is referred to as the wildland urban intermix. Wildland urban intermix communities are rural, low density communities where homes are intermixed in wildland areas. Wildland urban intermix communities are difficult to defend because they are sprawling communities over a large geographical area with wild fuels throughout. This profile makes access, structure protection, and fire control difficult as fire can freely run through the community.

WUI fires are often the most damaging. WUI fires occur where the natural and urban development intersect. Even relatively small acreage fires may result in disastrous damages. The damages are primarily reported as damage to infrastructure, built environment, loss of socio-economic values and injuries to people.

The pattern of increased damages is directly related to increased urban spread into historical forested areas that have wildfire as part of the natural ecosystem. Many WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern will now burn developed areas. WUI fires may also include fires that occur in remote areas that have critical infrastructure easements through them, including electrical transmission towers, railroads, water reservoirs, communications relay sites or other infrastructure assets. The WUI for Plumas County from the 2019 Plumas County Community Wildfire Protection Plan (CWPP) is shown on Figure 4-156.

Figure 4-156 WUI Boundaries in Plumas County



Source: 2019 Plumas County Community Wildfire Protection Plan

The HMPC did note that there is no standard definition of how to delineate the boundaries of any particular WUI area. The Fire Safe Council map that is embedded in the document was approved by the Plumas County Board of Supervisors. From the CWPP regarding Plumas County's WUI:

> ***In 2004-2005 when the first Plumas County WUI map was developed the concept was to have two WUI boundaries, an "Adjacent WUI" and an Extended WUI", (0-.75 and.75 to 1.5 mile respectively). Consequently, the GIS program generated WUI's with circles around the CAR's, using the above criteria.***
>
> ***In 2010, the WUI boundaries were expanded to better link communities and the WUI. While implementing the CWPP since 2005, it became apparent to PC FSC during collaborative project outreach & development that the earlier computer generated WUI boundaries should be more contiguous with respect to connecting communities and logical in terms of watersheds, ridges, valleys or roads. Earlier WUI circle maps weren't well suited to watershed scale and larger community project planning. On November 2, 2010 the Plumas County Board of Supervisors approved the updated "Wildland Urban Interface" Map.***

Plumas County Wildfire Setting

As previously stated, there are areas in the County that are prone to wildfire. Wildland fires affect grass, forest, and brushlands, as well as any structures located within them. Where there is human access to wildland areas the risk of fire increases due to a greater chance for human carelessness and historical fire management practices. Generally, there are four major factors that sustain wildfires and allow for predictions of a given area's potential to burn. These factors include fuel, topography, weather, and human actions.

- **Fuel** – Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles and leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also to be considered as a fuel source, are man-made structures and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for fire spread. The volume of available fuel is described in terms of Fuel Loading. Certain areas in and surrounding Plumas County are extremely vulnerable to fires as a result of overgrown fuels combined with a growing number of structures being built near and within rural lands. Fuel is the only factor that is under human control.
- **Topography** – An area's terrain and land slopes affect its susceptibility to wildfire spread. Fire intensities and rates of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The natural arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes. According to the Plumas County 2019 CWPP, Plumas County sits mostly in the Sierra Nevada Range and lies between the Central Valley and Great Basin. There are about 30 mountain peaks over 7,000 feet in elevation. Most of the population centers are over 3,400 feet. Wide ranges of elevation (1,600- 8,000+ feet) are responsible in part for the variety of climates and vegetation found in the County. Another significant factor is the continuous interaction of maritime

air masses with those of continental origin. The combination of these influences results in pronounced climatic changes within short distances.

- **Weather** – Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread, and the more intense it will be. Winds can be significant at times in Plumas County. Wind from the Central Valley is especially conducive to hot, dry conditions, in the Sierra Foothills, which can lead to extreme fire danger. Wind shifts, in addition to wind speed, can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. Most wind shifts in Plumas County occur in the Feather River Canyon. According to the 2019 CWPP, since 1970, most of the acres burned have been under southwest and north wind conditions. Critical fire weather patterns vary within the County, but mostly a southwest flow, which occurs across Plumas County due to the general wind flow associated with air moving from sea to land and California lying in the "Belt of the Westerlies" global circulation pattern. In addition to the general southwesterly flow, topography and local up canyon flow from diurnal heating of the Sacramento Valley compliment this air movement, usually increasing speeds. The strongest southwest winds are associated with frontal system or low-pressure trough. These winds tend to cause most of the large fires in the county to burn from the southwest to the northeast. On the western slopes of the County, before the crest of the Sierras, most large fires are driven from east to west by north and east winds, when a high-pressure form over the Great Basin and reversing normal air flows from land to sea. These conditions are magnified at night and in the early morning hours when down canyon winds are accelerated by the local diurnal process, the general flow and channeled topographically. These north and east wind events usually occur in the spring and fall, and have the largest impacts in the Feather River Canyons. In these events, relative humidity is also lower as the air mass originates on land versus sea, and as the air moves downslope it compresses, creating additional lowering. This is similar to what occurs in Southern California during Santa Ana conditions. Meteorologists with the US Forest Service conducted a study of these wind events. They found that while these patterns only occurred about 25% of the time in fire season, that 90% of large fires, on the western slopes, burned during those events. As part of a weather system, lightning also ignites wildfires, often in difficult to reach terrain for firefighters. Lightning also ignites wildfires, often in difficult-to reach terrain for firefighters. Related to weather is the issue of recent drought conditions contributing to concerns about wildfire vulnerability. During periods of drought, the threat of wildfire increases.
- **Human Actions** – Most wildfires are ignited by human action, the result of direct acts of arson, carelessness, or accidents. Many fires originate in populated areas along roads and around homes, and are often the result of arson or careless acts such as the disposal of cigarettes, use of equipment or debris burning. Recreation areas that are located in high fire hazard areas also result in increased human activity that can increase the potential for wildfires to occur.

Wildfires tend to be measured in structure damages, injuries, and loss of life as well as on acres burned and the intensity of the burn. CAL FIRE measures fuels in the areas as part of their Fire Hazard Severity maps. Extents are measured in the following Fire Hazard Severity Zones (FHSZ) categories (discussed in more detail below):

- Very High
- High

- Moderate
- Non-Wildland/Non-Urban
- Urban/Unzoned

Geographical extents of these FHSZs in the County can be found on Table 4-85.

Table 4-85 Plumas County – Geographical Extents of Fire Hazard Severity Zones

Fire Hazard Severity Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Very High	1,506,183	86.23%	39,220	51.41%	1,466,963	87.82%
High	111,978	6.41%	10,619	13.92%	101,359	6.07%
Moderate	71,238	4.08%	12,788	16.76%	58,450	3.50%
Non-Wildland/non-Urban	53,695	3.07%	11,368	14.90%	42,326	2.53%
Urban Unzoned	106	0.01%	55	0.07%	51	0.00%
Total	**1,743,200**	**99.80%**	**74,050**	**97.07%**	**1,669,150**	**99.92%**

Source: CAL FIRE

Fires can have a quick speed of onset, especially during periods of drought. Fires can burn for a short period of time, or may have durations lasting for a week or more.

Post-Wildfire Landslides and Debris Flows

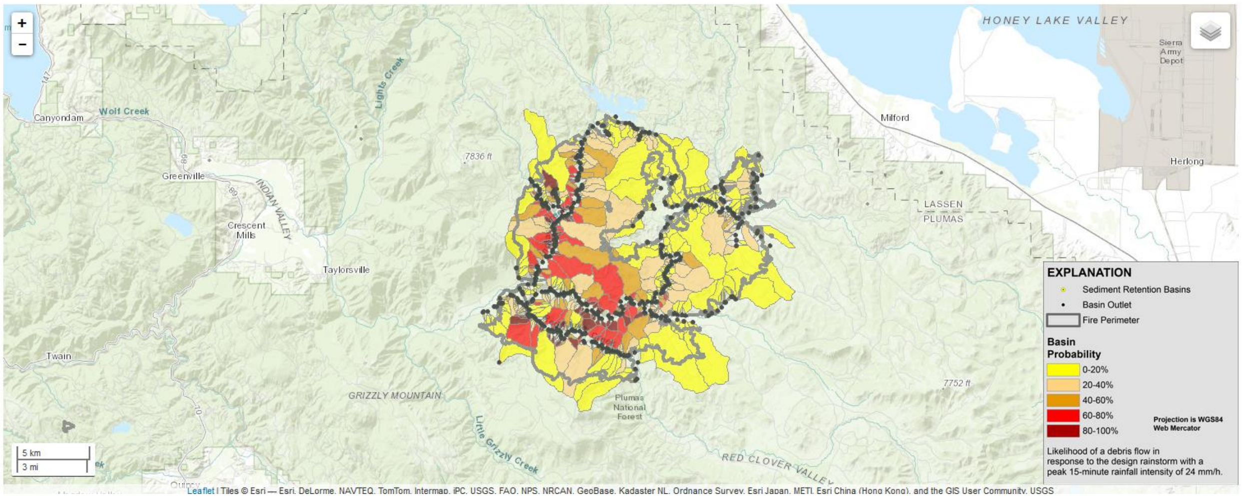
Post-wildfire landslides and debris flows are a concern in Plumas County. Fires that burn in sloped areas remove vegetation that holds hillsides together during rainstorms. Once that vegetation is removed, the hillside may be compromised, resulting in landslides and debris flows. Mapping of these areas has begun to occur.

2019 Walker Fire Landslide and Debris Flow Mapping

Post-fire debris flow hazard assessments for the Walker Fire were performed by the USGS. These assessments are prepared at the request of land and emergency management agencies responsible for managing wildfires impacts. The assessments are presented as a series of maps and geospatial data showing the probability of debris flows and their expected volume for burned drainage basins. Other landslide hazard assessments produced by the USGS are performed at the request of government agencies or sometimes as demonstration products from research to improve methods of hazard and risk assessment.

Figure 4-157 estimates of the likelihood of debris flow (in %), potential volume of debris flow (in m3), and combined relative debris flow hazard from the Walker Fire. These predictions are made at the scale of the drainage basin, and at the scale of the individual stream segment. Estimates of probability, volume, and combined hazard are based upon a design storm with a peak 15-minute rainfall intensity of 24 millimeters per hour (mm/h).

Figure 4-157 Walker Fire Landslide and Debris Flow Probabilities



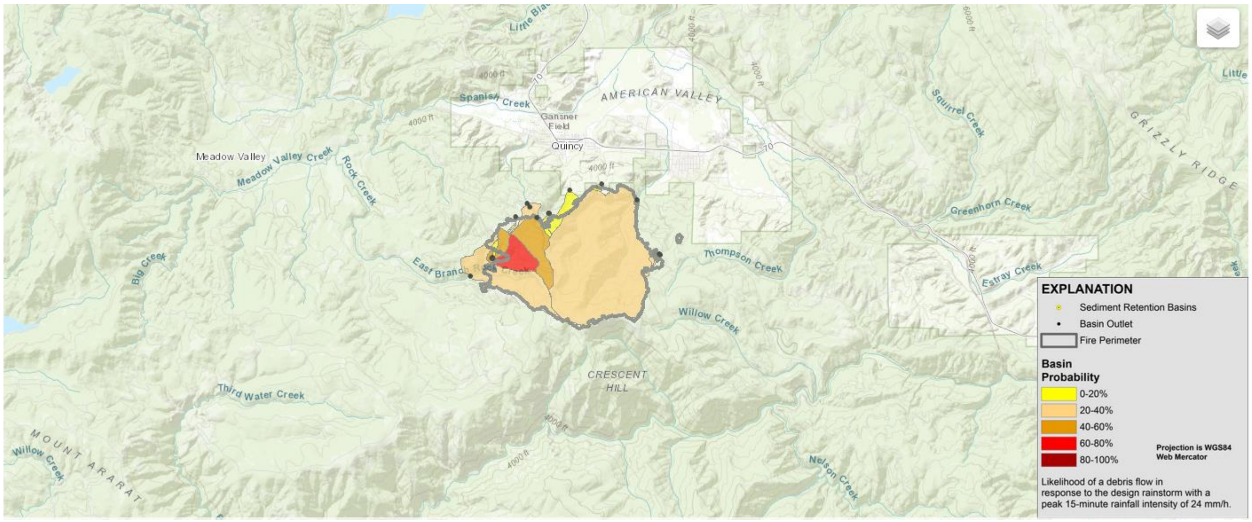
Source: USGS (https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=261)

2017 Minerva 5 Wildfire

Post-fire debris flow hazard assessments for the Minerva were performed by the USGS. These assessments are prepared at the request of land and emergency management agencies responsible for managing wildfires impacts. The assessments are presented as a series of maps and geospatial data showing the probability of debris flows and their expected volume for burned drainage basins. Other landslide hazard assessments produced by the USGS are performed at the request of government agencies or sometimes as demonstration products from research to improve methods of hazard and risk assessment.

Figure 4-158 estimates of the likelihood of debris flow (in %), potential volume of debris flow (in m3), and combined relative debris flow hazard from the Minerva 5 Fire. These predictions are made at the scale of the drainage basin, and at the scale of the individual stream segment. Estimates of probability, volume, and combined hazard are based upon a design storm with a peak 15-minute rainfall intensity of 24 millimeters per hour (mm/h).

Figure 4-158 Minerva 5 Fire Landslide and Debris Flow Probabilities



Source: USGS (https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=105)

Past Occurrences

Disaster Declaration History

A search of FEMA and Cal OES disaster declarations turned up three state and four federal events. This is shown in Table 4-86. The 2008 BTU Lightning Complex Fire caused the federal disaster in 2008 (along with other California wildfires that summer). The Bucks Fire caused a federal and state disaster declaration in 1999. The Plumas National Forest Fire #531 (known as the Clarks Fire) cause a state declaration in 1987 (along with other California wildfires that summer). An unnamed fire occurred in 1960 which caused a state declaration (along with other California wildfires that summer).

Table 4-86 Plumas County – State and Federal Disaster Declaration from Wildfire 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Fire	3	1960, 1987, 1999	4	1999, 2008, 2020 (twice)

Source: Cal OES, FEMA

NCDC Events

The NCDC has tracked wildfire events in the County dating back to 1993. Events in Plumas County in the database is shown in Table 4-87.

*Table 4-87 NCDC Wildfire Events in Plumas County 1993 to 9/30/2019**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Dense Smoke	1	0	0	0	0	$0	$0

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Wildfire	9	0	0	0	0	$22,775,000	$0
Total	**10**	**0**	**0**	**0**	**0**	**$22,775,000**	**$0**

Source: NCDC
*Deaths, injuries, and damages are for the entire event, and may not be exclusive to the County.

CAL FIRE Events

CAL FIRE, USDA Forest Service Region 5, Bureau of Land Management (BLM), the National Park Service (NPS), Contract Counties and other agencies jointly maintain a comprehensive fire perimeter GIS layer for public and private lands throughout the state. The data covers fires back to 1878 (though the first recorded incident for the County was in 1917). For the National Park Service, Bureau of Land Management, and US Forest Service, fires of 10 acres and greater are reported. For CAL FIRE, timber fires greater than 10 acres, brush fires greater than 50 acres, grass fires greater than 300 acres, and fires that destroy three or more residential dwellings or commercial structures are reported. CAL FIRE recognizes the various federal, state, and local agencies that have contributed to this dataset, including USDA Forest Service Region 5, BLM, National Park Service, and numerous local agencies.

Fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, fires were too small for the minimum cutoffs, documentation was inadequate, or fire perimeters have not yet been incorporated into the database. Also, agencies are at different stages of participation. For these reasons, the data should not be used for statistical or analytical purposes.

The data provides a reasonable view of the spatial distribution of past large fires in California. Using GIS, fire perimeters that intersect Plumas County since 1950 were extracted and are listed in Table 4-88. Each of them was tracked by CAL FIRE. Figure 4-159 shows largest 15 fires in the CAL FIRE database for the County from 1950 to 2018, colored by the size of the acreage burned. All wildfires in the CAL FIRE database that intersect the County can be found in Appendix G.

Figure 4-159 Plumas County – Wildfire History CAL FIRE 1910 to 2018

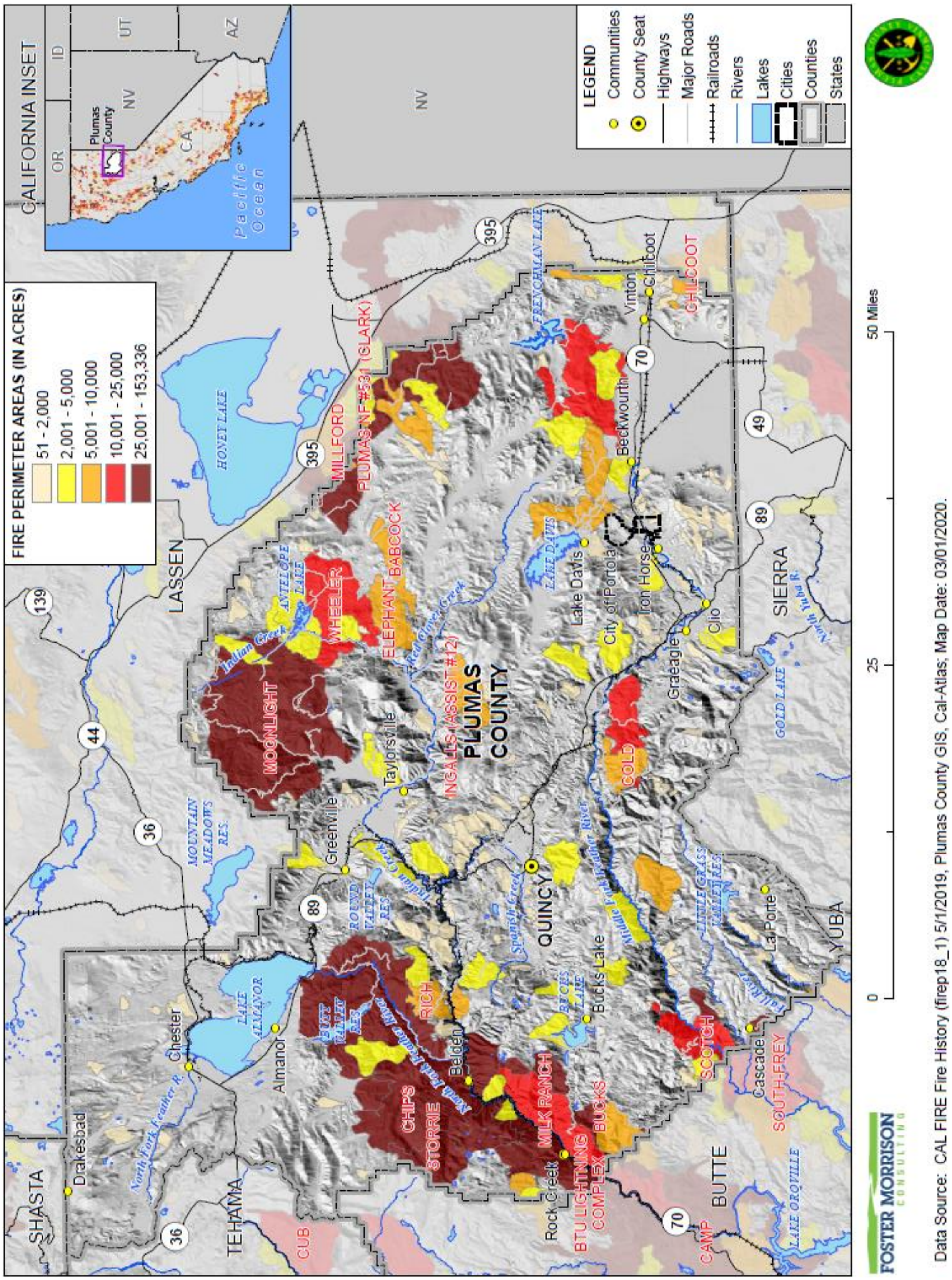


Table 4-88 Plumas County – Largest 15 Wildfires by Acres Burned 1950-2018

Wildfire Name	Date	Cause Description	GIS Acres
(blank)	–	Unknown/Unidentified	163,031
CHIPS	7/28/2012	Campfire	76,346
MOONLIGHT	9/3/2007	Equipment Use	64,512
STORRIE	8/17/2000	Railroad	55,729
(blank)	–	Miscellaneous	38,396
BUCKS	8/23/1999	Lightning	27,888
WHEELER	7/5/2007	Lightning	22,330
PLUMAS NF #531 (CLARK)	8/30/1987	Miscellaneous	19,391
BTU LIGHTNING COMPLEX	7/2/2008	Lightning	16,476
MILK RANCH	9/11/1951	Miscellaneous	14,505
(blank)	(blank)	Lightning	12,926
SCOTCH	6/21/2008	Lightning	9,799
ELEPHANT	9/17/1981	Lightning	6,852
INGALLS (ASSIST #12)	9/17/1981	Unknown/Unidentified	6,697
RICH	7/29/2008	Railroad	6,111

Source: CAL FIRE

Hazard Mitigation Planning Committee

The HMPC noted the following fires to affect the County:

An unnamed fire occurred in **1960** which caused a state declaration (along with other California wildfires that summer).

1979 – A member of the HMPC from Viera Ranch noted there was a forest fire in Indian Valley.

1984 - A member of the HMPC from Viera Ranch noted there were multiple fires caused by dry lightning in the area. These wildfires caused air quality issues in Quincy.

1987 – The Plumas National Forest Fire #531 (known as the Clarks Fire) cause a state declaration in 1987 (along with other California wildfires that summer).

1999 – The Bucks Fire caused a federal and state disaster declaration in 1999. Dry lightning caused 25 fires in the forest in the County. The Quincy area was very smokey, with ash falling like now. Winds increased and Meadow Valley was placed on standby for evacuation. Tobin was surrounded by fire.

2000 Storrie Fire – The Forest Service had about 2,600 federal, state and local firefighters, air tankers and helicopter crews to battle the fire that burned 52,000 acres over three weeks. The federal government estimates the cost of the fire at $22 million. The fire caused extensive damage to trees and destroyed 21,000 acres of wildlife habitat. The remaining $80 million of the settlement is earmarked for damages to natural resources, with the money used for the remediation of Lassen and Plumas national forests. Union Pacific

Railroad Co. has agreed to a $102 million settlement for damages from the Storrie forest fire in Lassen and Plumas national forests in 2000, the largest-ever federal settlement for a forest fire. Federal authorities allege Union Pacific employees failed to clear the area when they were using grinders and rail saws during repair work, sparking the fire on Aug. 17, 2000.

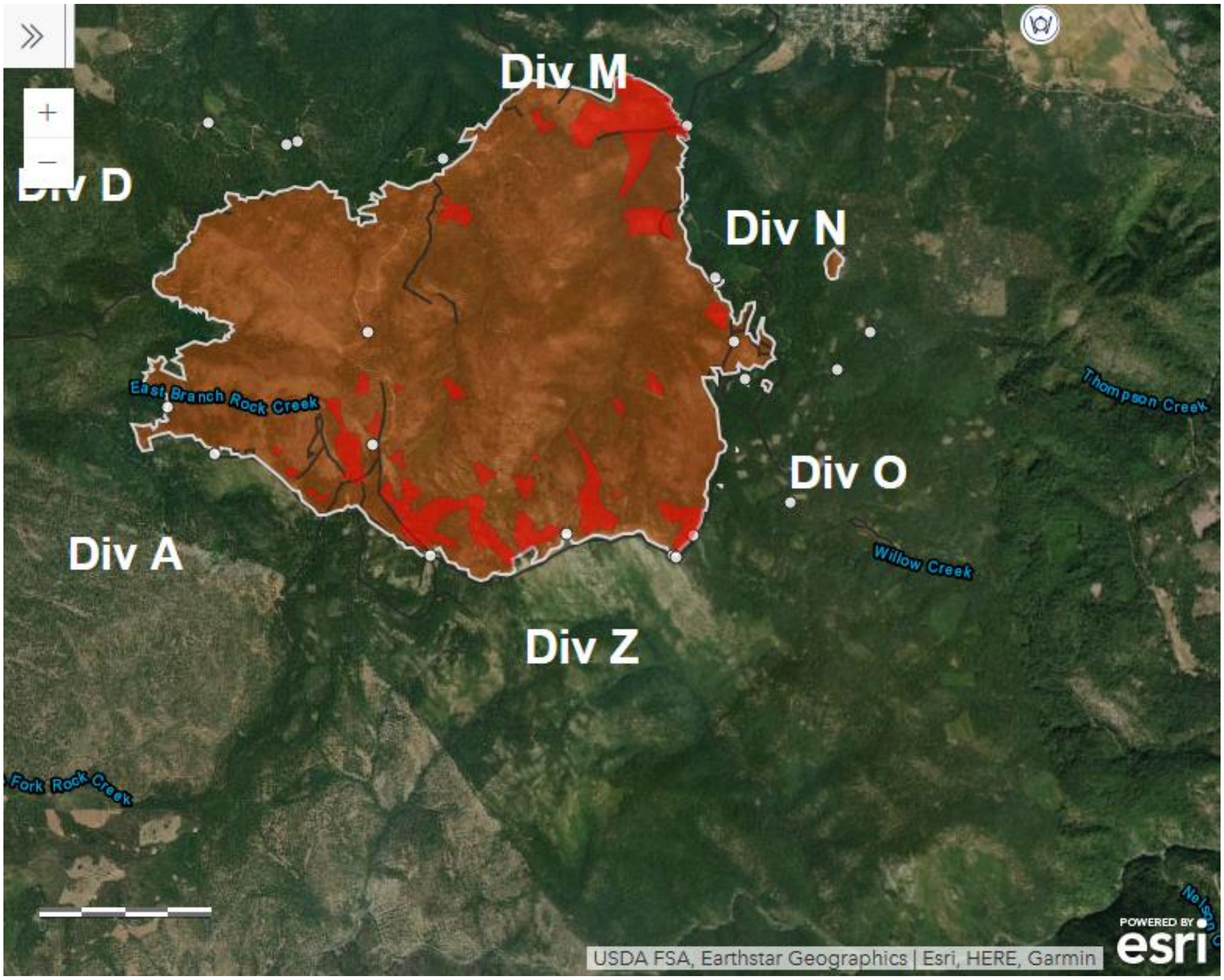
The **2007** Moonlight Fire was one of the most destructive fires in Plumas County history with a burn perimeter of 64,997 acres. Seven structures were destroyed, 2 residences and 5 outbuildings, and 1 outbuilding was damaged. An additional 25 residences and 10 outbuildings were threatened due to their location within the interior of the fire containment lines. 34 injuries and zero deaths were reported. The total cost of fighting the fire was $31.5 million, utilizing 42 engines, one helicopter, 11 dozers, 34 water tenders, 11 fire crews, and 707 total fire personnel. The blaze was caused by employees of Sierra Pacific Industries and a contractor who struck a rock with a dozer, causing sparks to ignite the dry ground in the area. The federal government was able to successfully sue the logging company for $122.5 million in damages resulting from the fire that killed 15 million trees.

The **2008** BTU Lightning Complex Fire caused the federal disaster in 2008 (along with other California wildfires that summer).

2012 Chips Fire – The Chips Fire burned in the Plumas National Forest. The fire started on July 28, causing damage estimated by the US Forest Service of $53.3 million. The Plumas County Sheriff's Office issued a mandatory evacuation for Butt Reservoir, Ohio Valley, Humbug, Humboldt Area, and Yellow Creek. An evacuation advisory was issued to all Canyon Dam, Big Meadows, Rocky Point Campground, Prattville, Almanor, and West Almanor residents and visitors. The distribution lines powering the City of Quincy and the Eastern Feather River were damaged by fire. PG&E crews were working to restore damaged distribution lines. A mandatory evacuation was ordered for Seneca and Ohio Valley, with voluntary evacuations for Rush Creek, Canyon Dam, Big Meadow, and Rocky Point. A Sheriff's advisory was in effect for West Almanor, Almanor, and Prattville.

2017 Minerva Fire – The Minerva Fire burned in July and August of 2017. The Minerva Fire almost burned into Quincy. On July 29th, the Plumas County Sherriff and OES stated "Residents of Quincy are strongly encouraged to start making emergency plans for the possibility of evacuation. Residents are encouraged to shut all windows, collect all personal documents, photos, avoid use of air conditioning, and locate your pets and keep them nearby." Air quality was poor in the County, especially near Quincy. The Oakland Camp area needed to be evacuated. The HMPC noted that they had school buses pick up evacuees from a fire near Oakland Camp and drop at fairgrounds/Red Cross. More than 1,800 firefighters were brought in to fight the blaze. The fire burned more than 4,300 acres. Authorities in Plumas County arrested a 36-year-old Quincy resident on suspicion of starting several fires in the surrounding forest, including the Minerva Fire. The burn area from the fire is shown on Figure 4-160.

Figure 4-160 Minerva Fire Burn Area



Source: https://yubanet.com/containedlocal16/minerva/

2018 Camp Fire – During the 2018 Camp Fire, there was a small area of Plumas County that was burned. High amounts of smoke caused air quality issues throughout the County. The EOC was mobilized for 4 to 5 days. Evacuees from Butte County were housed for a period of approximately 5 days. Mobilization costs were borne by the County and reimbursed by FEMA.

2019 Walker Fire – The Walker Fire was a wildfire that was burning in Genesee Valley in the Plumas National Forest approximately 11 miles east of the community of Taylorsville in Plumas County, California. The blaze was reported on Wednesday, September 4, 2019 and immediately expanded in size over its several days of burning. The fire actively threatened homes from Genesee Valley to Antelope Road. Communities along Highway 395 from Thunder Mountain Road (Wales Canyon) to the Laufman Grade (Old Highway 59), including the communities of Murdock Crossing, Stoney, Milford and Brockman Canyon, were under mandatory evacuation. On September 10, the Walker Fire had grown to 47,340 acres and was 12 percent contained. The Lassen County Fairground evacuation center was closed that morning. The majority of residential evacuation orders were lifted, except the Murdock Crossing and Stoney areas.

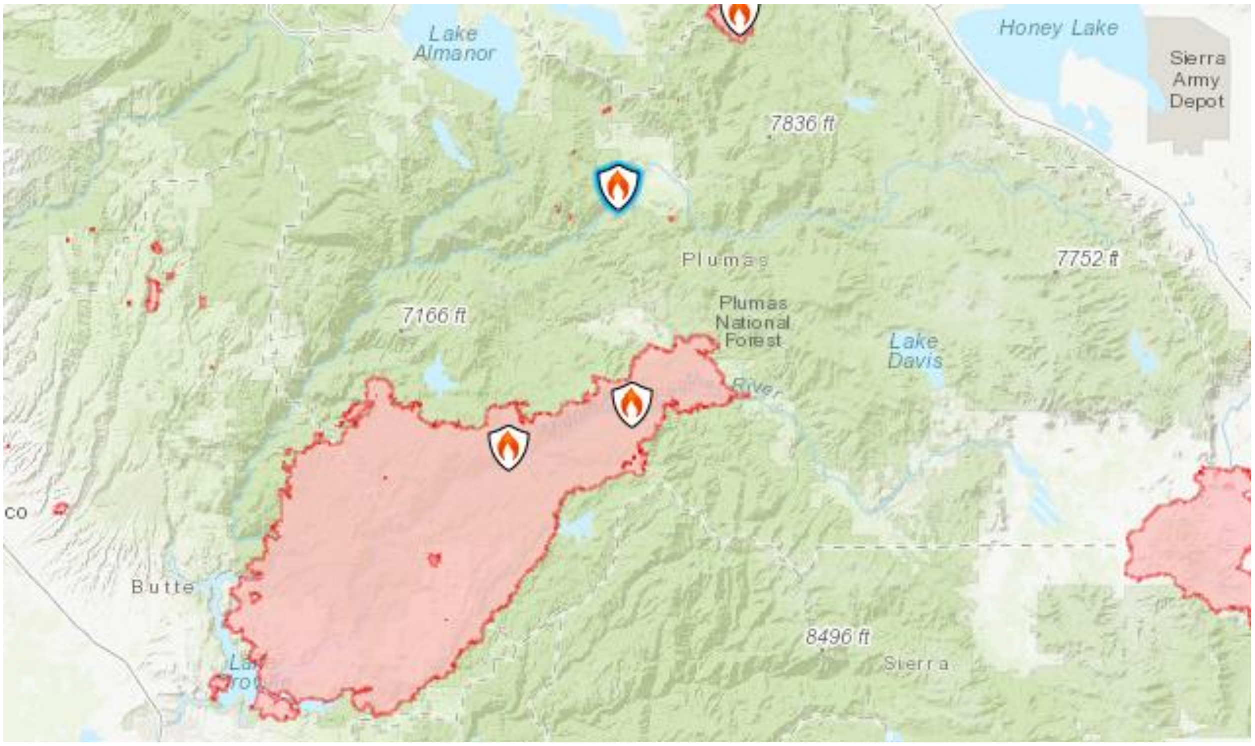
The next evening, the fire continued to grow, but was 28 percent contained. Crews extended dozer lines and handlines to expand the containment. Structural defense was put in place for buildings at Murdock Crossing and mop up continued at Antelope Lake, Round Mountain and the eastern side of the fire. However, by the morning of September 14, the fire had expanded to 54,612 acres and was 97 percent contained. By the time the fire was extinguished, 9 structures had been destroyed. 55,000 acres of grazing land were burned, with livestock water troughs and fencing burned. Damages to livestock grazing were in excess of $1.2 million. The Agriculture Commissioner noted that the loss of grazing lands affected both current year and potential future loss for up to 3 years based on government regulations and weather.

It is important to note that in addition to the Plumas County fire history detailed above, there are numerous smaller fires that occur in the area year after year. These smaller fires have the ability to quickly get out of hand and become significant fires. Also, depending on the area, small fires in acreage can result in large losses. The HMPC provided the following details on fire history in Plumas County.

July 2020 Hog Fire – The 2020 Hog Fire affected nearby Lassen County. Though it did not burn areas in Plumas County, there were impacts to Plumas County. The Hog Fire, in Lassen County near Susanville, destroyed the one cable bringing Internet into the Lake Almanor Basin, Greenville and beyond. Sheriff Todd Johns said that Frontier Communications replaced the damaged lines, only to have them destroyed again. Officials say an essential fiber optic cable was damaged by the fire on the morning of the 21st and impacted communications and connectivity for Susanville and neighboring Plumas County.

August and September 2020 North Complex Fire – The North Complex Fire was a massive wildfire currently burning in Northern California in the counties of Plumas and Butte. The fires were started by lightning on August 17, 2020; by September 5, all the individual fires had been put out with the exception of the Claremont and Bear Fires, which merged on that date. Starting on September 8, strong winds caused the Bear Fire to explode in size to the southwest. As of September 20, the complex fire had burned an estimated 291,200 acres. Smoke from the fire has created extremely unhealthy air conditions in Quincy and nearby communities for several weeks. There is a worry that the post-wildfire burn scar will pose landslide, debris flow, and flooding issues.

Figure 4-161 North Complex Fire Burn Area



Source: Cal Fire Inciweb. Retrieved 9/28/2020

Public Safety Power Shutoff Events

The County noted that there have been events in the past where wildfires have not occurred, but wildfire conditions were high. During these time of high winds, high temps, and high wildfire risk, a PSPS occurred in the County. These events from 2019 are discussed below:

Figure 4-162 Plumas County – 2019 PSPS Events

PG&E

2019 PSPS Overview for Plumas County

EVENT DETAILS	SEPT 23 - 26	OCT 5 - 6	OCT 9 - 12	OCT 23 - 25	OCT 26 - NOV 1
CUSTOMERS IMPACTED	~5	~5	~800	~300	~800
CRCs OPENED	0	0	1	0	0
CRC VISITORS	N/A	N/A	0	N/A	N/A

Note: All data is subject to change based on ongoing data reconciliation.

All data is preliminary and based on early 2020 work planning. Data as of March 2020.
Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

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The HMPC noted that PG&E has approached Feather River College about using its campus as a location during PSPS outages. The College has not committed.

Likelihood of Future Occurrence

Highly Likely — Traditionally, from May to October of each year (though becoming more of a year around threat in recent years), Plumas County faces a serious wildland fire threat. The threat of wildfire and potential losses are constantly increasing as human development and population increase and the wildland urban interface areas expand. Due to its high fuel load and long, dry summers, sizable portions of Plumas County continue to be at risk from wildfire. However, many of the fires occur in more remote areas of the County with limited structures and people at risk.

Climate Change and Wildfire

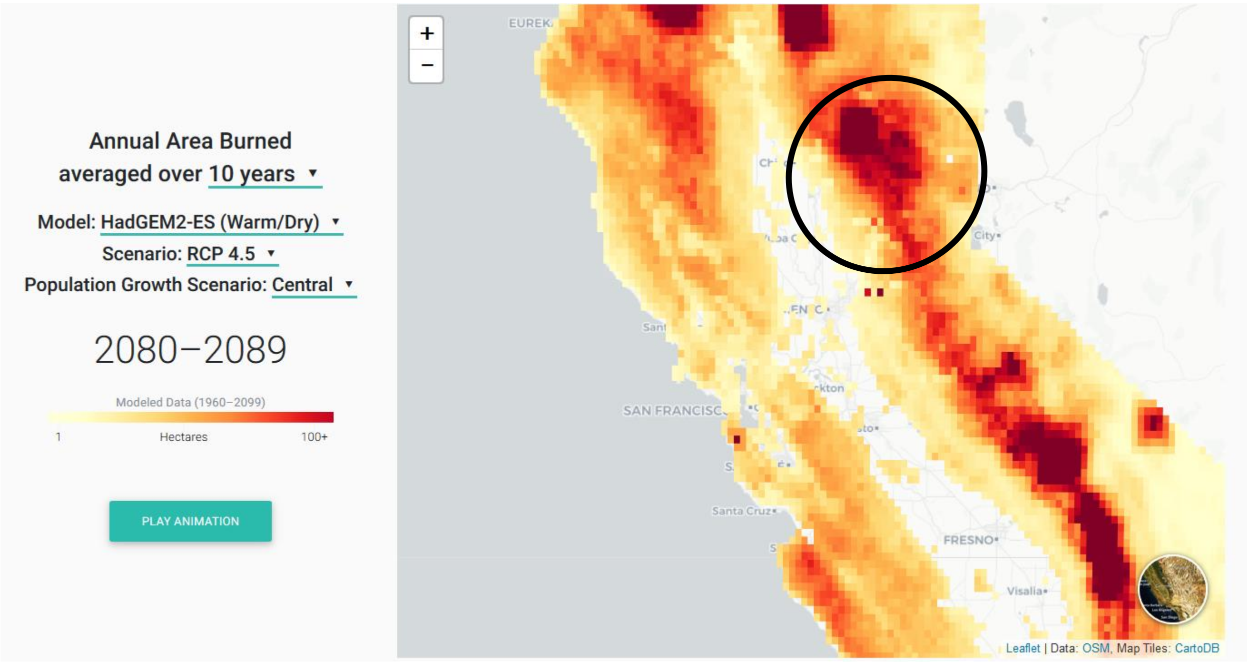
Climate change and its effects on wildfire come from two sources:

- Cal-Adapt
- 2019 Plumas County CWPP

Cal-Adapt

Warmer temperatures can exacerbate drought conditions. Drought often kills plants and trees, which serve as fuel for wildfires. Warmer temperatures could increase the number of wildfires and pest outbreaks, such as the western pine beetle. Cal-Adapt's wildfire tool predicts the potential increase in the amount of burned areas for the year 2080-2089, as compared to recent (2010) conditions. This is shown in Figure 4-163. Based on this model, Cal-Adapt predicts that wildfire risk in Plumas County will increase slightly (and much less than other California counties) in the near term and subside during mid-to late-century. However, wildfire models can vary depending on the parameters used. Cal-Adapt does not take landscape and fuel sources into account in their model. In all likelihood, in Plumas County, precipitation patterns, high levels of heat, topography, and fuel load will determine the frequency and intensity of future wildfire.

Figure 4-163 Plumas County – Projected Increase in Wildfire Burn Areas



Source: Cal-Adapt

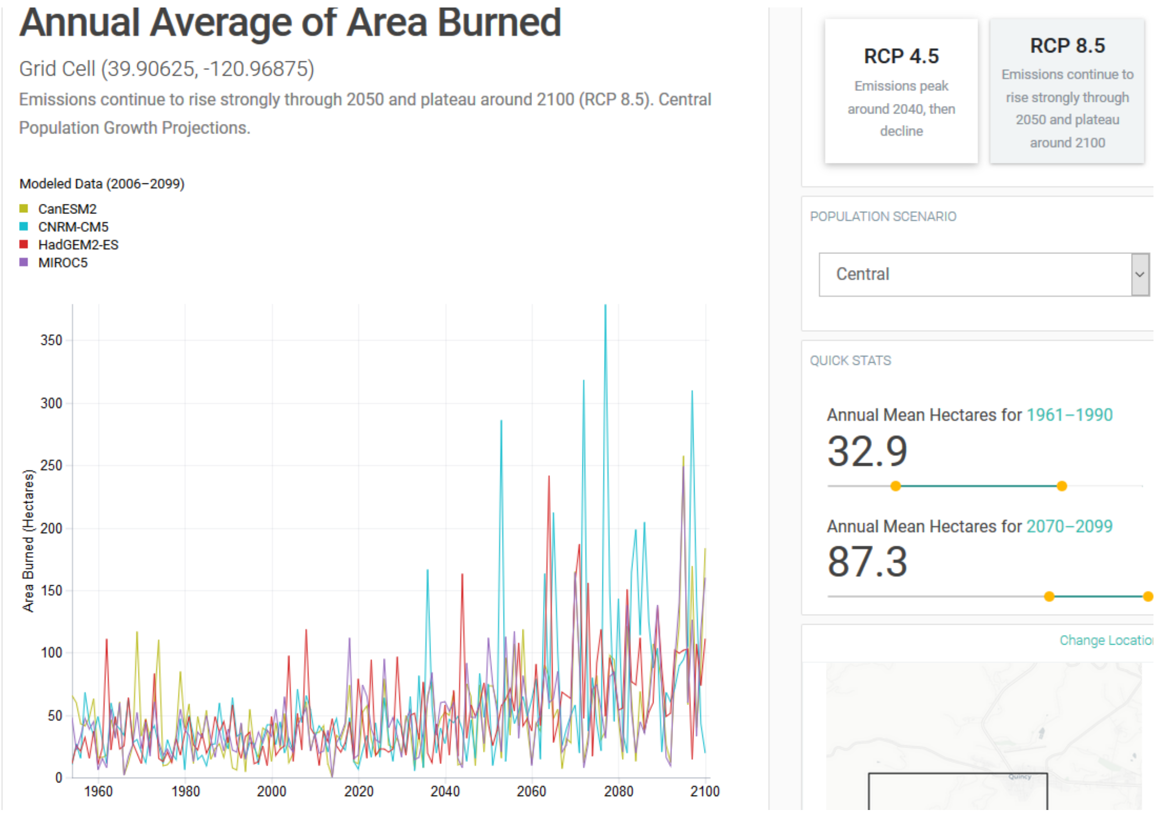
Cal-Adapt has also sought to model annual averages of area burned in the State. Four models have been selected by California's Climate Action Team Research Working Group as priority models for research contributing to California's Fourth Climate Change Assessment. Projected future climate from these four models can be described as producing:

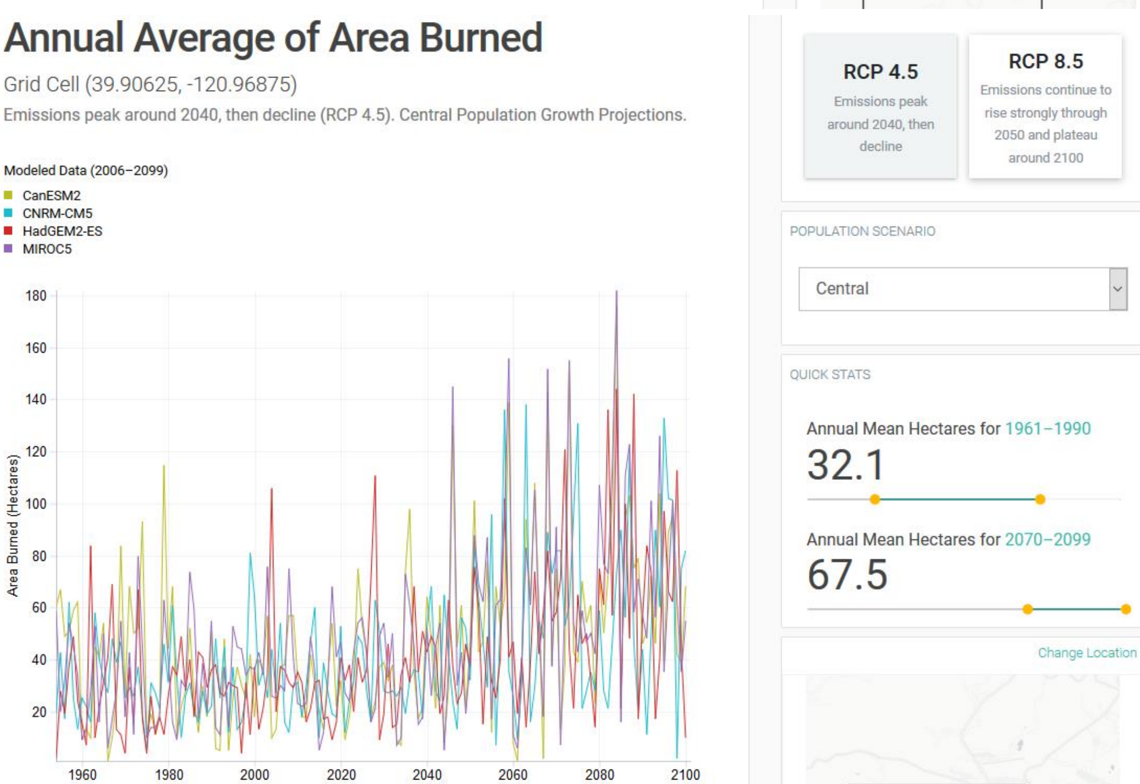
- A warm/dry simulation (HadGEM2-ES) – shown by the red line on the below charts
- A cooler/wetter simulation (CNRM-CM5) – shown by the blue line on the below charts
- An average simulation (CanESM2) – shown by the green line on the below charts
- The model simulation that is most unlike the first three for the best coverage of different possibilities (MIROC5) – shown by the purple line on the below charts

Future modeled annual averages of area burned from Cal-Adapt for the Plumas County Planning (using the quad that contains the City of Quincy) are shown in Figure 4-164. It shows the following:

- The upper chart shows modeled annual averages of area burned for the selected area on map under the RCP 8.5 scenario in which emissions continue to rise strongly through 2050 and plateau around 2100.
- The lower chart shows modeled annual averages of area burned for the selected area on map under the RCP 4.5 scenario in which emissions peak around 2040, then decline.

Figure 4-164 Plumas County – Future Acreage Burned: High and Low Emission Scenarios





Source: Cal-Adapt – Annual Average of Acres Burned

2019 Plumas County CWPP

The 2019 Plumas County CWPP noted that the majority of scientific research concerning climate trends indicates that climate has been changing since the mid-twentieth century. Trends suggest that the northern Sierra Nevada may become generally warmer and wetter, with longer periods of prolonged summer drought. While warmer and wetter weather patterns may increase forest growth and carbon sequestration, warmer temperatures – in combination with longer periods of prolonged summer drought – will likely increase forest insect and disease outbreaks and the occurrence of high severity fire – disturbances which may result in increased carbon losses. Such high severity disturbances could result in type-conversion to shrublands in forested ecosystems that are not adapted to such disturbance patterns – which could drastically alter carbon cycles in the short and long term. High-intensity wildfires, drought, and declining forest health are some effects of climate change that are worsening the threats to forests and reducing forest productivity.

Hotter and drier weather alter forest hydrology and water balance available to forest communities. Increased temperatures alter the timing of snowmelt, affecting the seasonal availability of water with earlier dry conditions which then provides fuel to earlier and hotter fires from stressed trees and shrubs. Drought also reduces trees' ability to produce sap, which protects them from destructive insects and diseases. Research has found that large trees may be most susceptible to climate driven mortality – which the authors suggested can also be compounded by high stand densities of small trees due to fire suppression. Others suggest that "regional warming and consequent increases in water deficits are likely contributors to the increase in mortality rates," and suggest that exogenous warming trends may be more of a driver of mortality, particularly in large diameter trees, than increasing stand density. Nonetheless, research indicates that warming climate is driving changes in forest structure.

Vulnerability Assessment

Vulnerability—High

Risk and vulnerability to the Plumas County Planning Area from wildfire is of concern, with some areas of the County being at greater risk than others as described further in this section. High fuel loads in portions of the County, along with geographical and topographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. During the May to October fire season, the dry vegetation and hot and sometimes windy weather, combined with continued growth in the WUI areas, results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the County, especially in these interface areas, the risk and vulnerability to wildfires will likely increase.

The 2035 General Plan Public Health and Safety Element noted that suppression of natural fires has allowed the forest understory to become dense, creating the potential for larger and more intense wildland fires. Wind, steepness of terrain, and naturally volatile or hot-burning vegetation contributes to wildland fire hazard potential.

Impacts

Wildfires can result in loss of life, injuries, damage to structures, and can cause short-term and long-term disruption to the County. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the County by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Fires may result in casualties and can destroy buildings and infrastructure. The HMPC noted that there have had several times when wildfire took out all the communications towers, including 911 systems.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In some cases, the economic impact of this loss of services may be comparable to the economic impact of physical damages or, in some cases, even greater. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Fires can also cause major damage to power plants and power lines needed to distribute electricity to operate facilities. As a result of PSPS incident, many resident have purchased generators. These generators are becoming a fire hazard. In 2019, a generator started a house fire in Pioneer.

In Plumas County, past wildfires have caused damages to the County. The County has suffered loss of structures, loss of tax revenue, high costs to battle fires, and loss of lives. The HMPC has noted that both developed and undeveloped areas are at risk. Loss of industrial timberlands, grazing lands, agricultural crops may occur as a result of wildfire. Localized road and school closures have been reported during wildfires. Roads, bridges, telecommunications and high voltage transmission lines are also at risk to wildfire.

Potential losses from wildfire include human life, structures and other improvements, natural and cultural resources, quality and quantity of water supplies, cropland, timber, and recreational opportunities. Economic losses could also result. Smoke and air pollution from wildfires can be a severe health hazard. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides and mudflows, and erosion during the rainy season.

In addition, there are natural resources at risk when wildland-urban interface fires occur. One is the watershed and ecosystem losses that occur from wildland fires. This includes impacts to water supplies and water quality as well as air quality. Another is the aesthetic value of the area. Major fires that result in visible damage detract from that value. Other assets at risk include wildland recreation areas, wildlife and habitat areas, and rangeland resources. The loss to these natural resources can be significant.

Wildfire (Smoke) and Air Quality

During many summer months in past years, Plumas County residents have had to breathe wildfire smoke, from fires both within and outside of the County. Smoke from wildfires is made up of gas and particulate matter, which can be easily observed in the air. Air quality standards have been established to protect human health with the pollutant referred to as PM2.5 which consists of particles 2.5 microns or less in diameter. These smaller sizes of particles are responsible for adverse health effects because of their ability to reach the lower regions of the respiratory tract.

Cal-Adapt is an online tool put together by the California Energy Commission that downscales global climate models to the California level with projections for sea-level rise, drought, temperature increase, heat, and wildfire, from 2020 out to 2085. Figure 4-163 showed the 2085 wildfire projection for Plumas County. Air quality in these areas of the County could be greatly reduced due to wildfire if the scenario projected is accurate.

Insurance in WUI Areas

The HMPC noted that in the WUI areas, there has been increased difficulty in obtaining home insurance and the cost of insurance premiums. Some residents have experienced cancellations of their policies due to catastrophic and recent wildfires occurring throughout California which has reduced the risk tolerance of many insurance companies. This increases costs to those who live in the WUI, and in some circumstances limits where people choose to live.

The HMPC noted additionally that insurance premium increases and policy cancellations not only increase the cost of living (a particular challenge for those in DAC and SDAC communities) it also affects the real estate industry and, in turn, the tax base. This can have implications for schools and infrastructure in the County.

Wildfire Analysis

The Plumas County Planning Area has mapped CAL FIRE fire hazard severity zones (FHSZs) based on fire responsibility areas as further described below. GIS was used to determine the possible impacts of wildfire within the County and how the wildfire risk varies across the Planning Area. The wildfire analysis includes an analysis of affected parcels and values by Fire Responsibility areas and by CAL FIRE's FHSZs.

Fire Responsibility Area Analysis

There are numerous wildland fire protection agencies that have responsibility within the County, including the USFS, the BLM, the BIA, and CAL FIRE. There are also numerous fire departments and fire protection districts that serve local areas, many of whom have mutual aid agreements with each other as well as state and federal agencies for fire suppression and protection. Fire Responsibility areas are generally categorized by Federal Responsibility Areas (FRA), State Responsibility Areas (SRA) and Local Responsibility Areas (LRA).

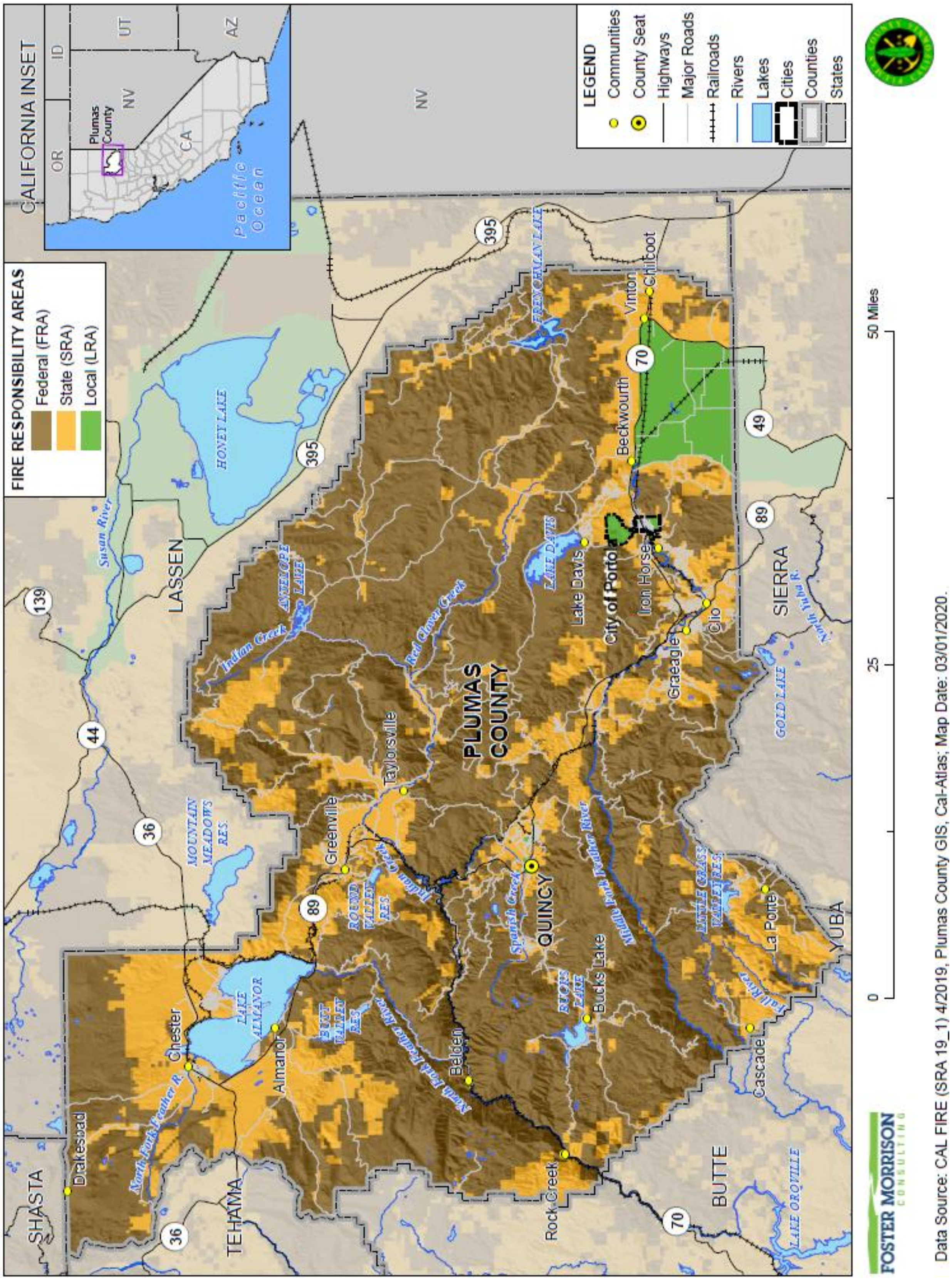
The CAL FIRE data, detailing Fire Responsibility Areas within the County Planning Area, was utilized to determine the locations, numbers, types, and values of land and structures falling within each Fire Responsibility Area. The following sections provide details on the methodology and results for this analysis.

Methodology

CAL FIRE has a legal responsibility to provide fire protection on all SRA lands, which are defined based on land ownership, population density and land use. CAL FIRE's State Responsibility Area layer was used in this analysis to show Plumas County's parcel counts and values by FRA, SRA, and LRA.

The fire responsibility area layer was overlaid with the parcel data. Since it is possible for any given parcel to intersect with multiple fire responsibility areas, for purposes of this analysis, the parcel centroid was used to determine which fire responsibility area to assign to each parcel. Once completed, the parcel boundary layer was joined to the centroid layer and values were transferred based on the identification number in the Assessor's database and the FIS parcel layer. Based on this approach, the fire responsibility areas for the Plumas County Planning Area were determined and further broken out by property use and included information on both land and improved values. Locations of each responsibility area are shown in Figure 4-165.

Figure 4-165 Plumas County Planning Area – Fire Responsibility Areas by FRA, SRA, LRA



Fire Responsibility Areas and Values at Risk Results

Most of the physical area of Plumas County falls in the FRA and SRA. The FRA contains 851 parcels, of which 3 are improved. The SRA contains 11,492 improved parcels, with over $4.3 billion in total value. The LRA has 2,241 improved parcels with $762 million in total value. It should be noted that fire does not just affect structural values, fire can also affect land values. As such the Assessor's land values and all parcels were accounted for in this analysis to represent total county values at risk. However, it is highly unlikely the whole County will ever be on fire at once. The County parcel inventory and associated values by fire responsibility area are provided in Table 4-89 for the entire Plumas County Planning Area, as described in the Values at Risk in Section 4.2. Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the fire hazard severity zones due primarily to Proposition 13 and to a lesser extent properties falling under the Williamson Act.

Table 4-89 Plumas County Planning Area – Count and Value of Parcels by Local, State, and Federal Responsibility Areas by Property Use

Fire Responsibility Area	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
FRA	851	3	$82,693	$71,521	$0	$50,344	$204,558
SRA	20,753	11,492	$1,171,362,962	$2,070,122,430	$11,047,284	$1,117,730,814	$4,370,263,490
LRA	2,802	2,241	$114,697,139	$362,897,827	$7,587,111	$276,779,944	$761,962,021
Grand Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**

Source: CAL FIRE, Plumas County 12/31/2018 Parcel/Assessor's Data

Fire Hazard Severity Zone Analysis

As part of the Fire and Resource Assessment Program (FRAP), CAL FIRE was mandated to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as FHSZs, then define the application of various mitigation strategies to reduce risk associated with wildland fires.

Fire hazard is a way to measure the physical fire behavior so that people can predict the damage a fire is likely to cause. Fire hazard measurement includes the speed at which a wildfire moves, the amount of heat the fire produces, and most importantly, the burning fire brands that the fire sends ahead of the flaming front.

The fire hazard model developed by CAL FIRE considers the wildland fuels. Fuel is that part of the natural vegetation that burns during the wildfire. The model also considers topography, especially the steepness of the slopes. Fires burn faster as they burn up-slope. Weather (temperature, humidity, and wind) has a significant influence on fire behavior. The model recognizes that some areas of California have more frequent and severe wildfires than other areas. Finally, the model considers the production of burning fire brands (embers) how far they move, and how receptive the landing site is to new fires.

In 2007, CAL FIRE updated its FHSZ maps for the State of California to provide updated map zones, based on new data, science, and technology that will create more accurate zone designations such that mitigation strategies are implemented in areas where hazards warrant these investments. The zones will provide specific designation for application of defensible space and building standards consistent with known mechanisms of fire risk to people, property, and natural resources. The program is still ongoing with fire hazard severity zone maps being updated based on designated responsibility areas: FRA, SRA, and LRA.

The CAL FIRE data, detailing FHSZs within the Plumas County Planning Area, was utilized to determine the locations, numbers, types, and values of land and structures falling within each FHSZ. The following sections provide details on the methodology and results for this analysis.

Methodology

CAL FIRE mapped the SRA FHSZs, or areas of significant fire hazard, based on fuels, terrain, weather, and other relevant factors. Zones are designated with Very High, High, Moderate, Non-Wildland/Non-Urban and Urban Unzoned hazard classes. The goal of this mapping effort is to create more accurate fire hazard zone designations such that mitigation strategies are implemented in areas where hazards warrant these investments. The FHSZs will provide specific designation for application of defensible space and building standards consistent with known mechanisms of fire risk to people, property, and natural resources.

The "Draft" LRA FHSZ (c6fhszl06_1) dated September 2007 layer and the Adopted SRA FHSZ (fhszs06_3_6) dated November 2007 were used to get a complete coverage of Fire Hazards.

Analysis was performed using the FHSZ datasets, and using GIS, the parcel layer was overlaid on the Draft and Adopted FHSZ layers. For the purposes of this analysis, if the parcel centroid intersects the zone's area, it will be assumed that the entire parcel is in that area. This analysis illustrates the FHSZs specific to the Planning Area and the unincorporated County.

Fire Hazard Severity Zones Analysis Results: Values at Risk

The FHSZs in Plumas County are shown in Figure 4-166. Analysis results for Plumas County are summarized in Table 4-90 and broken out by property use in Table 4-91. These tables summarize total parcel counts, improved parcel counts, and their improved and land values, other values, and the estimated contents replacement values based on the CRV factors detailed in Table 4-6.

Figure 4-166 Plumas County Planning Area – Fire Hazard Severity Zones

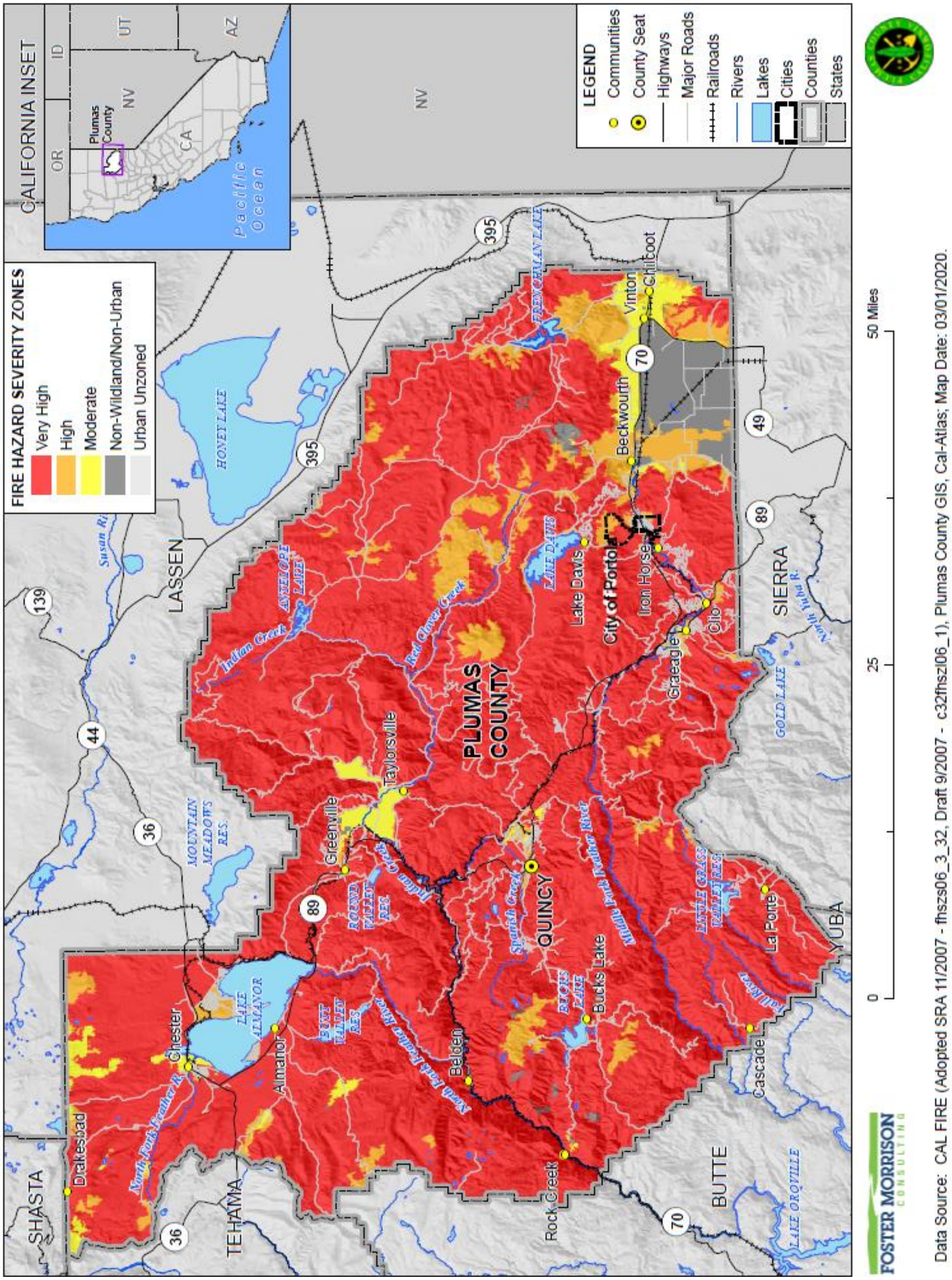


Table 4-90 Plumas County Planning Area – Count and Value of Parcels in Fire Hazard Severity Zones

Fire Hazard Severity Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Very High	15,077	7,919	$625,137,169	$1,199,929,774	$5,144,346	$648,472,350	$2,478,683,639
High	7,405	4,552	$536,265,058	$986,940,105	$5,389,174	$547,521,263	$2,076,115,600
Moderate	1,595	1,073	$107,749,579	$195,097,153	$6,584,813	$135,902,803	$445,334,348
Non-Wildland/Non-Urban	163	63	$11,861,793	$8,059,341	$1,173,270	$7,591,665	$28,686,069
Urban Unzoned	166	129	$5,129,195	$43,065,405	$342,792	$55,073,021	$103,610,413
Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**

Source: CAL FIRE, Plumas County February 2020 Parcel/Assessor's Data

Table 4-91 Plumas County Planning Area – Count and Value of Parcels in Fire Hazard Severity Zones by Property Use

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Very High							
Agricultural	1,629	167	$63,634,788	$9,922,123	$214,838	$9,922,123	$83,693,872
Commercial	380	247	$26,245,635	$60,124,482	$1,116,488	$60,124,482	$147,611,087
Federal Lands	206	0	$0	$0	$0	$0	$0
Government	460	0	$143,742	$0	$0	$0	$143,742
Industrial	49	28	$2,915,409	$3,075,066	$0	$4,612,599	$10,603,074
Institutional	43	25	$845,530	$8,581,918	$70,710	$8,581,918	$18,080,076
Miscellaneous	92	0	$8,119	$0	$0	$0	$8,119
Recreational	435	41	$8,711,556	$12,236,271	$1,370,705	$12,236,271	$34,554,803
Residential	11,133	7,411	$522,632,390	$1,105,989,914	$2,371,605	$552,994,957	$2,183,988,866
ROW/Utilities	650	0	$0	$0	$0	$0	$0
Very High Total	**15,077**	**7,919**	**$625,137,169**	**$1,199,929,774**	**$5,144,346**	**$648,472,350**	**$2,478,683,639**
High							
Agricultural	116	22	$14,709,786	$5,381,274	$30,562	$5,381,274	$25,502,896
Commercial	360	259	$31,785,031	$74,735,975	$3,510,251	$74,735,975	$184,767,232
Federal Lands	6		$0	$0	$0	$0	$0
Government	86		$0	$0	$0	$0	$0
Industrial	35	22	$2,329,289	$3,308,741	$3,120	$4,963,112	$10,604,262
Institutional	27	14	$896,583	$3,357,032	$0	$3,357,032	$7,610,647

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Miscellaneous	12		$0	$0	$0	$0	$0
Recreational	76	55	$5,269,263	$18,010,657	$59,240	$18,010,657	$41,349,817
Residential	6,378	4,180	$481,275,106	$882,146,426	$1,786,001	$441,073,213	$1,806,280,746
ROW/Utilities	309	0	$0	$0	$0	$0	$0
High Total	**7,405**	**4,552**	**$536,265,058**	**$986,940,105**	**$5,389,174**	**$547,521,263**	**$2,076,115,600**
Moderate							
Agricultural	171	58	$19,432,016	$5,208,224	$922,149	$5,208,224	$30,770,613
Commercial	110	91	$9,643,026	$61,986,773	$5,095,089	$61,986,773	$138,711,661
Federal Lands	1	0	$0	$0	$0	$0	$0
Government	38	0	$0	$0	$0	$0	$0
Industrial	45	23	$2,866,861	$4,527,585	$18,164	$6,791,378	$14,203,988
Institutional	13	4	$99,442	$458,286	$5,445	$458,286	$1,021,459
Miscellaneous	11	0	$0	$0	$0	$0	$0
Recreational	5	0	$0	$0	$0	$0	$0
Residential	1,114	897	$75,708,234	$122,916,285	$543,966	$61,458,143	$260,626,628
ROW/Utilities	87	0	$0	$0	$0	$0	$0
Moderate Total	**1,595**	**1,073**	**$107,749,579**	**$195,097,153**	**$6,584,813**	**$135,902,803**	**$445,334,348**
Non-Wildland/Non-Urban							
Agricultural	69	31	$8,164,038	$3,355,287	$1,126,390	$3,355,287	$16,001,002
Commercial	4	3	$267,336	$1,021,107	$46,880	$1,021,107	$2,356,430
Federal Lands	1	0	$0	$0	$0	$0	$0
Government	5	0	$0	$0	$0	$0	$0
Industrial	14	9	$1,129,647	$1,373,797	$0	$2,060,696	$4,564,140
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	14	0	$0	$0	$0	$0	$0
Recreational	5	0	$0	$0	$0	$0	$0
Residential	40	20	$2,300,772	$2,309,150	$0	$1,154,575	$5,764,497
ROW/Utilities	11	0	$0	$0	$0	$0	$0
Non-Wildland/Non-Urban Total	**163**	**63**	**$11,861,793**	**$8,059,341**	**$1,173,270**	**$7,591,665**	**$28,686,069**
Urban Unzoned							
Agricultural	0	0	$0	$0	$0	$0	$0
Commercial	13	9	$724,420	$1,022,616	$0	$1,022,616	$2,769,652
Federal Lands	0	0	$0	$0	$0	$0	$0
Government	1	0	$0	$0	$0	$0	$0

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Personal Property Value	Estimated Contents Value	Total Value
Industrial	4	2	$458,430	$32,816,957	$293,260	$49,225,436	$82,794,083
Institutional	4	2	$42,845	$300,896	$3,750	$300,896	$648,387
Miscellaneous	0	0	$0	$0	$0	$0	$0
Recreational	1	1	$135,089	$123,211	$0	$123,211	$381,511
Residential	140	115	$3,768,411	$8,801,725	$45,782	$4,400,863	$17,016,781
ROW/Utilities	3	0	$0	$0	$0	$0	$0
Urban Unzoned Total	**166**	**129**	**$5,129,195**	**$43,065,405**	**$342,792**	**$55,073,021**	**$103,610,413**
Unincorporated Plumas County Total	**24,406**	**13,736**	**$1,286,142,794**	**$2,433,091,778**	**$18,634,395**	**$1,394,561,101**	**$5,132,430,068**

Source: CAL FIRE, Plumas County February 2020 Parcel/Assessor's Data

Population at Risk

A separate analysis was performed to determine population that reside in FHSZs. Using GIS, the CAL FIRE FHSZ datasets were overlayed on the improved residential parcel data. Those parcel centroids that intersect each FHSZ were counted and multiplied by the Census Bureau average household size; results were tabulated by FHSZ (see Table 4-92). According to this analysis, there is a population of 2,081 in the Moderate FHSZ, 9,698 in the High FHSZ, and 17,193 in the Very High FHSZ in the County.

Table 4-92 Plumas County Planning Area – Residential Populations at Risk in Moderate or Higher Fire Hazard Severity Zones

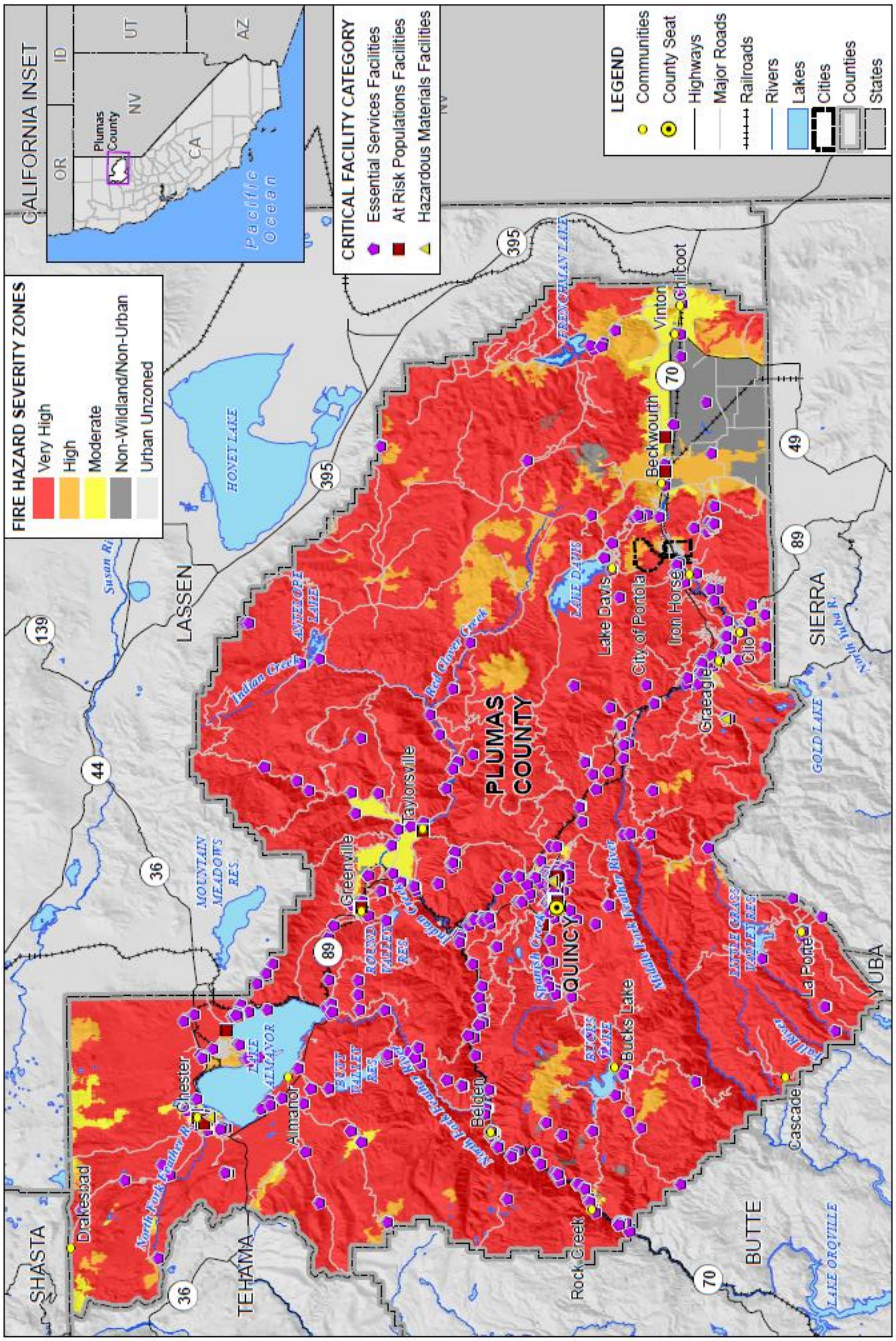
	Very High		High		Moderate	
Jurisdiction	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk
Unincorporated Plumas County	7,411	17,193	4,180	9,698	897	2,081
Total	**7,411**	**17,193**	**4,180**	**9,698**	**897**	**2,081**

Source: CAL FIRE, US Census Bureau Average Household Sizes: unincorporated Plumas County (2.32)

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Plumas County to determine critical facilities in the Fire Hazard Severity Zones. Using GIS, the CAL FIRE, Fire Hazard Severity Zones were overlayed on the critical facility GIS layer. Figure 4-167 shows critical facilities, as well as the Fire Hazard Severity Zones. Table 4-93 details critical facilities by facility type and count for the Planning Area. Details of critical facility definition, type, name and address by flood zone are listed in Appendix F.

Figure 4-167 Plumas County– Critical Facilities in FHSZs



Data Source: CAL FIRE (Adopted SRA 11/2007 - fhszs06_3_32, Draft 9/2007 - c32fhszl06_1), Plumas County GIS, Cal-Atlas; Map Date: 03/01/2020.

Table 4-93 Plumas County– Critical Facilities in FHSZs

Fire Hazard Severity Zones	Critical Facility Category	Facility Count
Very High	Essential Services Facilities	566
	At Risk Populations Facilities	19
	Hazardous Materials Facilities	2
	Total	**587**
High	Essential Services Facilities	148
	At Risk Populations Facilities	11
	Hazardous Materials Facilities	1
	Total	**160**
Moderate	Essential Services Facilities	44
	At Risk Populations Facilities	4
	Hazardous Materials Facilities	1
	Total	**49**
Non-Wildland/Non-Urban	Essential Services Facilities	10
	Total	**10**
Urban Unzoned	Essential Services Facilities	5
	At Risk Populations Facilities	4
	Total	**9**
Grand Total		**815**

Source: Plumas County GIS, CAL FIRE

Overall Community Impact

The overall impact to the community from a severe wildfire includes:

- Injury and loss of life;
- Air quality and health impacts;
- Commercial and residential structural and property damage;
- Decreased water quality in area watersheds;
- Increase in post-fire hazards such as flooding, sedimentation, and debris flows/mudslides;
- Damage to natural resource habitats and other resources, such as crops, timber and rangelands;
- Loss of water, power, roads, phones, and transportation, which could impact, strand, and/or impair mobility for emergency responders and/or area residents;
- Economic losses (jobs, sales, tax revenue) associated with loss of commercial structures;
- Negative impact on commercial and residential property values;
- Loss of churches, which could severely impact the social fabric of the community;
- Loss of schools, which could severely impact the entire school system and disrupt families and teachers, as temporary facilities and relocations would likely be needed; and
- Impact on the overall mental health of the community.

Future Development

Population growth and development in Plumas County has recently slowed; however, additional growth and development within the WUI and other high fire hazard areas of the County would place additional values at risk to wildfire. California building codes are in effect to reduce this risk, including WUI standards.

GIS Analysis

Plumas County's February 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. The Plumas County Planning Department provided a table containing the assessor parcel numbers (APNs) for the 1,075 parcels representing the different future development projects or areas. Using the GIS parcel spatial file and the APNs, the future development projects were mapped.

For the wildfire analysis of future development areas, the parcel data was converted to a point layer using a centroid conversion process, in which each parcel was identified by a central point and linked to the Assessor's data. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts and acreage within each FHSZ. The County was separated into three areas. Figure 4-168 shows the FHSZs and future development areas in the central portion of the County. Figure 4-169 shows the FHSZs and future development areas in the central portion of the County. Figure 4-170 shows the FHSZs and future development areas in the south portion of the County. Parcels and acreages in the FHSZs are summarized in Table 4-94, and detailed in Table 4-95.

Figure 4-168 Plumas County North – Future Development in FHSZs

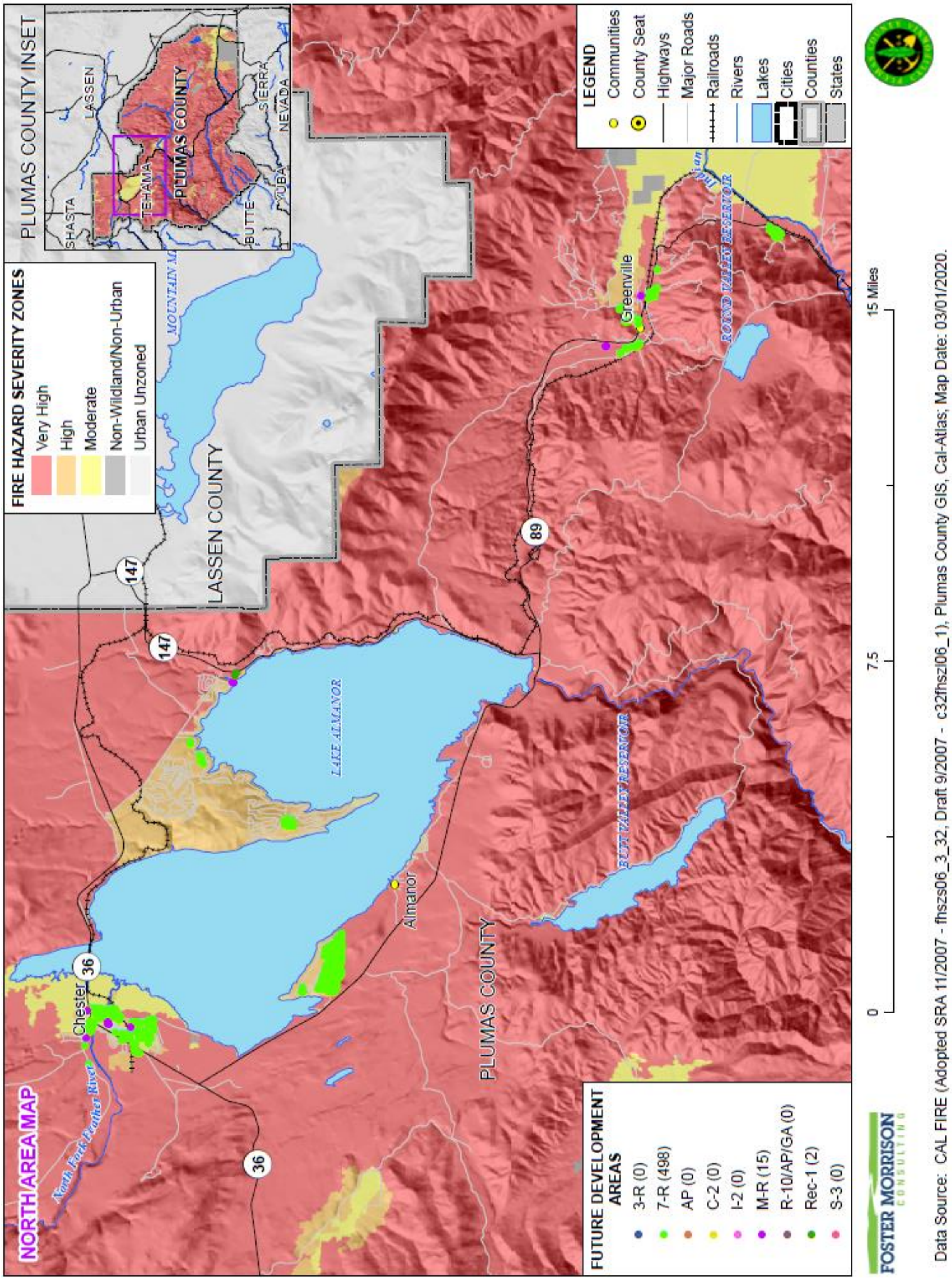


Figure 4-169 Plumas County Central – Future Development in FHSZs

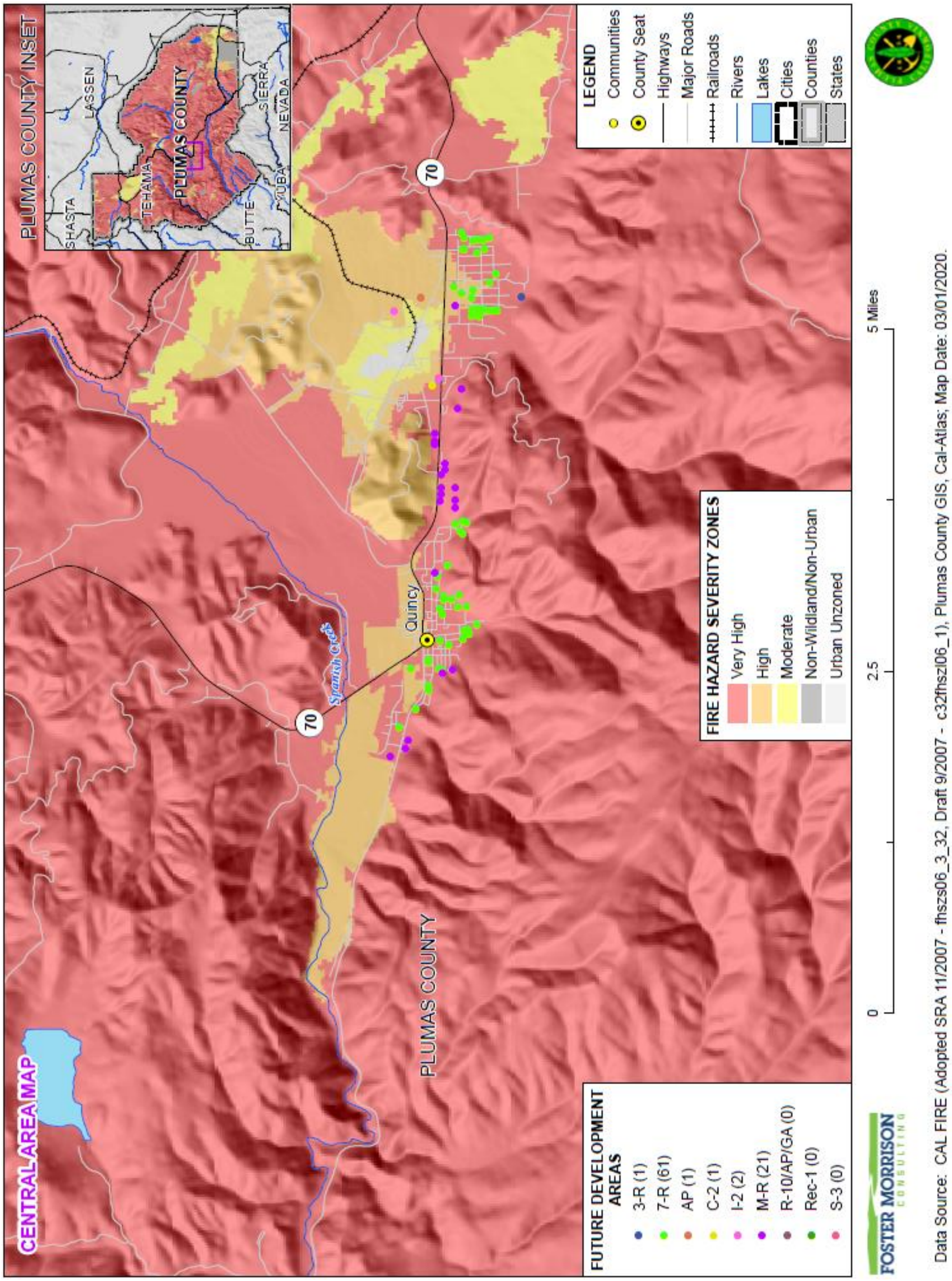


Figure 4-170 Plumas County South – Future Development in FHSZs

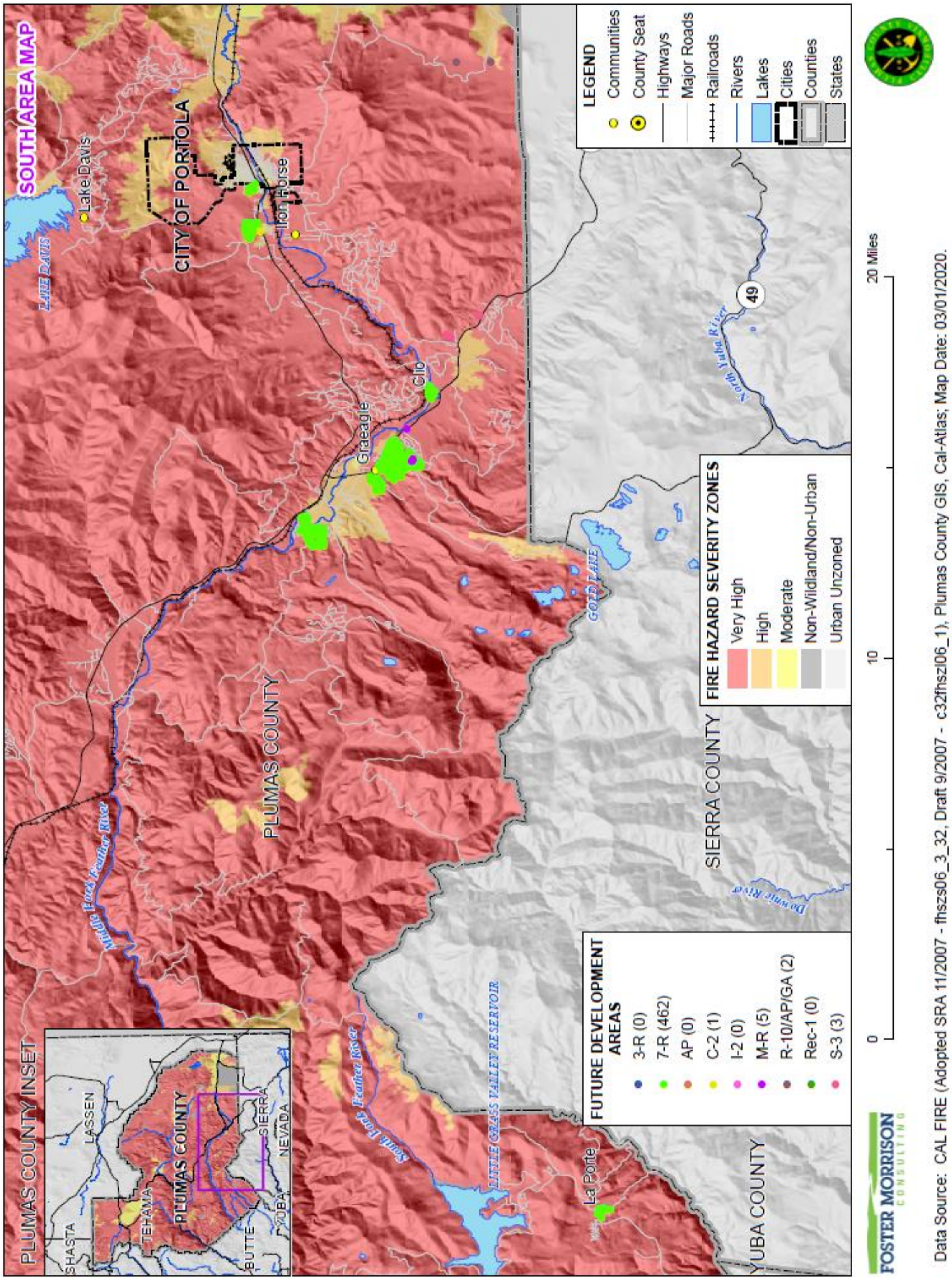


Table 4-94 Plumas County – Future Development Parcel and Acre Counts in FHSZs

Fire Hazard Severity Zone/ Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Very High			
3-R	1	0	9.010
7-R	516	196	238.836
C-2	2	0	6.730
I-2	1	0	0.980
M-R	29	6	103.952
R-10/AP/GA	2	1	1,108.880
Rec-1	2	1	13.840
S-3	3	1	56.270
Very High Total	**556**	**205**	**1,538.498**
High			
7-R	389	149	231.144
AP	1		4.010
I-2	1	1	14.950
M-R	4	2	7.380
High Total	**395**	**152**	**257.484**
Moderate			
7-R	100	42	30.373
M-R	8	0	3.240
Moderate Total	**108**	**42**	**33.613**
Urban Unzoned			
7-R	16	4	3.654
Urban Unzoned Total	**16**	**4**	**3.654**
Grand Total	**1,075**	**403**	**1,833.249**

Source: Plumas County GIS, CAL FIRE

Table 4-95 Plumas County – Future Development Parcel and Acre Counts in FHSZs and Areas

Map Area/Fire Hazard Severity Zone/ Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
North Area			
Very High			
7-R	80	25	67.222
M-R	4	1	3.980

Map Area/Fire Hazard Severity Zone/ Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Rec-1	2	1	13.840
Very High Total	**86**	**27**	**85.042**
High			
7-R	336	129	209.780
M-R	3	2	6.390
High Total	**339**	**131**	**216.170**
Moderate			
7-R	66	32	18.403
M-R	8		3.240
Moderate Total	**74**	**32**	**21.643**
Urban Unzoned			
7-R	16	4	3.654
Urban Unzoned Total	**16**	**4**	**3.654**
North Area Total	**515**	**194**	**326.509**
Central Area			
Very High			
3-R	1		9.010
7-R	54	18	27.324
C-2	1		2.870
I-2	1		0.980
M-R	20	4	32.330
Very High Total	**77**	**22**	**72.514**
High			
7-R	7	4	2.639
AP	1		4.010
I-2	1	1	14.950
M-R	1		0.990
High Total	**10**	**5**	**22.589**
Central Area Total	**87**	**27**	**95.103**
South Area			
Very High			
7-R	382	153	144.290
C-2	1		3.860
M-R	5	1	67.642
R-10	2	1	1,108.880
S-3	3	1	56.270

Map Area/Fire Hazard Severity Zone/ Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Very High Total	**393**	**156**	**1,380.942**
High			
7-R	46	16	18.725
High Total	**46**	**16**	**18.725**
Moderate			
7-R	34	10	11.970
Moderate Total	**34**	**10**	**11.970**
South Area Total	**473**	**182**	**1,411.637**
Grand Total	**1,075**	**403**	**1,833.249**

Source: Plumas County GIS, CAL FIRE

4.3.19. Natural Hazards Summary

Table 4-96 summarizes the results of the hazard identification, hazard profile, and vulnerability assessment for the Plumas County Planning Area based on hazards data and input from the HMPC. For each hazard profiled in Section 4.3, this table includes the likelihood of future occurrence and whether the hazard is considered a priority hazard for mitigation actions (as discussed in Chapter 5 of this Plan Update) in the Plumas County Planning Area.

As detailed in the hazard identification section, those hazards identified as a high or medium significance in Table 4-3 are considered priority hazards for mitigation planning. Those hazards that occur infrequently or have little or no impact on the Planning Area were determined to be of low significance and not considered a priority hazard. Significance was determined based on the hazard profile, focusing on key criteria such as frequency, extent, and resulting damage, including deaths/injuries and property, crop, and economic damage. The ability of a community to reduce losses through implementation of existing and new mitigation measures was also considered as to the significance of a hazard. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the Plumas County Planning Area, enabling the County to focus resources where they are most needed.

Table 4-96 Hazard Identification/Profile Summary and Determination of Priority Hazards

Hazard	Likelihood of Future Occurrence	Priority Hazard
Avalanche	Highly Likely	N
Climate Change	Likely	Y
Dam Failure	Unlikely	Y
Drought & Water shortage	Likely	Y
Earthquake	Occasional	Y
Floods: 1%/0.2% annual chance	Occasional/ Unlikely	Y
Floods: Localized Stormwater	Highly Likely	Y

Hazard	Likelihood of Future Occurrence	Priority Hazard
Landslide, Mudslide, and Debris Flow	Likely	Y
Levee Failure	Unlikely	Y
Pandemic	Likely	Y
Severe Weather: Extreme Heat	Highly Likely	Y
Severe Weather: Heavy Rains and Storms	Highly Likely	Y
Severe Weather: High Winds and Tornadoes	Highly Likely/ Unlikely	Y
Severe Weather: Winter Storms and Freeze	Highly Likely	Y
Tree Mortality	Likely	Y
Volcano	Unlikely	N
Wildfire	Highly Likely	Y

4.4 Capability Assessment

Thus far, the planning process has identified the natural hazards posing a threat to the Plumas County Planning Area and described, in general, the vulnerability of the County to these risks. The next step is to assess what loss prevention mechanisms are already in place. This part of the planning process is the mitigation capability assessment. Combining the risk assessment with the mitigation capability assessment results in the County's net vulnerability to disasters, and more accurately focuses the goals, objectives, and proposed actions of this LHMP Update.

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

This section presents the County's mitigation capabilities that are applicable to the County. These are in addition to, and supplement, the many plans, reports, and technical information reviewed and used for this LHMP Update as identified in Chapter 3 and in Chapter 4.

Similar to the HMPC's effort to describe hazards, risks, and vulnerability of the County, this mitigation capability assessment describes the County's existing capabilities, programs, and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This assessment is divided into four sections: regulatory mitigation capabilities are discussed in Section 4.4.1; administrative and technical mitigation capabilities are discussed in Section 4.4.2; fiscal mitigation capabilities are discussed in Section 4.4.3; mitigation education, outreach, and partnerships are discussed in Section 4.4.4, and other mitigation efforts are discussed in Section 4.4.5.

4.4.1. Plumas County's Regulatory Mitigation Capabilities

Table 4-97 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Plumas County. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Table 4-97 Plumas County Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan	Yes 2013	Yes – see Element 6 "Public Health & Safety" Section 6.1: General Health and Safety Policies Section 6.2: Geologic and Seismic Hazards Section 6.3: Wildland Fire Hazards and Fire Protection Section 6.4: Flood and Dam Inundation Section 6.5: Hazardous Wastes Section 6.6: Airport Hazards Section 6.7: Emergency Operations Section 6.8: Healthy Communities See page 148 for implementation measures re: potential projects Plan goals, policies, and implementation measures can be used to implement mitigation actions.
Capital Improvements Plan	Y	Draft is still being edited but the RTP contains most of what is in the CIP
Economic Development Plan	No, but	See General Plan Economics Element for economic development goals, policies, and implementation measures
Local Emergency Operations Plan	Yes	See link to County website: https://www.plumascounty.us/1941/Emergency-Operations-Plan
Continuity of Operations Plan	Y	See EOP "Basic Plan" "Continuity of Government" plan starting on page 23
Transportation Plan	Y	Plumas County Transportation Commission https://www.plumascounty.us/1900/Regional-Transportation-Plan
Stormwater Management Plan/Program	N	No master plan as far storm water goes, very few actual storm water systems, mostly surface run-off
Engineering Studies for Streams	?	We typically will have hydraulics studies for projects on streams – my question is, what is your definition of an "engineering" study, it can mean lots of things which means I would be sending you lots of documents that may not be what they want.
Community Wildfire Protection Plan	Y	See link: https://www.plumasfiresafe.org/wildfire-planning-documents.html

Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	N	--
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	Y	Yes (2019 CA Building Code and Title 24)
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	See Table 4-98
Fire department ISO rating:	Y	See attached "Plumas County Fire Protection Agencies (Oct 2019), see "ISO rating"
Site plan review requirements	Y	Yes (Plumas County Code, Title 9 Planning and Zoning)
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts?** **Is the ordinance adequately administered and enforced?**
Zoning ordinance	Y	Title 4, Public Safety, Chapter 1 – Disaster Response and Emergency Organization; Chapter 2 – Fire Prevention; Title 9, Planning and Zoning, Chapter 2, Zoning; Section 9-2.407.5-Flood; Article 35 Flood Plain Combining Zone (FP); Chapter 3 Subdivisions; Section 9-3.309-Flood Hazards: Drainage; Chapter 9 – State Responsibility Area Fire Safe Regulations; and Title 8, Building Regulations, Chapter 17 – Flood
Subdivision ordinance	N	But, look to develop an ordinance in 2020/2021 The Subdivision Ordinance should: Update the Plumas County Code to be in conformance with the California Subdivision Map Act, including language regarding procedures for processing Certificate of Compliance and Reversion to Acreage proposals. Clarify the responsibilities of the Planning Director, Zoning Administrator, County Engineer, Road Commissioner, and County Surveyor in processing tentative and final maps. Incorporate the application requirements as approved by the Board of Supervisors in previous resolutions. Provide for a streamlined process that leads to development of standard conditions of approval as delineated in the wording of the ordinance. Incorporate goals, policies and implementation measures from the 2035 Plumas County General Plan.

Floodplain ordinance	Y	Chapter 2, Zoning; Article 35 – Floodplain combining zone (FP) But, the original comprehensive flood plain ordinance was adopted in 1998, and was based on the Model Flood Plain ordinance produced by the Department of Water Resources (CA DWR). At the last audit conducted by CA DWR and the Federal Emergency Management Agency (FEMA), it was recommended that the ordinance be updated to the latest state/federal Model Flood Plain ordinance. Update Title 8 (Building Regulations), Chapter 17 (Flood) of the Plumas County Code re: Flood Plain Ordinance and applicable Title 9 (Planning and Zoning) sections. Issue identified during 2011 audit by CA DWR and FEMA. Update Flood Plain Ordinance to the latest December 2006 CA DWR CA Model Flood Plain Ordinance. Coordinate with Public Works. Related General Plan policies: PHS 6.4.1 Coordination with Federal Emergency Management Agency, United States Army Corps of Engineers and Department of Water Resources Division of Flood Management PHS 6.4.2 Development in Floodways and Dam Inundation Areas PHS 6.4.4 Floodplain Development Restrictions PHS 6.4.7 Limit Surface Runoff PHS Implementation Measures 1, 10, 20 COS 7.2.4 Stream Corridor Development W 9.7.2 Downstream Peak Flows
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Implement State Responsibility Areas (SRAs) Fire Safe Regulations, various County Code sections
Flood insurance rate maps	Y, but	Most of the County is not FEMA mapped, so there's a lot of Zone "A" (100-year) areas generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no BFE or flood depths are known.
Elevation Certificates	Y	On an as needed basis, per parcel/structure – puts a burden on property owners in Zone "A" to conduct an engineered analysis (e.g., flood study) to provide property-specific BFE information and inform areas within and beyond the "Zone A" boundary as shown on the FEMA FIRM
Acquisition of land for open space and public recreation uses	N	--
Erosion or sediment control program	N	Plumas County does not have a grading or drainage ordinance. Grading permits follow the California Building Code Appendix J for issuance, which does not necessarily address 2035 General Plan policies. Public Works Department is currently preparing a draft Grading and Drainage Plan ordinance. Public Works estimates the draft coming to Planning Commission in 2020.
Other		

How can these capabilities be expanded and improved to reduce risk?
Have a BCEGS Score Develop a climate action plan / climate resilience and adaptation plan Develop subdivision ordinance Develop grading and drainage ordinance FEMA needs to map more of the County so property owners are not burdened with paying for a flood study to determine BFE to get an elevation cert

BCEGS Scores by Fire Protection Agency

BCEGS scores vary by fire protection agency. This can be seen in Table 4-98.

Table 4-98 Plumas County – Fire Protection Agency BCEGS Scores

ISO Rating	Department
4/9	Beckwourth Fire Protection District
10	C-Road Comm. Services District
4	Chester Public Utility District
9	Crescent Mills Fire Protection Dist
5/5X	Eastern Plumas Rural Fire District
4/8b	Graeagle Fire Protection District
5	Greenhorn Creek CSD
4/4Y	Hamilton Branch Fire Protection Dist
4/8	Indian Valley CSD
7/9	La Porte Fire Protection District
8B	Long Valley CSD
8	Meadow Valley Fire District
3	Peninsula Fire Protection District
4/4Y	Plumas Eureka CSD
5	Portola City Fire Department
10	Prattville-Almanor Fire District
3/3Y	Quincy Fire Protection District
8B	Sierra Valley Fire District
3	West Almanor CSD

Source: Plumas County OES

As indicated in the tables above, Plumas County has several plans and programs that guide the County's mitigation of development of hazard-prone areas. Starting with the Plumas County General Plan, which is the most comprehensive of the County's plans when it comes to mitigation, some of these are described in more detail below.

2035 Plumas County General Plan (Adopted December 2013)

A general plan is a legal document, required by state law, that serves as a community's "constitution" for land use and development. The plan must be a comprehensive, long-term document, detailing proposals for the "physical development of the county or city, and of any land outside its boundaries which in the planning agency's judgment bears relation to its planning" (Government Code §65300 et seq.). Time horizons vary, but the typical general plan looks 10 to 20 years into the future. The law specifically requires that the general plan address seven topics or "elements." These are land use, circulation (transportation), housing, conservation, open space, noise, and safety. The plan must analyze issues of importance to the community, set forth policies in text and diagrams for conservation and development, and outline specific programs for implementing these policies.

Goals and policies related to mitigation from the General Plan include the following:

Land Use Element

Goal LU-5	**To promote a development pattern that maximizes the use of existing infrastructure prior to the construction of new infrastructure. Develop a land use pattern to facilitate the delivery of community services in the most cost-effective manner possible for infrastructure construction and maintenance, fire protection, emergency medical and police.**
Policy 1.5.3	Provision for Fire and Life Safety Services – The County shall require development to be located adjacent to, or within, areas where fire and life safety services exist, or can be efficiently and economically provided.

Goal LU 1.11	**To promote development patterns that recognize the need to conserve water resources, consistent with other stated goals.**
Policy 1.11.1	Groundwater Management Plans – The County shall support the development and implementation of a regional groundwater management plan and shall work with water resources agencies, water users, and other affected parties to develop basin-specific plans for high priority groundwater basins to ensure a sustainable, adequate, safe and economically viable groundwater supply for existing and future uses within the County.

Public Health & Safety Element

Goal PHS 6.1	**To protect local communities from injury and damage resulting from natural catastrophes and man-made hazardous conditions.**
Policy 6.1.1	Development Constraints – The County shall limit the density and intensity of development in areas to the levels needed to reduce hazards to public health and safety.
Policy 6.1.2	Building and Code Updates – Except as otherwise noted by State law, the County shall ensure that all new structures intended for human habitation are designed in compliance with the latest adopted editions of the California Building Standards Code.
Policy 6.1.3	Hazard Awareness and Public Education – The County shall continue to promote awareness and education among residents regarding possible natural hazards, including soil conditions, landslides, earthquakes, flooding, wildfire hazards and emergency procedures.

Goal PHS 6.1	To protect local communities from injury and damage resulting from natural catastrophes and man-made hazardous conditions.
Policy 6.1.4	Public Safety Programs – The County shall promote all applicable public safety programs, including neighborhood-watch programs, hazards materials disposal, public awareness and prevention of wildfire hazards, and other public-education efforts.

Goal PHS 6.2	To identify and prevent development in "areas of unstable geologic conditions," which include: active faults, landslides and areas of potential ground failure such as liquefaction, mudslides and subsidence.
Policy6.2.1	Maintenance of Updated Geologic and Seismic Hazard Information – The County shall maintain updated geologic, seismic and avalanche hazard maps and other hazard inventory information in cooperation with the State Office of Emergency Services, California Department of Conservation—Division of Mines and Geology, United States Forest Service, California Department of Transportation and other agencies as this information is made available.
Policy6.2.2	Design Measures – The County shall require earthquake resistant designs consistent with the requirements of the California Building Standards Code for all critical structures, such as fire stations, emergency communication centers, private schools, high occupancy buildings, and non-highway bridges.
Policy6.2.3	Seismic Retrofitting – The County shall support and encourage seismic upgrades to older buildings that may be structurally deficient. Upgrades shall consider any applicable historic building preservation requirements.
Policy6.2.4	Development on Slopes – The County shall not allow development on slopes 30 percent or greater, unless the applicant can sufficiently mitigate the inherent problems associated with developing on steep slopes.
Policy6.2.5	Avalanche, Landslide and Mudflow Hazards – The County shall prohibit new subdivisions in high risk areas of known avalanche, landslide or mudflow hazards.
Policy6.2.6	Naturally Occurring Asbestos – The County shall work with the Northern Sierra Air Quality Management District to map locations of naturally occurring asbestos and to mitigate potential hazards from development.
Policy6.2.7	Development Requirements – The County shall continue to address seismic standards of dam safety as required by the State Division of Safety and Dams.

Goal PHS 6.3	To minimize the possibility of the loss of life, injury, damage to property, and loss of habitat and natural resources as a result of fire.
Policy 6.3.1	Defensible Space – The County shall review and update its Fire Safe ordinance to attain and maintain defensible space through conditioning of tentative maps and in new development at the final map and/or building-permit stage.
Policy 6.3.2	Limitations in Fire Hazard Areas – The County shall consult the current Fire Hazard Severity Zone Maps during the review of all projects so that standards and mitigation measures appropriate to each hazard classification can be applied. Land use densities and intensities shall be determined by mitigation measures in areas designated with a high or very high fire hazard rating. Intensive development in areas with high or very high fire hazard rating shall be discouraged.
Policy 6.3.3	Structural Fire Protection – All developments within the service boundaries of an entity which provides structural fire protection may be required to make contribution to the maintenance of the existing level of structural service proportionate to the increase in demand for service structural fire protection and Emergency Medical Services resulting from the development.

Goal PHS 6.3	To minimize the possibility of the loss of life, injury, damage to property, and loss of habitat and natural resources as a result of fire.
Policy 6.3.4	New Development Requirements – As a requirement for approving new development, the County must find (based on information provided by the applicant and the responsible fire protection district), that concurrent with development, adequate emergency water flow, fire access – Public Health & Safety Element| 140 – and fire-fighting personnel and equipment, will be available in accordance with applicable State, County, and local fire district standards.
Policy 6.3.5	Emergency Access – As a requirement of new development, the applicant must demonstrate that adequate emergency access exists or can be provided to ensure that emergency vehicles can access the site and that private vehicles can evacuate the area.
Policy 6.3.6	Fire Protection and Roadside Maintenance – As a condition of development, the County shall require the long-term maintenance of private roads, including roadside vegetation management, to the standards of original improvements.
Policy 6.3.7	Rural Fire Protection Water System – The County shall research the feasibility of a countywide rural fire protection water system that provides a cost-effective, adequate water supply.
Policy 6.3.8	Fire Protection Facility Upgrades – The County shall encourage upgrading facilities within existing fire protection districts and encourage expansion of existing districts where warranted by population density allowed under the General Plan.
Policy 6.3.9	Fuel Modification – The County shall require new development within high and very high fire hazard areas to designate fuel break zones that comply with defensible space requirements to benefit the new and, where possible, existing development.
Policy 6.3.10	Prescribed Burning – The County shall encourage the use of prescribed burning as a management tool for hazardous fuels reduction, timber management purposes, livestock production and enhancement of wildlife habitat. The County shall support removal of fuels and chipping and onsite distribution of chipped materials as an alternative to burning.
Policy 6.3.11	Regional Cooperation – The County shall cooperate with Federal, State, community fire safety groups and other fire protection entities in fire prevention programs and in identifying opportunities for hazardous fuel reduction projects in zones of high and very high fire hazard either prior to or as a component of project review.
Policy 6.3.12	Fire Prevention Education – The County, in cooperation with Federal and State agencies, community fire safety groups, and the local fire protection districts, shall educate the public about the hazards of wildfires, methods to reduce the potential for fires to occur, and mitigation measures, including reducing fuel loads, to lessen the impacts of wildfires.
Policy 6.3.13	Landscape-Scale Fuel Modification – The County shall support fuel modification across public and private forestlands to reduce the potential for catastrophic wildfires, with the highest priority directed toward reducing hazardous fuel levels in the wildland-urban interface.

Goal PHS 6.4	To minimize the loss of life, injury or damage to property as a result of floods in Plumas County.
Policy 6.4.1	Coordination with Federal Emergency Management Agency, United States Army Corps of Engineers and Department of Water Resources Division of Flood Management – The County shall continue participation in the Federal Emergency Management Agency's National Flood Insurance Program, utilizing the Flood Insurance Rate Maps and the County's floodplain ordinances that implement Federal and State flood management standards. The County shall continue to utilize floodplain management and flood control information provided by the Department of Water Resources Division of Flood Management and the United States Army Corps of Engineers and coordinate with these agencies when undertaking updates to the County's floodplain ordinances and policies.

Goal PHS 6.4	To minimize the loss of life, injury or damage to property as a result of floods in Plumas County.
Policy 6.4.2	Development in Floodways and Dam Inundation Areas – The County shall prohibit the development of new critical or high-occupancy structures within the floodway of any river, stream or other body of water. Similar structures should not be located within the inundation area resulting from failure of dams identified by the State Department of Water Resources Division of Safety of Dams.
Policy 6.4.3	New Parcels in Floodplain – The County shall strongly discourage the creation of new residential parcels which lie entirely within Special Flood Hazard Areas as identified on the most current version of the Flood Insurance Rate Maps provided by the Federal Emergency Management Agency. Proposals for new parcels that are partially located within designated Special Flood Hazard Areas must be evaluated to determine if sufficient land is available outside the Special Flood Hazard Area to support residential development and that potential flood impacts can be sufficiently mitigated.
Policy 6.4.4	Floodplain Development Restrictions – The County shall ensure that riparian areas and drainage areas within floodplains are free from development that may adversely affect floodway capacity or characteristics of natural/riparian areas or natural groundwater recharge areas.
Policy 6.4.5	Multi-Purpose Flood Control Measures – The County shall encourage multi-purpose flood control projects that incorporate recreation, resource conservation, preservation of natural riparian habitat and scenic values of the County's waterways.
Policy 6.4.6	Flood Control Design – The County shall avoid flood control projects involving further channeling, straightening or lining of waterways until alternative multi-purpose modes of treatment, such as wider berms and landscaped areas in combination with recreation amenities, are studied.
Policy 6.4.7	Limit Surface Runoff – The County shall review development projects to determine that such development can be permitted without alteration of off-site historical flood patterns or contribution to flooding hazards for downstream users. Each project with the potential to create off-site drainage shall be required to submit a plan showing how the impacts of such drainage will be addressed, both on-site and off-site.
Policy 6.4.8	Storm Water Retention/Detention and Groundwater Infiltration – As appropriate, the County shall require development to incorporate storm-water retention/detention ponds to encourage groundwater recharge and to make efficient use of storm water.

Goal PHS 6.7	To provide effective emergency response to natural or human-made hazards and disasters.
Policy 6.7.1	Emergency Response Services Coordination with Government Agencies – The County shall coordinate emergency response with local, State and Federal governmental agencies, community organizations, volunteer agencies and other response partners during emergencies or disasters utilizing the Standardized Emergency Management System (SEMS) and the National Incident Management System (NIMS).
Policy 6.7.2	Mutual Aid Agreement – The County shall participate in established local, State and Federal mutual aid systems. Where necessary and appropriate, the County shall enter into agreements to ensure the effective provision of emergency services, such as mass care, heavy rescue, hazardous materials or other specialized functions.
Policy 6.7.3	Maintenance of Emergency Evacuation Plans – The County shall continue to create, revise and maintain emergency plans for the broad range of natural and human-made disasters and response activities that could be foreseen to impact Plumas County. This shall include, but not be limited to, flooding, dam failure, extreme weather, evacuation/transportation, mass care and shelter, and animal evacuation and sheltering. Emergency Planning projects shall be in line with the County's Emergency Operations Plan and incorporate current guidance and initiatives from State and Federal Emergency Management Agencies.

Goal PHS 6.7	To provide effective emergency response to natural or human-made hazards and disasters.
Policy 6.7.4	Streets and Highways Upgrades – The County shall evaluate and strive to upgrade vital streets and highways to an acceptable level for emergency services and for public safety.
Policy 6.7.5	Search and Rescue – The County should continue to provide search and rescue operation capabilities through the Plumas County Sheriff's Department.
Policy 6.7.6	Joint Exercises – The County shall encourage fire, law enforcement, emergency medical services, resource management, public health and other governmental and non-governmental response partners to periodically conduct joint training exercises with the goal of developing the best possible coordinated action and effective response times in the event of a natural or human-made disaster across all local jurisdictions.

Conservation & Open Space Element

Goal COS 7.10	To address climate change and manage its effects by pursuing programs and strategies in order to meet or exceed state requirements for reductions in GHG emissions.
Policy 7.10.1	Inventory and Monitor GHG Emissions – The County shall inventory and monitor GHG emissions in County operations and in the community, consistent with Northern Sierra Air Quality Management District and/or State guidelines.
Policy 7.10.2	Climate Action Plan – The County shall establish a Climate Action Plan that identifies strategies for increasing energy efficiency, carbon sequestration, GHG emissions reductions, and land use and transportation strategies that are consistent with appropriate climate change regulations (i.e. State of California's Global Warming Solution Act).
Policy 7.10.3	Support Statewide Climate Change Solutions – The County shall monitor and support the efforts of CAL EPA, CARB, and the NSAQMB, under AB 32 (Health and Safety Code §38501 et seq.), to formulate mitigation strategies, if any, that may be implemented by local government, and further require the County to ultimately consider any such strategies once they become available and are appropriate for rural adaptation.
Policy 7.10.4	Forest Sequestration and Biomass Energy – The County shall investigate providing incentives for increased carbon sequestration on forest lands and encourage the use of forest biomass for sustainable energy generation.
Policy 7.10.5	Sustainable Business Practices – The County shall encourage all businesses to take the following actions as appropriate for each business: replace high mileage fleet vehicles with hybrid and/or alternative fuel vehicles, increase the energy efficiency of facilities, transition to the use of renewable energy instead of non-renewable energy sources, adopt purchasing practices that promote emissions reductions, and reusable materials and increased recycling.
Policy 7.10.6	Sustainable Agricultural Practices – The County shall promote GHG emission reductions by encouraging carbon efficient farming methods, such as no-till farming, crop rotation, cover cropping, installation of renewable energy technologies, protection of grasslands, open space, riparian, and forest lands from conversion to other uses, and development of energy-efficient structures.
Policy 7.10.7	Public Awareness and Education – The County shall work to increase public awareness regarding climate change and encourage County residents and businesses to become involved in activities and lifestyle changes that will aid in the reduction of GHG emissions.

Agriculture and Forestry Element

Goal AG/FOR 8.5	Protect the supply and quality of the County's water resources, by maintaining the proper ecological function of watersheds, including sediment transport groundwater recharge and filtration, biological processes, flood mitigations, and maintaining enough water for local and agricultural needs and uses.
Policy 8.5.1	Water for Agricultural Uses – Protect sustainable supplies of water for agricultural uses.

Goal AG/FOR 8.11	Promote the utilization of forested lands to address GHG emissions.
Policy 8.11.1	Forestlands as Locations for Carbon Sequestration - The County shall work through the CEQA process to comply with GHG reductions as set forth in AB 32 to create policies that encourage utilization of forestlands to serve as locations for carbon sequestration.
Policy 8.11.2	GHG Emissions Mitigation – The County shall determine impacts of development projects on GHG emissions and require enforceable mitigation measures. If, after analyzing and requiring all reasonable and feasible on-site mitigation measures for avoiding or reducing GHG-related impacts, the lead agency determines that additional mitigation is required, the agency shall consider additional off-site mitigation. Priority for off-site mitigation shall be given to agricultural and forested lands serving as locations for carbon sequestration.

Water Resources Element

Goal W 9.1	To manage groundwater as a valuable and limited resource and to ensure its sustainability as a reliable water supply sufficient to meet the existing and future needs of Plumas County.
Policy 9.1.1	Groundwater Management – The County shall support the development and implementation of a regional groundwater management plan and shall work with water resource agencies, such as the Sierra Valley Groundwater Management District, water users and other affected parties to develop basin-specific plans for high priority groundwater basins to ensure a sustainable, adequate, safe and economically viable groundwater supply for existing and future uses within the County.
Policy 9.1.2	Groundwater Recharge Area Protection – The County shall require that all projects be designed to maintain or increase the site's pre-development absorption of rainfall (minimize runoff), and to recharge groundwater where appropriate. Implementation would include standards that could regulate impervious surfaces, provide for water impoundments (retention/detention structures), protecting and planting vegetation, use of permeable paving materials, bioswales, water gardens, and cisterns, and other measures to increase runoff retention, protect water quality, and enhance groundwater recharge.
Policy 9.1.3	Groundwater Demand Reductions – The County shall encourage the use of alternate sources of water supply as appropriate and to the maximum extent feasible in an effort to reduce demand on key groundwater resources in the county.

Goal W 9.2	To protect, restore and enhance the quality of surface and groundwater resources to meet the needs of all reasonable beneficial uses.
Policy 9.2.1	Participation in Water Quality Objectives – The County shall support and assist in the development of reasonable and prudent Total Maximum Daily Loads for the impaired water bodies and pollutants of concern identified by the Central Valley Regional Water Quality Control Board to achieve compliance with adopted Total Maximum Daily Loads. Work with the Central Valley Regional Water Quality Control Board to develop and implement measures consistent with the adopted Total Maximum Daily Loads. The County shall also work closely with the Central Valley Regional Water Quality Control Board, the City of Portola, public water supply purveyors and other interested parties in the development and implementation of water quality plans and measures.
Policy 9.2.2	Background Water Quality – The County shall encourage the use of water management strategies, biological remediation and the best available technology to address naturally occurring water quality problems.
Policy 9.2.3	County Facilities – The County shall design, construct and maintain County buildings, roads, bridges, drainage and other facilities to minimize sediment and other pollutants in stormwater flows.
Policy 9.2.4	Wildfire and Water Quality Controls The County shall, in cooperation with wildfire management agencies, such as Cal Fire, United States Forest Service and local fire protection agencies, develop a variety of land-use planning, site design and vegetation management techniques to reduce the risk of wildfires. This risk reduction shall also include post-fire erosion, sedimentation and water-quality conditions.
Policy 9.2.5	Wastewater Standards and National Pollutant Discharge Elimination System (NPDES) The County shall support wastewater agencies' efforts to meet applicable NPDES permit requirements and waste discharge requirements in compliance with the Federal Water Pollution Control Act and California's Porter-Cologne Water Quality Control Act.
Policy 9.2.6	Erosion and Sediment Control Measures The County shall ensure that Best Management Practices to control erosion and sediment will be incorporated into development design and improvements.
Policy 9.2.7	Wastewater Application Management The County shall approach all wastewater applications, both individual on-site and community systems, in a manner that supports Federal, State and local wastewater regulations to ensure the protection of public health and the environment.

Goal W 9.3	To ensure that the County proactively develops and supports programs and policies for forest and watershed management to counteract trends in declining snowpack storage, accelerated Spring runoff, and declining overall runoff that threaten both larger flood events and diminished late-season water supplies.
Policy 9.3.1	Water Resource Adaptation – The County shall encourage water purveyors to develop plans for responding to potential changes in weather patterns resulting from climate change effects, the sharing of water resources to improve water supply reliability and the allocation of water supply to priority users. Climate patterns will also be monitored for their ability to affect existing drainage patterns and their resultant effects to flood-prone areas.
Policy 9.3.2	Forest Management – The County shall support plans and projects to improve the conditions of overstocked forestlands, especially around communities-at-risk, to reduce the potential adverse impacts from wildfires, to protect watersheds, habitats and reduce excessive evapotranspiration losses.

Goal W 9.4	**To maintain sound management of the water resources in Plumas County's diverse watersheds and assure that any proposals for surface and groundwater exports are stringently reviewed to ensure that they do not undermine the County's ability to sustain an adequate supply of high-quality water for all its water users and dependent natural resources.**
Policy 9.4.1	Watershed Protection – The County shall require new development projects to mitigate potential impacts on surface water, recreation areas, agriculture and wildlife habitat areas.
Policy 9.4.2	In-stream Flow Rate Management – The County shall support reasonable in-stream flow standards to protect aquatic habitat and fisheries while balancing water supply needs and protecting water rights within the Feather River watershed.
Policy 9.4.3	Watershed and Community-Based Efforts – The County shall support the efforts of local community-based watershed groups to protect water resources and work with local groups to ensure decisions and programs take into account local opinions, priorities and needs.
Policy 9.4.4	Regional Water Management – The County shall support regional efforts through the Upper Feather River Integrated Regional Water Management Plan (UFRIRWMP) to ensure coordination and adaptive management between statewide water resource planning efforts, regional priorities and local needs. The goals and objectives of the UFRIRWMP shall be considered in establishing County water resource priorities and policies.
Policy 9.4.5	Watershed Program Funding – The County shall support efforts to obtain grant funding for locally sponsored watershed programs, and planning efforts and projects that enhance and protect the Feather River Watershed.
Policy 9.4.6	Water Export Projects on Plumas County Watercourses – The County, prior to giving its approval and support to export projects on county watercourses, will require the following information to demonstrate the export project's adherence to the requirements of California Water Code Section 10505 protecting development rights and Section 11460 protecting beneficial needs of the watersheds.
Policy 9.4.7	Minimizing the Effects of Water Exports – The County shall require that exports not damage the County's environmental and economic setting by ensuring that "no unreasonable effect" occurs in the transfer and withdrawal of water resources pursuant to Section 1810 of the State Water Code.
Policy 9.4.8	Hydroelectric Project Relicensing – The County shall encourage that dam relicensing projects effectively balance development values, such as electric power, flood control and water supply, with non-developmental values, such as environmental resource protection, recreation, habitat restoration and water quality, and other values that best reflect the public interest. Efforts to mitigate project impacts should not impose redirected impacts on other public or private resources.

Goal W 9.5	**To encourage public water systems and their sources to provide an adequate supply to meet long-term needs and that is provided in a manner that maintains water resources for other water users while protecting the natural environment.**
Policy 9.5.1	Adequate Water Supply Facilities and Services – The County shall support water purveyors' plans to develop new reliable future sources of supply, while promoting water conservation and water recycling/reuse. Additionally, through the development review process, the County shall ensure that public water facilities and services will be adequate and operational to serve new development and meet capacity demands when needed. Such needs shall include capacities necessary to comply with public safety.
Policy 9.5.2	Cooperative Planning for Water Supply – The County shall work with public water supply purveyors to disseminate and discuss information on the limits of available water supplies, how the supplies can be used efficiently, the possible effects of drought conditions, acceptable levels of risk of shortage for various water users, priorities for allocation of the available water supply, conditions for use of limited supplies, and limits of alternate sources that could be used or developed.

Goal W 9.5	To encourage public water systems and their sources to provide an adequate supply to meet long-term needs and that is provided in a manner that maintains water resources for other water users while protecting the natural environment.
Policy 9.5.3	Urban Water Management Plans – The County shall encourage and assist in the preparation of master facilities plans, and urban water management plans where required by State law, for all public water suppliers, to design and construct all facilities in accordance with sustainable yields and the planning documents of applicable jurisdictions.
Policy 9.5.4	Water Supply for New Development – The County shall ensure a sufficient water supply for all new residential/non-residential development. To do this, the County shall comply with Water Code Section 10910 (Senate Bill 610) and Government Code Section 66473.7 (Senate Bill 221), or more current state code requirements. Where these codes do not apply (i.e., because the "projects" at issue do not meet the minimum size requirements for triggering duties under Senate Bill 610 or Senate Bill 221), the County shall impose conditions similar to those required by Water Code Section 10910 (Senate Bill 610) and Government Code Section 66473.7 (Senate Bill 221), or more current state code requirements, and suitable for the size and scale of the development. For projects requiring discretionary approvals from the County, the County shall identify the resultant significant environmental impacts associated with these projects, if any, along with available and feasible means to address these impacts.
Policy 9.5.5	Water Rights Protection – The County shall support public agencies and private entities within Plumas County in their efforts to protect their water rights and water supply contracts.
Policy 9.5.6	Consistent Fire Protection Standards – The County, in coordination with local water service purveyors, wildfire protection agencies and local fire protection agencies, shall ensure consistent and adequate standards for fire flows and fire protection for new development, with the protection of human life and property as the primary objectives.
Policy 9.5.7	Community Water Systems – The County shall require any new community water system, in the unincorporated area of the county, serving residential, industrial or commercial development to be owned and operated by a public or private entity that can demonstrate to the County adequate financial, managerial and operational resources.
Policy 9.5.8	Level of Service Impacts – The County shall ensure that any new development projects do not create significant adverse impacts on existing water and wastewater infrastructure.
Policy 9.5.9	Funding for Water Supply Improvements – The County shall support water/wastewater purveyors use of all appropriate and equitable financing methods (e.g., grant funding, assessment districts and development fees) to finance public facility design, construction, operation and maintenance.

Goal W 9.7	To manage stormwater from existing and future development in an efficient manner through methods that maintain natural water quality, enhance percolation for groundwater recharge, reduce potential flooding, support natural wetlands and provide opportunities for reuse.
Policy 9.7.1	Natural Stormwater Drainage Courses – The County shall require that natural drainage courses, including ephemeral streams, be retained and protected from development impacts which would alter the natural drainage courses, increase erosion or sedimentation or have a significant adverse effect on flow rates or water quality. Natural vegetation within riparian and wetland protection zones shall be maintained to preserve natural drainage characteristics consistent with the policies provided in the Conservation Element. Storm-water discharges from outfalls, culverts, gutters and other drainage control facilities that discharge into natural drainage courses shall be dissipated so that they make no contribution to additional erosion and, where feasible, are filtered and cleaned of pollutants.
Policy 9.7.2	Downstream Peak Flows – For new development, the County shall require that peak stormwater discharge not exceed the capacity limits of off-site drainage systems or cause downstream erosion, flooding, habitat destruction or impacts to wetlands and riparian areas.

Goal W 9.7	To manage stormwater from existing and future development in an efficient manner through methods that maintain natural water quality, enhance percolation for groundwater recharge, reduce potential flooding, support natural wetlands and provide opportunities for reuse.
Policy 9.7.3	Maintenance of Stormwater Runoff Systems – The County shall maintain its existing stormwater runoff systems to the extent possible, to assure that these systems do not fall into a state of disrepair such that they are causing water quality degradation inconsistent with their original design function.
Policy 9.7.4	Runoff Quality – The County shall require all drainage systems in new development and redevelopment to comply with applicable state and federal non-point source pollutant discharge requirements.
Policy 9.7.5	Best Management Practices – The County shall require best management practices in new development and redevelopment to reduce pollutants from entering natural water bodies while allowing stormwater reuse.
Policy 9.7.6	Interagency Cooperation – The County shall work with the Central Valley Regional Water Quality Control Board and local, state, and Federal flood control and water resources management agencies to adopt effective stormwater management measures.

Goal W 9.8	To increase the role of conservation and water-use efficiency to help meet domestic or municipal water supply needs.
Policy 9.8.1	Water Conservation – The County shall work with local water purveyors and managers to implement a variety of water conservation measures appropriate for existing and future needs that comply with state and federal legislation and the California Urban Water Conservation Council.
Policy 9.8.2	Recycled Water Use – The County shall encourage new development, redevelopment, and landscape and agricultural irrigators to use recycled water wherever practical and available; this includes striving for the highest possible quality of wastewater treatment to increase the potential use of recycled water for existing and future needs of the county.
Policy 9.8.3	Compact Development – The County shall support and encourage compact forms of development and shall focus new growth within existing community plan areas to help reduce water demands, reduce landscape areas and reduce the costs of water and wastewater infrastructure.
Policy 9.8.4	Existing Development – The County shall promote programs for retrofitting plumbing, providing cost rebates, identifying leaks, changing landscaping, irrigating efficiently and other methods of reducing water consumption by existing users. As appropriate, the County will assist existing users seeking grants or other funding opportunities for such water conservation projects.
Policy 9.8.5	County Buildings – The County shall assess its water use in County buildings and facilities and reduce water consumption to the maximum extent possible.
Policy 9.8.6	Agricultural Water Use – The County shall encourage and support water conservation for agricultural activities that increase the efficiency of water use for crop irrigation and livestock maintenance.
Policy 9.8.7	Sustainable Water Practices – The County shall encourage the use of sustainable, affordable water management practices that meet state and local standards, such as greywater reuse, rainwater capture/harvest, watershed management and stormwater infiltration to reduce demands on potable supply.
Policy 9.8.8	County Codes – The County shall establish a program to revise County Codes to increase, as appropriate, the use of recycled water for new commercial, residential, industrial and agricultural development.

Other Plumas County Plans/Studies/Programs

Plumas County Climate Change and Health Profile Report (2017)

The Climate Change and Health Profile Report seeks to provide a county-level summary of information on current and projected risks from climate change and potential health impacts. This report represents a synthesis of information on climate change and health for California communities based on recently published reports of state agencies and other public data.

The content of this report was guided by a cooperative agreement between CDPH and the CDC Climate-Ready States and Cities Initiative's program Building Resilience Against Climate Effects (BRACE). The goals of BRACE are to assist state health departments to build capacity for climate and health adaptation planning. This includes using the best available climate science to project likely climate impacts, identifying climate-related health risks and populations vulnerable to these impacts, assessing the added burden of disease and injury that climate change may cause, identifying appropriate interventions, planning more resilient communities, and evaluating to improve the planning effort. Communities with economic, environmental, and social disadvantages are likely to bear disproportionate health impacts of climate change.

This Climate Change and Health Profile Report is intended to inform, empower, and nurture collaboration that seeks to protect and enhance the health and well-being of all California residents. This report is part of a suite of tools that is being developed by the California Department of Public Health to support local, regional, and statewide efforts of the public health sector to build healthy, equitable, resilient, and adaptive communities ready to meet the challenges of climate change. Along with a county-level climate change and health vulnerability assessment and state guidance documents, such as Preparing California for Extreme Heat: Guidance and Recommendations, the profile provides a knowledge base for taking informed action to address climate change.

Plumas County Communities Wildfire Protection Plan (2019)

The purpose of this plan is to outline the risks and hazards associated with a wildland fire threat to Plumas County communities and to identify potential mitigation measures. The Plumas County Communities Wildfire Protection Plan (CWPP) is intended to provide documentation of implementing actions designed to reduce risk to homes and communities from wildfire through education and outreach programs, the development of partnerships, and implementation of preventative activities such as hazardous fuel reduction, defensible space, land use, or building codes. The emphasis of this plan is to work from the home outward into the Wildland Urban Interface, so that man-made and natural resources survive the eventual intrusion of a wildfire.

This plan is intended to: 1) meet the requirements of the Healthy Forest Restoration Act (HFRA) of 2003, 2) make the County eligible for National Fire Plan (NFP) funding assistance from the Departments of Agriculture and Interior (by meeting the requirements of HFRA), 3) provide information to assist communities in developing fuel reduction projects on private and public lands, 4) continue to serve as the Wildfire Hazard Mitigation portion of Plumas County's Multi-Hazard Mitigation Plan, which is required after November 1, 2004, for counties to be eligible to receive FEMA disaster assistance funding, and 5) provide direction in implementing the Plumas County Fire Safe Council's Mission: To reduce the loss of natural and human made resources caused by wildfire through Firewise community programs and pre-fire activities."

Lassen-Modoc Unit Strategic Fire Plan (2020)

Plumas County is served by the Lassen-Modoc Unit of CAL FIRE. The Lassen-Modoc Unit Fire Management Plan documents the assessment of the fire situation in the Unit. It includes stakeholder contributions and priorities which identify strategic targets for proactive approaches and project-based solutions. While the Unit Fire Management Plan addresses local needs, the State Board of Forestry and Fire Protection also has legislative mandates dating back to 1945 requiring it to determine the "intensity" or appropriate level of fire protection for all state responsibility areas in California (Public Resources Code §4130). The Unit Fire Management Plan is the means of focusing efforts on local needs while working within the framework of the California Fire Plan as adopted by the Board of Forestry and Fire Protection.

It is intended to be an ever-evolving working document which can be used to identify potentially hazardous areas or communities at risk, provide guidelines for fire prevention and protection projects and to assist the Fire Safe Councils and community groups with useful information in making their communities fire safe. This document should be used as a guide that can be amended over the years as necessary and as the basic framework for fire prevention projects within the Lassen-Modoc Unit. The California Fire Plan is outlined within this document. It is the goal of the Unit to apply the California Fire Plan to accomplish a systematic assessment of the fire problem. Through this assessment, the Unit strives to develop "fire safe" communities and reduce the potential occurrence of devastating wildfires. In an effort to implement the California Fire Plan, the Lassen-Modoc Unit utilizes computer-based data and Geographic Information System (GIS) to comprehensively analyze fire hazards, assets at risk and the level of service, all of which are included in the Unit Fire Management Plan. The Unit Fire Management Plan systematically assesses the existing levels of wild/and protection services, identifies high-risk and high value areas that are potential locations for costly and damaging wildfires, ranks the areas in terms of priority needs, and prescribes actions that can be taken to reduce future losses.

Plumas County Fire Chiefs Association – Local Fire Service Mutual Aid & Rescue Plan (2016)

The purpose of this Plan is to:

- To provide for rapid, systematic, and safe mobilization, organization, and operation of necessary local government fire and rescue resources to mitigate the effects of extraordinary events;
- To provide an annually updated fire and rescue inventory of all personnel, apparatus, and equipment;
- To promote recommended, standardized training and/or exercises for and between plan participants.

The plan is intended to provide a common mutual aid operating system for all incidents, which will require a minimum of transition from day to day operations. Basic ICS positions are included as a beginning point in which to build an organizational structure and manage the incident. Agencies requiring an enhanced ICS structure should refer to ICS Field Operations guide 420-1.

The effectiveness of mutual aid resources are determined by the application of a predetermined system familiar to all agencies, thus basic systems have been included to provide an integrated approach known to all involved agencies.

This plan is not intended to deplete any department of apparatus beyond that to which it has agreed and committed. Companies that are already provided to the requesting agency by automatic aid or day-to-day mutual aid agreements are considered part of the maximum commitment under this plan.

Integrated Regional Water Management Plan (2016)

This IRWM Plan articulates a coherent and durable vision for the management of water resources in the Upper Feather River (UFR) Region that highlights important actions needed to accomplish that vision through the year 2035--the planning horizon. This document is intended to be an ongoing adaptive planning tool that can evolve with a dynamic water future. It does not authorize or provide discretionary approval for any given project, nor does it establish new prescriptive compliance requirements. Rather, it provides a locally developed framework for improving understanding and undertaking the coordinated actions that will be needed to address the major water-related challenges/needs and conflicts facing the Region through the planning horizon.

The focus and direction described within this IRWM Plan provides participating entities and individuals with an opportunity to envision the integration of water management across the Region and thereby accomplish more to benefit the needs of the Region. The integrated array of goals and objectives, resource management strategies (RMS), implementation projects, and the Plan's implementation framework demonstrate the potential for further strengthening and broadening the collaborative working relationships for integrated water and watershed management that have been fostered throughout the 24-month plan development process.

Plumas County Ordinances

The Plumas County General Plan provides policy direction for land use, development, open space protection, and environmental quality; however, this policy direction must be carried out through numerous ordinances, programs, and agreements. The following ordinances are among the most important tools for implementing the General Plan and/or are critical to the mitigation of hazards identified in this plan.

Disaster Response and Emergency Organization (Title 4, Chapter 1)

The Plumas County Board of Supervisors acknowledges the serious responsibility of protecting the citizens of Plumas County. The Board of Supervisors understands that citizens will rely on County government to make decisions that will directly affect their lives during a disaster. The purpose of this chapter is to provide for the preparation, maintenance, exercise and implementation of plans for the protection of persons and property within this County in the event of an emergency. This chapter also authorizes the Plumas County Office of Emergency Services and Disaster Council.

As used in this chapter, "emergency" means the actual or threatened existence of an event bringing great damage and possible loss of life. The words emergency and disaster are interchangeable. Some of the hazards which could cause disasters in Plumas County are hazardous materials, wild land fire, severe winter storm, landslide, flood, earthquake, volcanic eruption, multi-casualty accident and nuclear, biochemical or conventional attack.

Fire Prevention Ordinance (Title 4, Chapter 2)

Every person owning, controlling, renting, occupying with or without permission of the owner thereof, or operating any cabin, tent, store, residence, hotel, or other structure in any unincorporated territory in the County, except all territory located within the boundaries of townsites and additions to townsites as the same are laid out and designated on the official plats of maps on file of record in the office of the County Recorder, shall maintain a firebreak or clearing free from all inflammable material for thirty (30') feet from any portion of such cabin, tent, residence, store, hotel, or other occupied structure and shall keep the roofs of all such buildings or other structures free from needles, leaves, or other debris during the period from April 1 to October 31 of each year; provided, however, where a natural firebreak is declared to exist by Federal or State forestry officers, no further clearing of inflammable materials shall be required.

Note: The 30' clearing is being expanded to 100' by the County.

Building Regulations (Title 8)

The current California Building Standards Code Part 1, Part 2 [including Appendix Chapter 1, Appendix C and Appendix J (formerly Appendix 33)], Part 3 [including Annex A], Part 4 [including appendix chapters thereto, except chapter 1], Part 5 [including Appendix I], Part 6 [including appendix chapters thereto], Part 8 [with appendices], Part 9 [including Appendix Chapter 4 and Appendix H, Part 10 [including appendix thereto], Part 12 [including appendix thereto] of Title 24 of the California Code of Regulations and the Uniform Swimming Pool, Spa and Hot Tub Code, 2006 edition, as published by IAPMO are hereby adopted as the Building Standards Code of the County of Plumas. For purposes of this section, "current" means the 2007 edition and any subsequent triennial edition of the California Building Standards Code. The County's Building Standards Code also shall include by operation of law any subsequent revisions, recompilations, or supplements of the California Building Standards Code or the Uniform Swimming Pool, Spa and Hot Tub Code, which shall be deemed effective and operative in Plumas County when they become effective and operative in the State of California. A copy shall be available for public inspection in the Office of the County Building Official.

Floodplain Ordinance (Title 8, Chapter 17)

The areas of special flood hazard identified by the Federal Insurance Administration of the Federal Emergency Management Agency on the Flood Insurance Rate Maps dated September 24, 1984, and all subsequent amendments and revisions and any subsequent Flood Insurance Study, are hereby adopted by reference and made a part of this chapter as though set forth in this chapter in full. The areas of special flood hazard are the minimum area to which the provisions of this chapter shall apply. The County shall obtain, review and reasonably utilize any base flood elevation and floodway data available from a federal, state, or other source as criteria for requiring that new construction, substantial improvements, or other man-made changes in areas of special flood hazard meet the standards of this chapter.

The County Engineer, the Building Official, the Director of Environmental Health and the Planning Director may make interpretations where needed, as to the exact location of the boundaries of the areas of special flood hazard, including where there appears to be a conflict between a mapped boundary and actual field conditions.

Note: there are also floodplain regulations in the Zoning Ordinance (Title 9) below.

Zoning Ordinance (Title 9, Chapter 2)

The provisions of this chapter are adopted to implement the General Plan by providing a precise delineation of permitted land uses, precluding land use conflicts, and by establishing general site development standards. This chapter shall specify the uses of land in a manner which conveys full knowledge of potential uses. The application of the provisions of this chapter shall be held to be only the minimum requirements for the promotion of the public health, safety, and general welfare and to protect property owners' rights to develop consistent with the General Plan. The provisions of this chapter are not intended to repeal or in any way interfere with other existing laws, ordinances, regulations, or permits. The County is hereby divided into the following zones:

- Single-Family Residential (2-R, 3-R, 7-R);
- Multiple-Family Residential (M-R);
- Suburban (S-1);
- Secondary Suburban (S-3);
- Rural (R-10);
- Rural (R-20);
- Core Commercial (C-1);
- Periphery Commercial (C-2);
- Convenience Commercial (C-3);
- Recreation Commercial (R-C);
- Recreation (Rec-P, Rec-1, Rec-3, Rec-10, Rec-20);
- Recreation-Open Space (Res-OS);
- Heavy Industrial (I-1);
- Light Industrial (I-2);
- Limited Combining (Ltd);
- Open Space (OS);
- Lake (L);
- Agricultural Preserve (AP);
- General Agriculture (GA);
- Timberland Production (TPZ);
- General Forest (GF);
- Mining (M);
- Flood Plain Combining (FP);
- Special Plan Combining (SP) (DRA, ScA, ScR, HA, HB);
- Manufactured Home Combining (MH);
- Business Exclusion Combining (BX); and
- Farm Animal Combining (F).

The Planning and Development Agency shall maintain a County-wide set of Zoning Plan Maps which shall show the zones which apply to all property in the County. Any change in the zones shown on the Zoning Plan Maps shall be made pursuant to the provisions of Sections 65500 et seq. and 65853 of the Government Code of the State. The Planning and Development Agency shall establish and show on the Zoning Plan Maps street addresses for parcels or buildings, as necessary, and shall maintain a file of street addresses.

Subdivisions (Title 9, Chapter 2)

The provisions of this chapter are adopted for the purpose of adopting subdivision regulations in accordance with the provisions of the Subdivision Map Act of the State, set forth in Division 2 of Title 7 of the Government Code of the State. The provisions of this chapter are adopted to regulate the subdivision of land within the County for the purposes of sale, lease, or financing in all instances except those which are exempt under the provisions of Sections 66411, 66412, 66424, and 66428 of the Government Code of the State. The general policy governing the subdivision of land in the County shall be to permit orderly, reasonable, and beneficial growth, to discourage overdevelopment and ill-conceived subdivisions, to protect and enhance in every way possible the public health, safety, and general welfare of the citizens, and to conserve the outstanding resources of land, water, air, timber, and scenic beauty.

The Board shall have the overall legislative and governing authority regarding land subdivisions in the County, and the rulings and decisions of the Board shall be final except as an appeal or recourse to law is provided in the Map Act, or as otherwise provided by law. The various County officers designated by the Map Act or by the provisions of Chapter 4 of Title 2 of this Code shall perform such functions and make such recommendations as are provided for in the Map Act or as are more specifically provided for in this chapter and in the various County departmental subdivision regulations approved by the Board.

Development Standards (Title 9, Chapter 3)

The provisions of this chapter are adopted to implement the General Plan by providing a precise delineation of its development standards and to provide for the control and design of improvements for development in accord with the Subdivision Map Act and Chapters 2 and 3 of this title. The application of the provisions of this chapter shall be held to be only the minimum requirements for the promotion of the public health, safety, and general welfare and to protect owners' rights to develop consistent with the General Plan, the Subdivision Map Act, and Chapters 2 and 3 of this title. It shall be the duty of the Department of Planning and Building Services and the Department of Public Works to administer the provisions of this chapter. The headquarters of the Ranger Units of the California Department of Forestry and Fire Protection which administer State Responsibility Area Fire protection in Plumas County shall be given reports of violations of those sections of this chapter which implement the SRA Fire Safe Regulations. Those sections are enumerated in Section 9-9.103 of Chapter 9 of Title 9 of this Code.

SRA Fire Safe Regulations (Title 9, Chapter 9)

The provisions of this chapter are to complete integration of the SRA Fire Safe Regulations into this Code and to specify those portions of this Code which implement those regulations. The application of the provisions of this chapter and those portions of this Code which implement the SRA Fire Safe Regulations shall be held to be only the minimum requirements for the promotion of the public health, safety and general welfare. The purpose of this article is to provide for exceptions from the provisions of this Code which implement the SRA Fire Safe Regulations in a manner consistent with the General Plan and public health, safety, and welfare, where the exceptions provide the same overall practical effect as these regulations towards providing defensible space.

This ordinance is certified by the Board of Forestry in lieu of SRA regulations in the County.

4.4.2. Plumas County's Administrative/Technical Mitigation Capabilities

Table 4-99 identifies the County personnel responsible for activities related to mitigation and loss prevention in the County.

Table 4-99 Plumas County Administrative/Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	Y	Coordination is effective with Commission, although only recommendation authority to Board of Supervisors on: Periodically review and recommend action on the general plan for the County; Periodically review and recommend action on any specific plans for the County; Periodically review and recommend action on the zoning ordinances of the County; and Initiate amendments to boundaries of zones and provisions of Chapter 2 of Title 9 of this Code pursuant to Section 9-2.902 of Article 9 of Chapter 2 of Title 9 of this Code.

Disaster Council	Y	Disaster Council – objective is to meet quarterly. Met on July 21, 2020 where main topics of discussion were: --Mass Care and Shelter Annex to EOP --PG&E PSPS – develop an Annex. How will Plumas County respond to PSPS including notifications to our Access and Functional Needs Population with Base Line Medical information provided by PG&E Feedback – OES should be the lead, likely underutilized; could have more involvement and defined leadership to be better utilized – mission could be expanded. Title 4 (Public Safety); Sec. 4-1.03. - Disaster Council. (a)So that informed decisions can be made and the public protected, the Board of Supervisors creates a group named the Plumas County Disaster Council and **charges it with the responsibility of developing and recommending for adoption by the Board of Supervisors an emergency operations plan, mutual aid plans and rules and regulations as necessary.** (b)The membership is flexible as new members can be added as the need for the knowledge and services of additional personnel becomes apparent. The Disaster Council should be made up of representatives from the County's functional areas, such as: fire and rescue operations, evacuation and transportation, public health services, care and shelter operations, radiological protection operations, coroner services, law enforcement and traffic control, restoration of services, communications, managing emergency operations and emergency medical services. (c)Some functional areas may be represented by more than one person. (d)The Chairman of the Board of Supervisors will be the Chairman of the Disaster Council, Vice-Chairman will be the Director of the Plumas County Office of Emergency Services. (e)Unlike other County committees and councils, this one does not have specific individuals as members, specific terms of service nor specific meeting times. (f)Either the Chairman or the Vice-Chairman can call a meeting. The Disaster Council **will meet at least bi-annually.**
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Coming	PW has applied for a multi-year maintenance permit from Cal F&W for 168 bridges, large culverts, and drainage ways so that we may expedite maintenance tasks such debris removal, brushing, basic bridge and culvert maintenance, etc. It's a large stack of maps and paper.
Mutual aid agreements	Y	--Mutual Aid Radio Systems --Plumas County Fire Chiefs Association Local Fire Service Mutual Aid & Rescue Plan (updated 2016)
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Y	Chief Building Official is also Director of Building Services – Chuck White is trained on hazards and mitigation and is part of the County's rescue

Floodplain Administrator	Y	Staffing is adequate and trained. Coordination is being worked on to increase effectiveness.
Emergency Manager	Y	County Sheriff is the "Director of OES" County Administrator is also "Risk Management" All County employees are Disaster Service Workers: According to California Government Code Sections 3100-3109, all public employees are designated as Disaster Service Workers. In Plumas County, all county employees take an oath of affirmation to ensure the county has the resources and readiness to help protect public health and safety and to protect lives and property during disasters or emergencies.
Community Planner	Y	Planning Director has experience with hazard mitigation.
Civil Engineer	Y	Staff is trained on regulation enforcement with a hazard focus. Coordination is effective.
GIS Coordinator	Y	GIS capabilities are strong and the GIS Department serves all County departments with mapping needs; GIS County portal: https://mangomap.com/plumasgis/maps Maps on the portal include: -fire district query -firewise communities map -snow load and fire hazard -Sheriff Evacuation Area Maps Static PDF Maps: https://plumascounty.us/2206/Static-PDF-Maps -State Responsibility Areas (SRA) lands for fire protection -various maps created for Fire Safe Council Link for FEMA FIRM Maps: https://plumascounty.us/2295/FEMA-Flood-Insurance-Rate-Maps-Informati
Other		
Technical	**Y/N**	**Describe capability Has capability been used to assess/mitigate risk in the past?**
Warning systems/services (Reverse 911, outdoor warning signals)	Y	--IPAWS – integrated public alert system --Code Red https://www.plumascounty.us/2163/CodeRed-Emergency-Alert-System --EAS, emergency alert system --NOAA, national weather service alert system --Outdoor warning sirens (in process Peninsula Fire Department)
Hazard data and information	Y	OES
Grant writing	Y	OES, Planning, and Public Works (may be others)

Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
The County could expand capabilities by hiring a Fire Warden. Wildfire is the biggest hazard faced by the County, but there is no overarching entity in the County to coordinate fire response among all the fire protection districts.		

4.4.3. Plumas County's Fiscal Mitigation Capabilities

Table 4-100 identifies financial tools or resources that the County could potentially use to help fund mitigation activities.

Table 4-100 Plumas County Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	N	
Authority to levy taxes for specific purposes	Y	Funding has not been used for mitigation in the past.
Fees for water, sewer, gas, or electric services	Y	Various community and public utility districts (see website for more information), along with Environmental Health (just did a fee study and raised fees) – see County department websites for fee schedules
Impact fees for new development	N	--
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	Funding has not been used for mitigation in the past.
Incur debt through private activities	N	
Community Development Block Grant	Y	For housing (not hazard mitigation) in the past via Plumas County Community Development Commission (housing authority)
Other federal funding programs	Y	--Homeland Security Grant --EMPG – Emergency Management Performance Grant --Title III Funding-Federal funding to County of Plumas
State funding programs	N	
Other	N	
How can these capabilities be expanded and improved to reduce risk?		
The County is seeking to integrate Capital Improvement Funding with hazard mitigation project funding. There is currently a push to assess project fees.		

4.4.4. Plumas County Mitigation Education, Outreach, and Partnerships

Table 4-101 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table 4-101 Plumas County Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Firewise Communities / Fire Safe Council
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	--Local Fire Departments -Plumas Fire Safe Council --Individual Firewise certified communities - Public Health
Natural disaster or safety related school programs	Y	--local Fire Departments - Plumas Unified School District Safety Officer
StormReady certification	N	
Firewise Communities certification	Y	As of 3/30/2020 – there are 21 certified communities, with 4 others in process
Public-private partnership initiatives addressing disaster-related issues	N	
Other	Y	Cooperation with electric companies like PG&E on PSPS and other events.
How can these capabilities be expanded and improved to reduce risk?		
The County is seeking to expand knowledge of evacuation routes and plans. There is a desire to put publications, mailings, and other education outreach ideas into place. There will be continued efforts to expand FireWise communities.		

Firewise in Plumas County

Plumas County has multiple Firewise communities. The following graphic shows investments made in Plumas County to Firewise efforts:

Source: Plumas County

Community Wildfire Safety Program

PG&E has partnered with the County to prepare for PSPS events. Goals of the program are to make PSPS events smaller in size, duration, and with more information communicated to residents. High Fire Threat maps were created, additional weather stations were installed, high definition cameras were added, and the system has been hardened and vegetation management has been performed.

4.4.5. Other Mitigation Efforts

The County has pursued other mitigation efforts not already captured in the capability assessment above. These include:

- Plumas County supports the U.S.D.A. Farm Service Agency County Emergency Board that provides technical assistance and assessment of local disasters. The team can quantify forage losses, analyzes grazing infrastructure losses, certify livestock death and other associated impacted to livestock grazing operations from drought and wildfires. The Emergency Board includes representation from the US Forest Service (Rangeland Team), University of California Cooperative Extension local livestock and natural resources advisors (Plumas-Sierra), and the Natural Resources Conservation Services (Quincy), under the leadership of the Farm Service Agency. The County Emergency Board also works with the "County Committee" that is a board of local livestock and agricultural producers that advise the local Farm Service Agency (based in Susanville).

- Evacuation maps have been created for several communities in case of wildfire. These maps show suggested primary and secondary evacuation routes out of each community. Depending on the type of emergency, there may be more than one route out of the area. Residents are aske to familiarize themselves with their surrounding neighborhood and listen for instructions from emergency personnel when asked to evacuate.
- Plumas County OES, in coordination with County GIS and Fire Safe Council, have put together a FIREWISE Program for many of the communities in the County. An interactive map of FireWise community boundaries has been put together online. This map (one of the first of its kind) can be found at https://mangomap.com/plumasgis/maps/104226/firewise-communities-#.
- Plumas County has EAPs on file for many of the dams in the County.
- In 2019, the County participated in a large, multi-agency wildfire exercise. There were hundreds of participants included: OES, Sheriff's Department, Cal-Fire, USFS, CHP, Peninsula Fire, PG&E, County Search/Rescue, local fire departments, community members. The County has functional exercises
- Public Works also participated with the wildfire exercise at Almanor and a couple years prior all players also held one in the Meadow Valley area.
- Plumas County's newly updated (2020) Living with Fire publication is available online. It includes evacuation information that could be handy for many folks right now. Hard copies are available from business racks where citizens would usually find the Plumas County Visitors Guide, post offices, fire departments, the Feather Publishing office in Quincy, or at the Fire Safe Council office.
- Plumas County Fire Save Council (PCFSC) has provided 698.1 acres of Hazardous Fuel Reduction on private lands with state and federal dollars
- PCFSC has treated 8,028.5 acres of public land (Plumas National Forest) for fuel reduction and forest health using state dollars
- PCFSC has provided annual Senior/Disabled Defensible Space services, providing treatment for hundreds of participants
- Starting in 2017, PCFSC has provided annual chipping services across Plumas County. In 2019 alone the program chipped 4,720 linear feet of material across 326 locations.
- Since 2014 PCFSC has secured $13 million in grant funds to support wildfire risk reduction activities.
- PCFSC has regularly produced Living with Fire publications for public outreach and education
- PCFSC has held multiple public showings of the documentary Wilder than Wild, as well as other public events
- 16 of Plumas County's 21 Firewise communities have been certified since 2014
- Plumas County OES hosted a Fire Preparedness Virtual Town Hall
- In 2019, inundation maps and an Emergency Action Plan were completed related to the Chester Diversion Dam.
- The County has an annual FireWise community event
- The County has put together home hardening workshops to mitigate against hazards like wildfire.
- The County has put together wildfire preparedness town hall events. These have been on Zoom recently due to the Covid outbreak.