Chapter 4 Risk Assessment

44 CFR 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: Natural Hazards** identifies the natural hazards that threaten the Colusa County Planning Area and unincorporated Colusa County and describes why some hazards have been omitted from further consideration.
- **Section 4.2 Colusa County Planning Area Assets Inventory and Growth and Development Trends** identifies the populations; structures and values; critical facilities and community lifelines; and cultural, historical, and natural resources; and economic and community activities of value. It also identifies past growth in the Colusa County Planning Area and reviews future development trends. This information is not hazard specific and covers the entire Colusa County Planning Area and unincorporated Colusa County.
- **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 Colusa County Planning Area and unincorporated Colusa County. The hazard profile also describes previous occurrences of hazard events and the likelihood of future occurrences. The vulnerability assessment evaluates the Colusa County's exposure to natural hazards considering: populations; structures and values; critical facilities and infrastructure; community lifelines; natural, historic, and

cultural resources; economic assets and community activities; and future development trends, and where possible, estimates potential hazard losses.

- **Section 4.4 Capability Assessment** inventories existing mitigation activities and policies, regulations, plans, and programs that pertain to hazards and mitigation in the Colusa County Planning Area and unincorporated Colusa County and can affect net vulnerability.
- **Section 4.5 Natural Hazard Summary** summarizes the results of the risk assessment and whether a hazard is considered a priority for mitigation strategy planning.

This risk assessment covers the entire geographical extent of Colusa County (i.e., the Colusa County Planning Area) and unincorporated Colusa County. And as required by FEMA, this risk assessment for the Colusa 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 2018 risk assessment. Information from the 2018 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 the Plan Update.

4.1 Hazard Identification

44 CFR 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 Colusa County Hazard Mitigation Planning Committee (HMPC) conducted a hazard identification study 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 the plan:

- National Climatic Data Center Storm Events Database
- 2018 Colusa County Hazard Mitigation Plan
- 2012 Colusa County General Plan
- 2023 State of California Hazard Mitigation Plan
- FEMA Disaster Declaration Database
- HMPC input

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 Colusa County Planning Area. Hazards data from the California Office of Emergency Services (Cal OES), FEMA, California Department of Water Resources, the National Oceanic

and Atmospheric Administration (NOAA), 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 Colusa County LHMP Update and the 2023 California State Hazard Mitigation Plan were consulted to evaluate the applicability of new hazards of concern to the State to the Colusa County Planning Area. Building upon this effort, hazards from the past plan were also identified, and comments explain how hazards were updated from the previous plan. Most hazards from the 2018 plan were profiled in this LHMP Update, with the exception of hazardous materials and volcano. No new hazards were added.

Table 4-1 Colusa County Hazard Identification and Comparison between 2018 and 2024 LHMP

2024 Hazards	2018 Hazards	Comment
Ag Hazards: Severe Weather/Invasive Species (Pests and Weeds)	Ag Hazards: Severe Weather/Insect Pests	This hazard was kept and slightly renamed.
Climate Change	Climate Change	This hazard was kept.
Dam Failure	Dam Failure	This hazard was kept.
Drought & Water shortage	Drought and Water Shortage	This hazard was kept.
Earthquake	Earthquake (minor/major)	This hazard was kept and slightly renamed.
Floods: 1%/0.2% annual chance	Flood: 100/500-year	This hazard was kept and slightly renamed.
Floods: Localized Stormwater	Flood: Localized/Stormwater	This hazard was kept.
–	Hazardous Materials Transportation	This hazard was dropped. It is covered in other County planning mechanisms.
Landslide, Mudslide, and Debris Flow	Landslide, Mudslide, and Debris Flows	This hazard was kept.
Levee Failure	Levee Failure	This hazard was kept.
Severe Weather: Extreme Cold and Freeze	Severe Weather: Extreme Cold and Freeze	This hazard was kept.
Severe Weather: Extreme Heat	Severe Weather: Extreme Heat	This hazard was kept.
Severe Weather: Heavy Rain and Storms (Wind, Hail, Lightning)	Severe Weather: Heavy Rains and Storms (winds, hail, lightning)	This hazard was kept.
Severe Weather: High Winds and Tornados	Severe Weather: High Winds/Tornadoes	This hazard was kept.
Stream Bank Erosion	Stream Bank Erosion	This hazard was kept.
Subsidence	Subsidence	This hazard was kept.
–	Volcano	This hazard was dropped due to the low chance of occurrence and limited mitigation actions the County can take.
Wildfire	Wildfire (smoke, tree mortality)	This hazard was kept.

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

Table 4-2 Colusa County – Excluded Hazards

Hazard Excluded	Why Excluded
Avalanches	The County does not have sufficient snowfall to have avalanche as a hazard.
Coastal Flooding, Erosion, and Sea Level Rise	The County is not on the coast.
Hurricane	The County is not on the coast.
Tsunami	The County is not on the coast.
Volcano	Given the location of active or potentially active volcanoes relative to the Planning Area, it was felt this hazard was not of concern to the County.

Table 4-3 was completed by the County and HMPC to identify, profile, and rate the significance of identified hazards.

Table 4-3 Colusa County Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Ag Hazards: Severe Weather/Invasive Species (Pests and Weeds)	Extensive	Highly Likely	Catastrophic	High	Medium
Climate Change	Extensive	Highly Likely	Limited	Medium	–
Dam Failure	Extensive	Occasional	Catastrophic	High	Medium
Drought & Water shortage	Extensive	Likely	Critical	High	High
Earthquake	Extensive	Unlikely	Critical	Medium	Low
Floods: 1%/0.2% annual chance	Extensive	Occasional/ Unlikely	Catastrophic	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Medium	Medium
Landslide, Mudslide, and Debris Flow	Limited	Likely	Limited	Medium	Medium
Levee Failure	Extensive	Occasional	Catastrophic	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Critical	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Medium	High
Severe Weather: Heavy Rain and Storms (Wind, Hail, Lightning)	Extensive	Highly Likely	Critical	Medium	Medium
Severe Weather: High Winds and Tornados	Extensive	Highly Likely / Occasional	Limited	Medium	Low
Stream Bank Erosion	Significant	Highly Likely	Limited	Medium	Medium
Subsidence	Limited	Likely	Limited	Medium	Low
Wildfire	Significant	Highly Likely	Critical	High	Medium

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 used to identify hazards was the researching of past events that triggered federal and/or state emergency or disaster declarations in the Colusa 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.

A USDA declaration will result in the implementation of the Emergency Loan Program through the Farm Services Agency. This program enables eligible farmers and ranchers in the affected county as well as contiguous counties to apply for low interest loans. A USDA declaration will automatically follow a major disaster declaration for counties designated major disaster areas and those that are contiguous to declared counties, including those that are across state lines. As part of an agreement with the USDA, the SBA offers low interest loans for eligible businesses that suffer economic losses in declared and contiguous counties that have been declared by the USDA. These loans are referred to as Economic Injury Disaster Loans. Disaster declarations for these programs are discussed in Section 4.3.6.

Based on the disaster declaration history provided in Table 4-4, Colusa County is among the many counties in California susceptible to disaster. Details on federal and state disaster declarations were obtained by the HMPC, FEMA, and Cal OES and compiled in chronological order in Table 4-4. A review of federal disasters shows 25 federal disaster declarations. Of these 25 federal declarations: 17 were associated with severe winter storms, heavy rains, or flooding; 2 were for freeze; 2 were from pandemic, 1 for drought; 1 for fire; 1 was for seismic sea wave (which was declared for the entire State of California); and 1 was for hurricane (a nationwide declaration for Katrina evacuations). A review of state declared disasters indicates that Colusa County received 32 state declarations between 1950 and 2024. Of the 31 state declarations: 19 were associated with severe winter storms, heavy rains, or flooding; 3 were for freeze and severe weather conditions; 3 were for drought; 2 were from economic disasters; 2 were from pandemic; 2 were for fire; and 1 was for road damage. A summary of these events by disaster type is shown in Table 4-5.

Table 4-4 Colusa County Federal and State Disaster Declarations, 1950-2024

Year	Disaster Name	Disaster Type	Disaster Cause	Federal Declaration # and Date	State Declaration # and Date
2023	California Severe Winter Storms, Flooding, and Mudslides	Flood	Storms	DR-4683 1/14/2023	–
2023	California Severe Winter Storms, Flooding, and Mudslides	Flood	Storms	EM-3591 1/9/2023	–
2021	2021 Drought	Drought	Drought	–	2022-05 4/21/2021
2020	California Covid 19 Pandemic	Biological	Pandemic	DR-4482 3/22/2020	2020-01 3/4/2020
2020	California Covid 19	Biological	Pandemic	EM-3428 3/13/2020	2020-01 3/4/2020
2019	California Severe Winter Storms, Flooding, Landslides, and Mudslides	Flood	Storms	DR-4434 5/17/2019	2019-03 5/18/2019
2019	California Severe Winter Storms, Flooding, Landslides, and Mudslides	Flood	Storms	DR-4431 5/1/2019	2019-02 5/1/2019
2018	Summer 2018 California Wildfires and High Winds	Fire	Fire	DR-4382 8/4/2018	2018-06 7/28/2018
2017	California Severe Winter Storms, Flooding, Mudslides	Flood	Storms	DR-4308 4/1/2017	–
2017	February 2017 Storms	Severe Storms	Storms	–	2017-03 3/7/2017
2014	California Drought	Drought	Drought	–	GP 2014-13 1/17/2014
2008	2008 January Storms	Flood	Storms	–	GP-2008-1 1/5/2008
2005/2006	2005/06 Winter Storms	Flood	Storms	DR-1628 2/3/2006	GP 2006-01 1/12/2006
2005	Hurricane Katrina Evacuations	Economic	Hurricane	EM-3248 9/13/2005	–
2003	State Road Damage	Road Damage	Flood	–	GP 2003 1/1/2003

Year	Disaster Name	Disaster Type	Disaster Cause	Federal Declaration # and Date	State Declaration # and Date
2001	Energy Emergency	Economic	Greed	–	GP 2001 1/1/2001
1998	1998 El Nino Floods	Flood	Storms	DR-1203 2/19/1998	98-01 Proclaimed
1997	1997 January Floods	Flood	Storms	DR-1155 1/4/1997	97-01 1/2/97-1/31/97
1995	California Severe Winter Storms, Flooding, Landslides, Mud Flows	Flood	Storms	DR-1046 3/12/1995	Proclaimed
1995	1995 Severe Winter Storms	Flood	Storms	DR-1044 1/13/1995	1/6/95-3/14/95
1990	1990 Freeze	Freeze	Freeze	DR-894 2/11/1991	12/19/90
1987	1987 Fires	Fire	Fire	–	GP 9/10/87, 9/3/87
1986	1986 Storms	Flood	Storms	DR-758 2/18/1986	86-01 2/18-86-3/12/86
1983	Winter Storms	Flood	Flood	DR-677 2/9/1983	82-18 12/8/82-3/21/83
1979	Gasoline Shortage	Economic	OPEC	–	5/8/1979-11/13/79
1978	Heavy Rains	Flood	Storms	–	DC 78-06-11 2/13/1978
1977	Drought	Drought	Drought	EM-3023 1/20/1977	–
1976	1976 Drought	Drought	Drought	–	2/9/76, 2/13,76, 2/24/76, 3/26/76, 7/6/76
1973	1973 Storms and Floods	Flood	Storms	–	2/28/1973
1972	1972 Freeze	Freeze	Freeze	–	7/13/1972
1970	1970 Northern California Flooding	Flood	Flood	DR 283 2/16/1970	1/27/1970 - 3/2/1970
1964/1965	Seismic Sea Wave	Other	Other	DR-169 4/1/1964	–
1964	1964 Late Winter Storms	Flood	Storms	DR-183 12/24/1964	–
1963	Severe Storms and Flooding	Flood	Storms	DR-138 10/24/1962	–

Year	Disaster Name	Disaster Type	Disaster Cause	Federal Declaration # and Date	State Declaration # and Date
1963	1963 Floods and Rains	Flood	Storms	DR-145 2/25/63	2/7/63, 2/26/63, 2/29/63, & 4/22/63
1963	1963 Floods	Flood	Storms	–	2/14/1964
1958	1958 April Storms and Floods	Flood	Storms	DR-82 4/4/1958	4/5/1958
1958	1958 February Storms and Floods	Flood	Storms	–	CDO 58-03 2/26/1958
1955	1955 Floods	Flood	Flood	DR-47 12/23/1955	12/22/1955
1950	1950 Floods	Flood	Flood	–	OCD 50-01 11/21/1950

Source: Cal OES, FEMA

Table 4-5 Colusa County – Federal and State Disaster Declarations Summary 1950-2024

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Drought	1	1977	3	1976, 2014, 2021
Economic	0	–	2	1979, 2001
Fire	1	2018	2	1987, 2018
Flood (including heavy rain and storms)	17	1955, 1958, 1963 (twice), 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2017, 2019 (twice), 2023 (twice)	19	1950, 1955, 1958 (twice), 1963 (twice), 1973, 1978, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017, 2019 (twice)
Freeze	2	1972, 1990	3	1970, 1972, 1990
Hurricane	1	2005	0	–
Pandemic	2	2020 (twice)	2	2020 (twice)
Road Damage	0	–	1	2003
Seismic Sea Wave	1	1964/1965	0	–
Totals	**25**	–	**32**	**–**

Source: Cal OES, FEMA

Colusa County Disasters since 2018 LHMP

- 2019 Floods (two federal and two state)
- 2020 Pandemic (two federal and two state)
- 2021 Drought (state)
- 2023 Floods (including heavy rain and storms) (two federal)

4.1.3. EOC Activations

The County maintains a list of EOC activations by hazard. EOC activations from 2008 to 2024 are shown in Table 4-6.

Table 4-6 Colusa County – EOC Activations Summary 2008-2024

Disaster Type	EOC Activations	
	Count	Date
Drought	3	6/2015; 10/2017, 1/2019
Flood and Storms	6	1/2008; 1/2010, 3/2011; 11/2012; 2/2017, 1/2019
Hazardous Materials	3	3/2008; 8/2008; 5/2009
Pandemic	1	3/2020
Subsidence	1	4/2014
Wildfire	3	8/2012, 7/2016, 8/2020, 6/2024
Winter Storm	2	1/2021, 1/2023
Totals	**19**	–

Source: Colusa County OES

4.2 Colusa County Asset Inventory and Growth and Development Trends

As a starting point for analyzing the Colusa County Planning Area's vulnerability to identified hazards, a variety of data was used to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster was to occur in the Colusa County Planning Area, this section describes significant lands, assets, and other resources at risk. This section is broken into two parts:

- **Asset Inventory** – The assets inventory identifies the Colusa County Planning Area's and unincorporated Colusa County's total assets, including the people and populations: structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. This data is not hazard specific, but is representative of total assets within the Colusa County Planning Area and unincorporated Colusa County, potentially at risk to identified hazards as discussed in Section 4.3 Hazard Profiles and Vulnerability Assessment.
- **Growth and Development Trends** – A discussion of growth and development trends in the Colusa County Planning Area with a focus on unincorporated Colusa County, both current and future, is presented.

Data Sources

- 2010 Colusa County General Plan Background Report
- 2020-2028 Colusa County Housing Element
- 2023 Colusa County Parcel/Assessor Data
- 2030 Colusa County General Plan Land Use Element
- CalAtlas

- California Department of Conservation
- California Department of Finance
- California Department of Fish and Wildlife Service
- California Department of Parks and Recreation Office of Historic Preservation
- California Department of Water Resources (CA DWR) Special Populations and Disadvantaged Community Mapping
- California Environmental Protection Agency (Cal EPA) Disadvantaged Communities
- California Natural Diversity Database
- Center for Disease Control (CDC) Social Vulnerability Index
- Colusa County Building Department and Planning Department
- Colusa County GIS
- FEMA Community Disaster Resilience Zones
- FEMA National Risk Index
- Hazus-MH 6.1
- State of California Department of Conservation
- US Census Bureau

4.2.1. Assets Inventory

If a catastrophic disaster was to occur in the Colusa County Planning Area, this section describes populations, structures, critical facilities and infrastructure, and other key assets and resources at risk that comprise the existing built environment. Assets inventoried in this baseline assessment include:

- People and Populations
- Structures
- Critical Facilities and Infrastructure,
- Community Lifelines
- Natural, Historic, and Cultural Resources
- Economic Assets and Community Activities of Value

Populations

Life safety is a priority issue for hazard mitigation planning. The people that work and recreate in the Colusa County Planning Area, and those that live and work in surrounding communities are also potentially at risk during a natural hazard event.

The estimated population of Colusa County (both incorporated communities and the unincorporated County) for January 1, 2024 was 21,171. Populations potentially at risk are described in the Table 4-7 based on California Department of Finance estimates. The most recent estimates are dated 1/1/2024, which are shown in the table below.

Table 4-7 Colusa County Planning Area – Populations

Jurisdiction	Population
Colusa	6,447
Williams	5,528

Jurisdiction	Population
Unincorporated Colusa County	9,768
Total	**21,743**

Source: Cal DOF E-1. 1/1/2024

Table 4-8 illustrates the pace of population growth in the Colusa County Planning Area dating back to 1940. The data on population and housing growth shows that Colusa County saw growth through 2010. The County has seen smaller population growth since 2010, with small losses in recent population. Details on population growth in the cities are included in their respective annexes to this Plan Update.

Table 4-8 Colusa County Planning Area – Population Growth 1940-2023

Year	Population	Percent Increase
1940	9,788	–
1950	11,651	19.0%
1960	12,075	3.6%
1970	12,430	2.9%
1980	12,791	2.9%
1990	16,275	27.2%
2000	18,804	15.5%
2010	21,419	13.9%
2020	21,839	2.0%
2024	21,743	-0.5%

Sources: 2022-2030 Colusa County Housing Element, California Department of Finance, US Census Bureau

Vulnerable and Underserved Populations

Vulnerable populations are those who may need additional help or accommodation during a hazard event. The vulnerable and underserved populations discussion for the Colusa County Planning Area is based on the following sources:

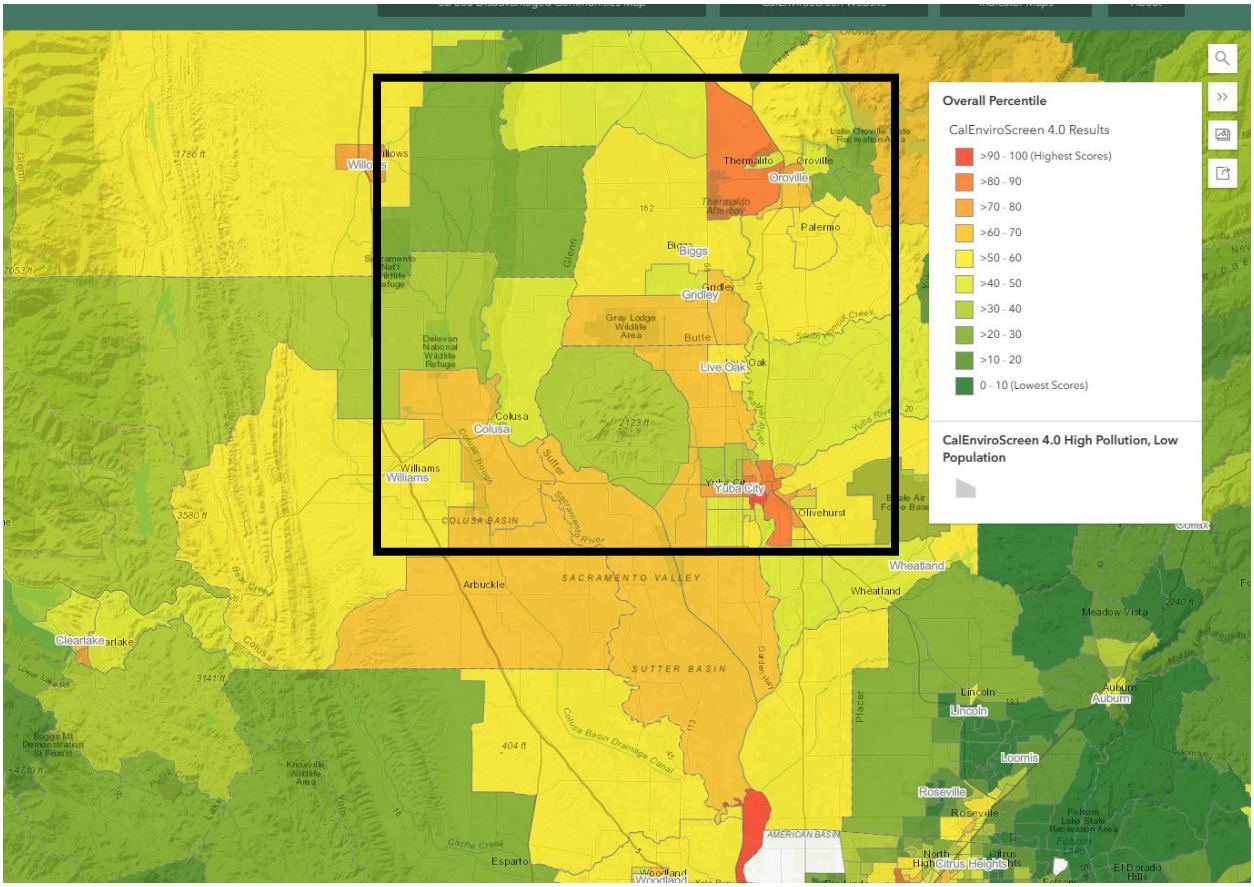
- California Environmental Protection Agency (Cal EPA) Disadvantaged Communities
- Center for Disease Control (CDC) Social Vulnerability Index
- California Department of Water Resources (CA DWR) Special Populations and Disadvantaged Community Mapping
- FEMA Community Disaster Resilience Zones
- FEMA National Risk Index
- Local Input

Note: These sources below show information for the Colusa County Planning Area and unincorporated Colusa County. Information on specific data for the incorporated jurisdictions can be found in their respective annexes to this Plan Update.

Cal EPA Disadvantaged Communities

Disadvantaged communities are defined by CalEPA as the top 25 percent of communities experiencing disproportionate amounts of pollution, environmental degradation, and socioeconomic and public health conditions according to the Office of Environmental Health Hazard Assessment's CalEnviroScreen tool. CalEPA is responsible for identifying disadvantaged communities for the purposes of the Cap-and-Trade funding program. This uses the CalEnviroScreen 4.0 Tool. Maps showing these areas in the Planning Area are shown on Figure 4-1.

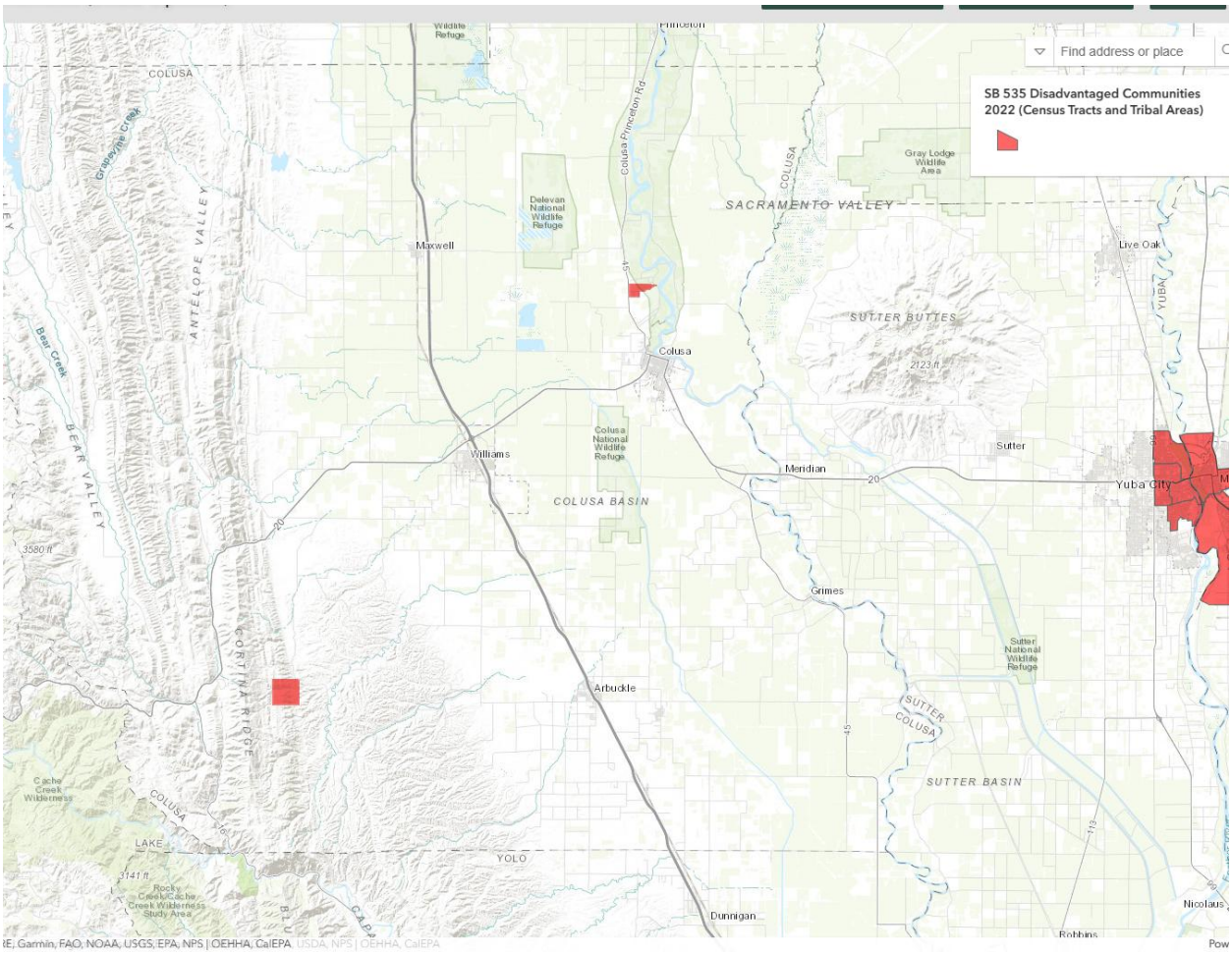
Figure 4-1 Colusa County Planning Area – Cal EPA Disadvantaged Communities



Source: Cal EPA, map retrieved 03/18/2024

Cal EPA has another way to track disadvantaged communities. California Climate Investments are funds (Greenhouse Gas Reduction Fund and appropriated by the Legislature) from the proceeds of the State's Cap-and-Trade Program specifically targeted for investment in disadvantaged communities in California. These funds must be used for programs that further reduce emissions of greenhouse gases. Senate Bill 535 directed that at least a quarter of the proceeds go to projects that provide a benefit to disadvantaged communities and at least 10 percent of the funds go to projects located within those communities. Cal EPA has also mapped these communities. Those communities that fall inside this program in Colusa County are shown on Figure 4-2.

Figure 4-2 Colusa County SB 535 Disadvantaged Communities (2022)



Source: Cal EPA, map retrieved 03/18/2024

CDC Social Vulnerability Index

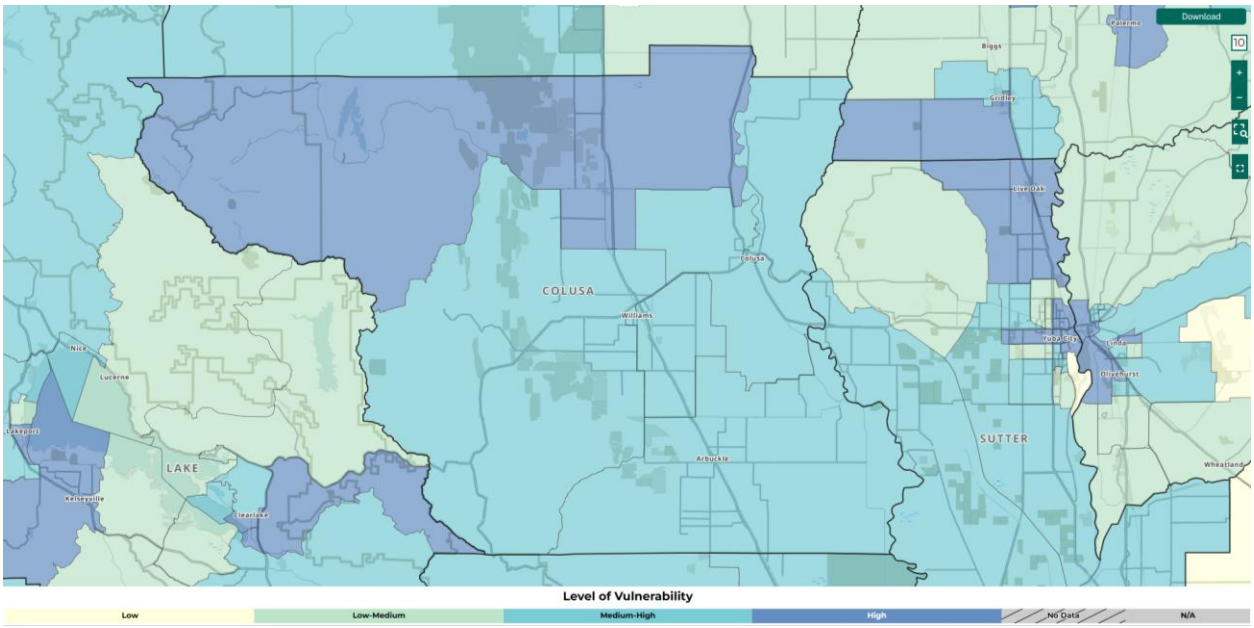
Every community must prepare for and respond to hazardous events, whether a natural disaster like a tornado or disease outbreak, or a human-made event such as a harmful chemical spill. A number of factors, including poverty, lack of access to transportation, and crowded housing may weaken a community's ability to prevent human suffering and financial loss in a disaster. These factors are known as social vulnerability.

Social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss. CDC Social Vulnerability Index (CDC SVI) uses 15 U.S. census variables to help local officials identify communities that may need support before, during, or after disasters.

The Agency for Toxic Substances and Disease Registry's (ATSDR) Geospatial Research, Analysis & Services Program (GRASP) created databases to help emergency response planners and public health officials identify and map communities that will most likely need support before, during, and after a hazardous event. CDC SVI uses U.S. Census data to determine the social vulnerability of every census

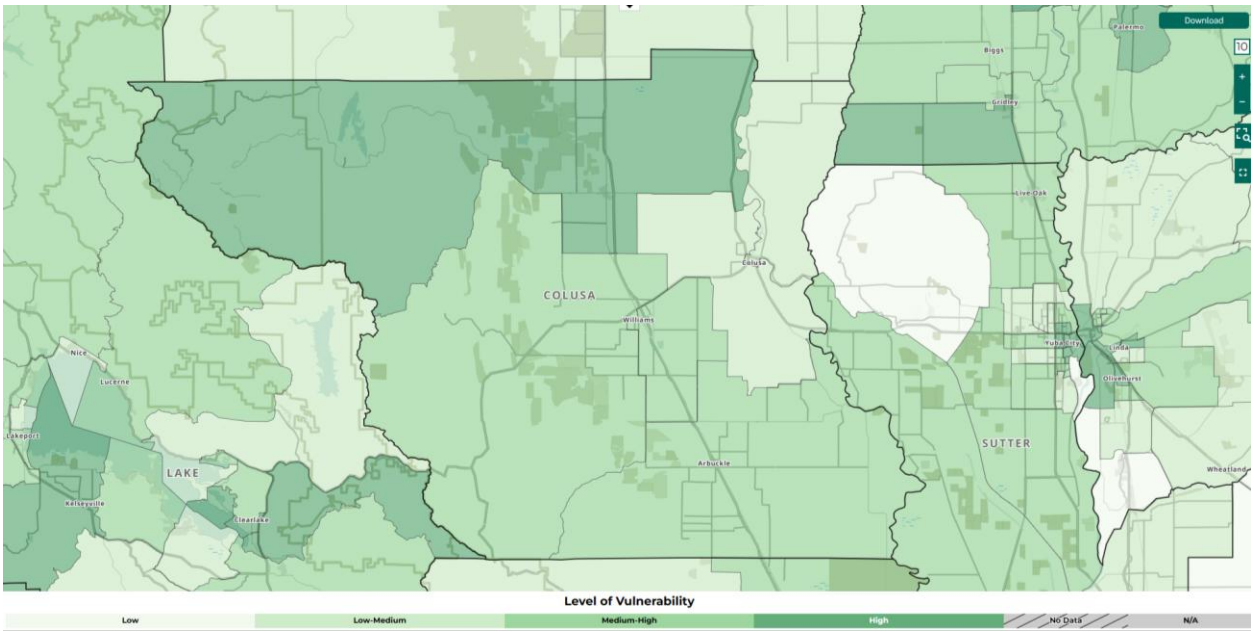
tract. Census tracts are subdivisions of counties for which the Census collects statistical data. The CDC SVI ranks each tract on 15 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking. Maps of the four themes are shown in the figure below. The overall SVI map is shown in Figure 4-3; the socioeconomic SVI for the Planning Area is shown in Figure 4-4; the household composition SVI is shown in Figure 4-5; the minority and language SVI is shown in Figure 4-6; and the housing and transportation SVI is shown in Figure 4-7.

Figure 4-3 Colusa County Planning Area – Overall Social Vulnerability



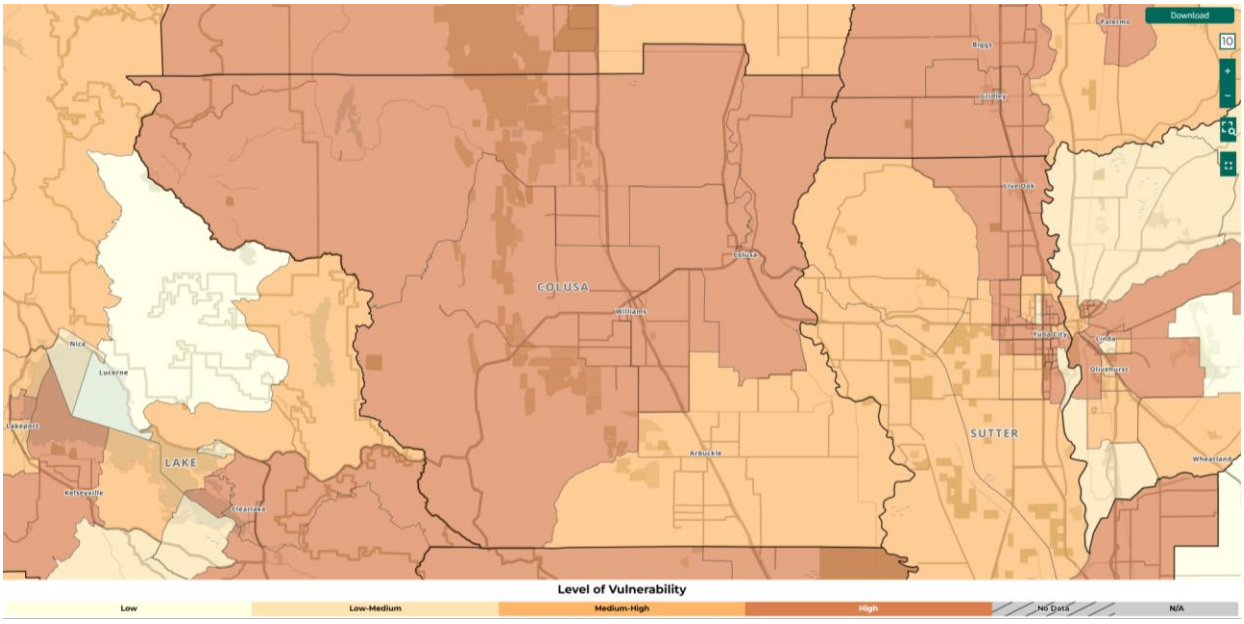
Source: CDC Social Vulnerability Index – map retrieved 3/14/2023
Level of Vulnerability Rating: **Yellow** – Low; **Green** – Low/Medium; **Aqua** – Medium/High; **Blue** – High; **Grey Hatched** – No Data; **Grey** – Not Available

Figure 4-4 Colusa County Planning Area – Socioeconomic Status Vulnerability



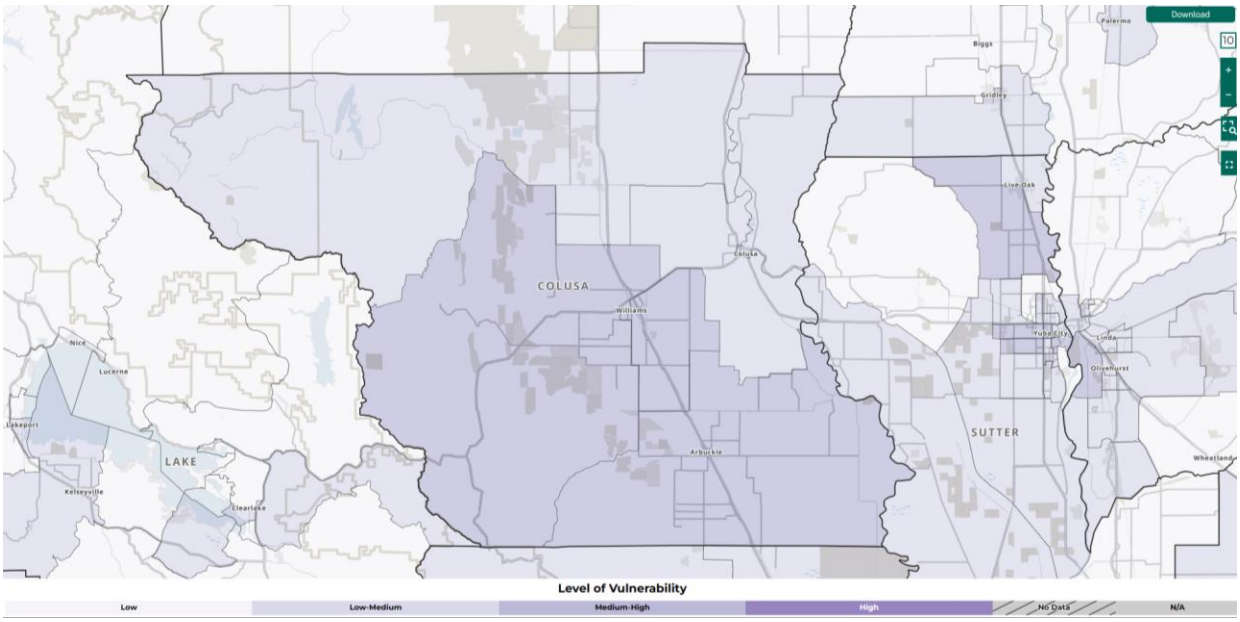
Source: CDC Social Vulnerability Index – map retrieved 3/14/2023
Level of Vulnerability Rating: **Faint Green** – Low; **Light Green** – Low/Medium; **Green** – Medium/High; **Dark Green** – High; **Grey Hatched** – No Data; **Grey** – Not Available

Figure 4-5 Colusa County Planning Area – Household Composition and Disabilities Social Vulnerability



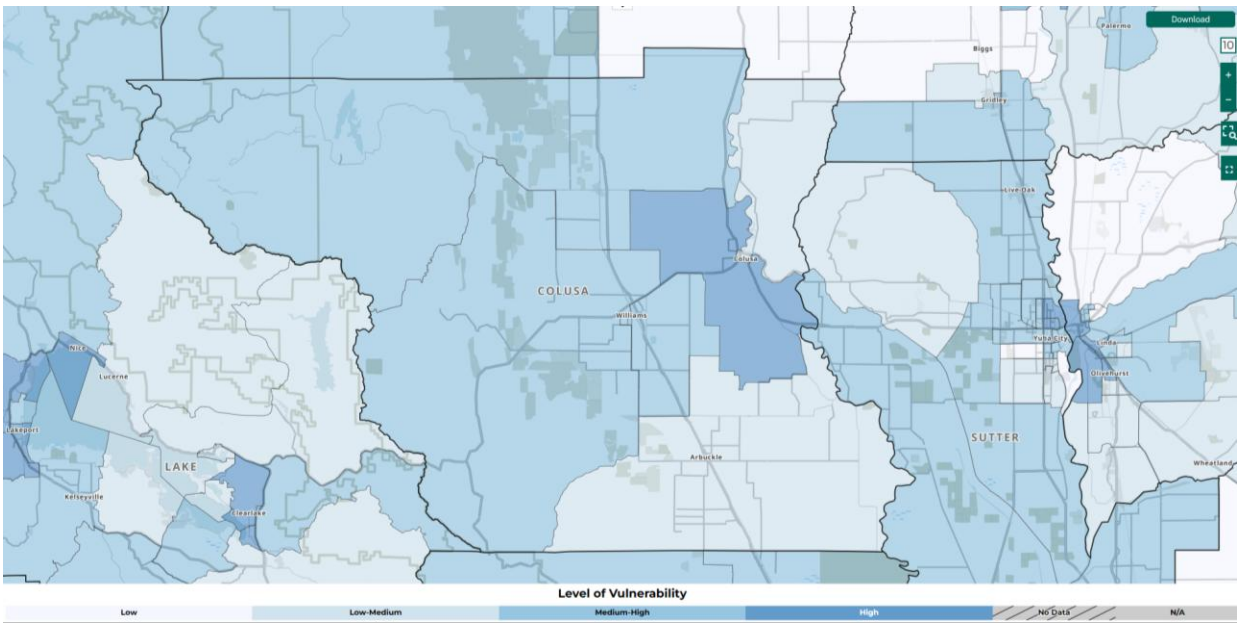
Source: CDC Social Vulnerability Index – map retrieved 3/14/2023
Level of Vulnerability Rating: **Faint Orange** – Low; **Light Orange**– Low/Medium; **Orange** – Medium/High; **Dark Orange** – High; **Grey Hatched** – No Data; **Grey** – Not Available

Figure 4-6 Colusa County Planning Area – Minority/Language Social Vulnerability



Source: CDC Social Vulnerability Index – map retrieved 3/14/2023
Level of Vulnerability Rating: **Faint Purple** – Low; **Light Purple** – Low/Medium; **Purple** – Medium/High; **Dark Purple** – High; **Grey Hatched** – No Data; **Grey** – Not Available

Figure 4-7 Colusa County Planning Area – Housing/Transportation Social Vulnerability

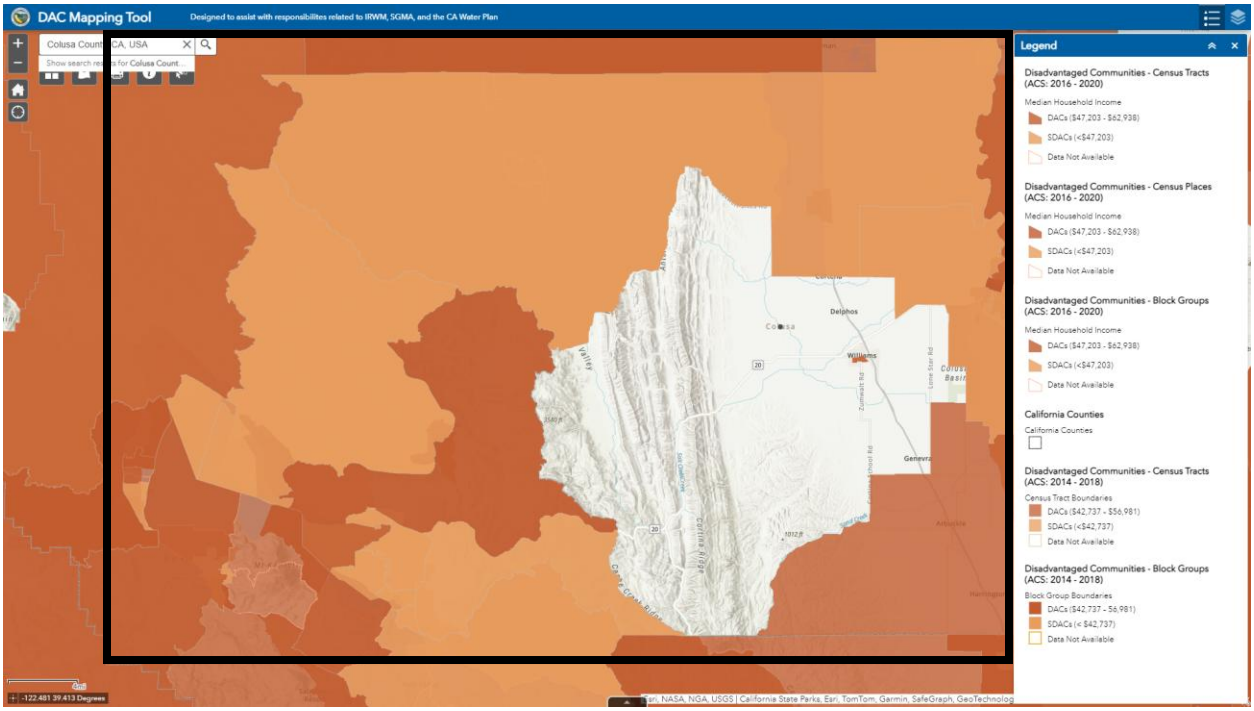


Source: CDC Social Vulnerability Index – map retrieved 3/14/2023
Level of Vulnerability Rating: **Faint Blue** – Low; **Light Blue** – Low/Medium; **Blue** – Medium/High; **Dark Blue** – High; **Grey Hatched** – No Data; **Grey** – Not Available

California DWR Disadvantaged Community Mapping Tool

The State of California's Proposition 1 Disadvantaged Community (DAC) Involvement Program is designated to ensure the involvement of DACs as well as Economically Distressed Areas and Underrepresented Communities, which DWR collectively refers to as DACs. The Cal DWR definition for a Disadvantaged Community is a community with an annual median household income (MHI) that is less than 80% of the Statewide annual MHI (PRC Section 75005(g)), and those census geographies with an annual MHI less than 60% of the Statewide annual MHI are considered "Severely Disadvantaged Communities". Those areas in the Planning Area considered disadvantaged are shown in Figure 4-8.

Figure 4-8 Colusa County Planning Area – Disadvantaged Areas

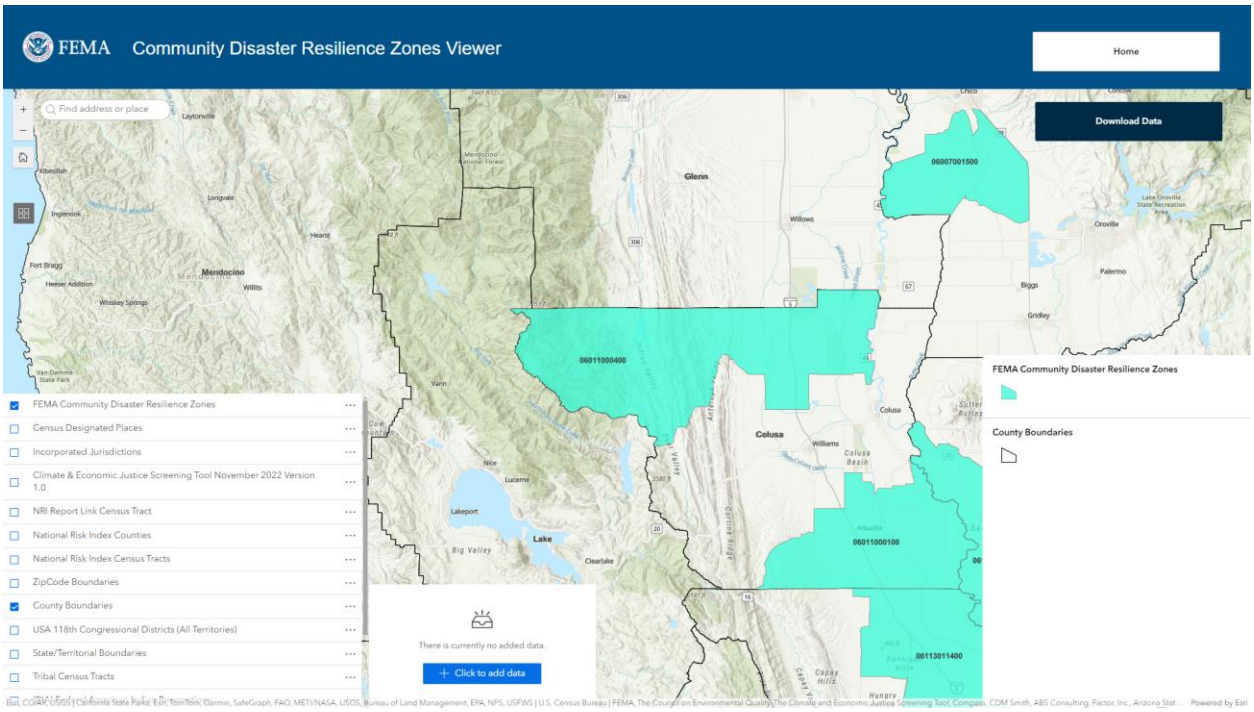


Source: Cal DWR DAC Mapping Tool – retrieved 3/14/2023

FEMA Community Disaster Resilience Zones

Community Disaster Resilience Zones aim to build and strengthen community resilience across the nation by driving federal, public, and private resources to the most at-risk and in-need communities. The Community Disaster Resilience Zones Act uses FEMA's National Risk Index to identify the most at-risk and in-need communities to identify resilience zones. Designated zones will be prioritized for targeted federal support, such as increased cost-share for resilience and mitigation projects, lessening the financial burden on communities to perform resilience-related activities. On September 6, 2023, FEMA announced the initial 483 designations in all 50 states and the District of Columbia. Figure 4-9 shows these zones in teal green.

Figure 4-9 Colusa County Planning Area – FEMA Community Disaster Resilience Zones



Source: FEMA. Map retrieved 3/15/2024.

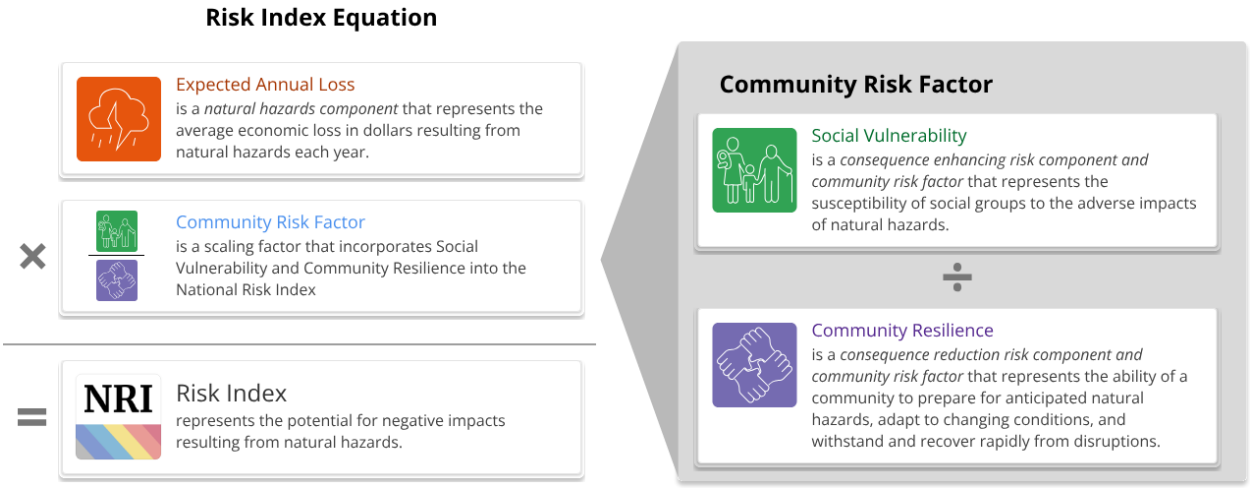
FEMA National Risk Index

Beginning in 2016, FEMA's Natural Hazards Risk Assessment Program (NHRAP) started work on the National Risk Index by adopting an established vision for a multi-hazard view of risk that combines the likelihood and consequence of natural hazards with social factors and resilience capabilities. The goal was to take a broad, holistic view and create a nationwide baseline of natural hazard risk.

A community's susceptibility to natural hazards varies from location to location. The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. It was designed and built by FEMA in close collaboration with various stakeholders and partners in academia; local, state, and federal government; and private industry. In the National Risk Index, risk is defined as the potential for negative impacts as a result of a natural hazard.

The risk equation behind the Risk Index includes three components (see Figure 4-10): a natural hazards component (Expected Annual Loss), a consequence enhancing component (Social Vulnerability), and a consequence reduction component (Community Resilience).

Figure 4-10 National Risk Index Equation



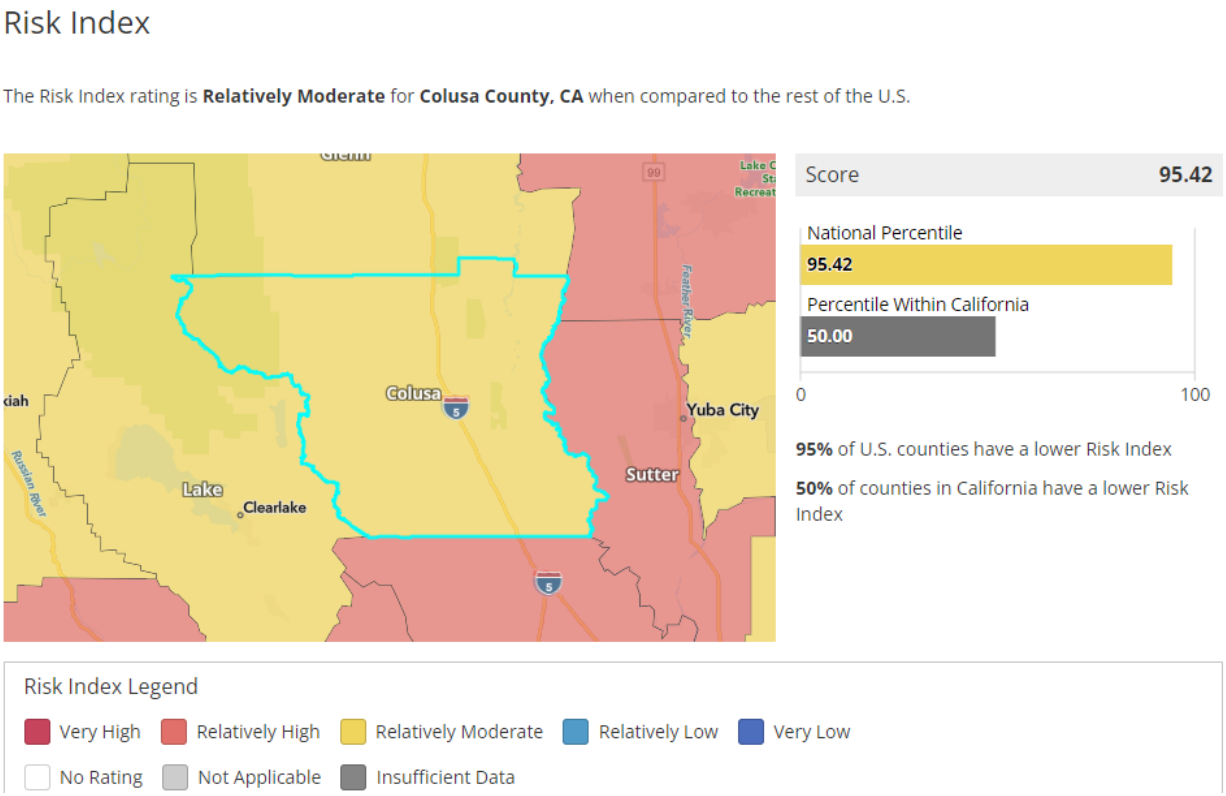
Source: FEMA National Risk Index

Using these three components, composite Risk Index values and hazard type Risk Index values are calculated for each community (county and Census tract) included in the Index. Risk Index values form an absolute basis for measuring Risk within the National Risk Index, and they are used to generate Risk Index percentiles and ratings across communities.

Data from the National Risk Index for the Colusa County is seen below. Figure 4-11 shows a summary map and score for the County. As shown, Colusa County's Risk Index rating is Relatively Moderate. Figure 4-12 shows the expected annual loss map and score. As shown, Colusa County's expected annual loss rating is Relatively Moderate. Figure 4-13 shows the social vulnerability map and score. As shown, Colusa County has a Relatively High social vulnerability. Figure 4-14 shows the community resilience map and score. As shown, communities in Colusa County have a Relatively Low ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.

The Colusa County FEMA National Risk Index Report is included in its entirety in Appendix G.

Figure 4-11 FEMA National Risk Index – Summary Map and Score for Colusa County

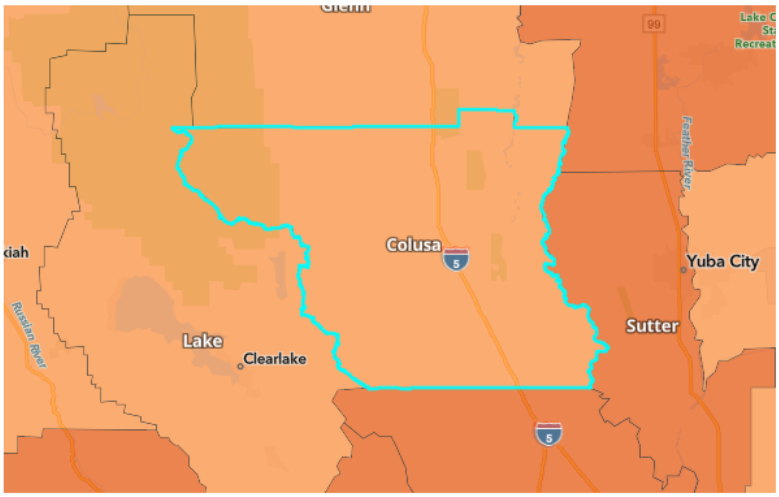


Source: FEMA National Risk Index, retrieved 3/26/2024.

Figure 4-12 FEMA National Risk Index – Expected Annual Loss Map and Score for Colusa County

Expected Annual Loss

In **Colusa County, CA**, expected loss each year due to natural hazards is **Relatively Moderate** when compared to the rest of the U.S.



Score **93.96**

National Percentile
93.96
Percentile Within California
46.60
0 100

94% of U.S. counties have a lower Expected Annual Loss

47% of counties in California have a lower Expected Annual Loss

Expected Annual Loss Legend

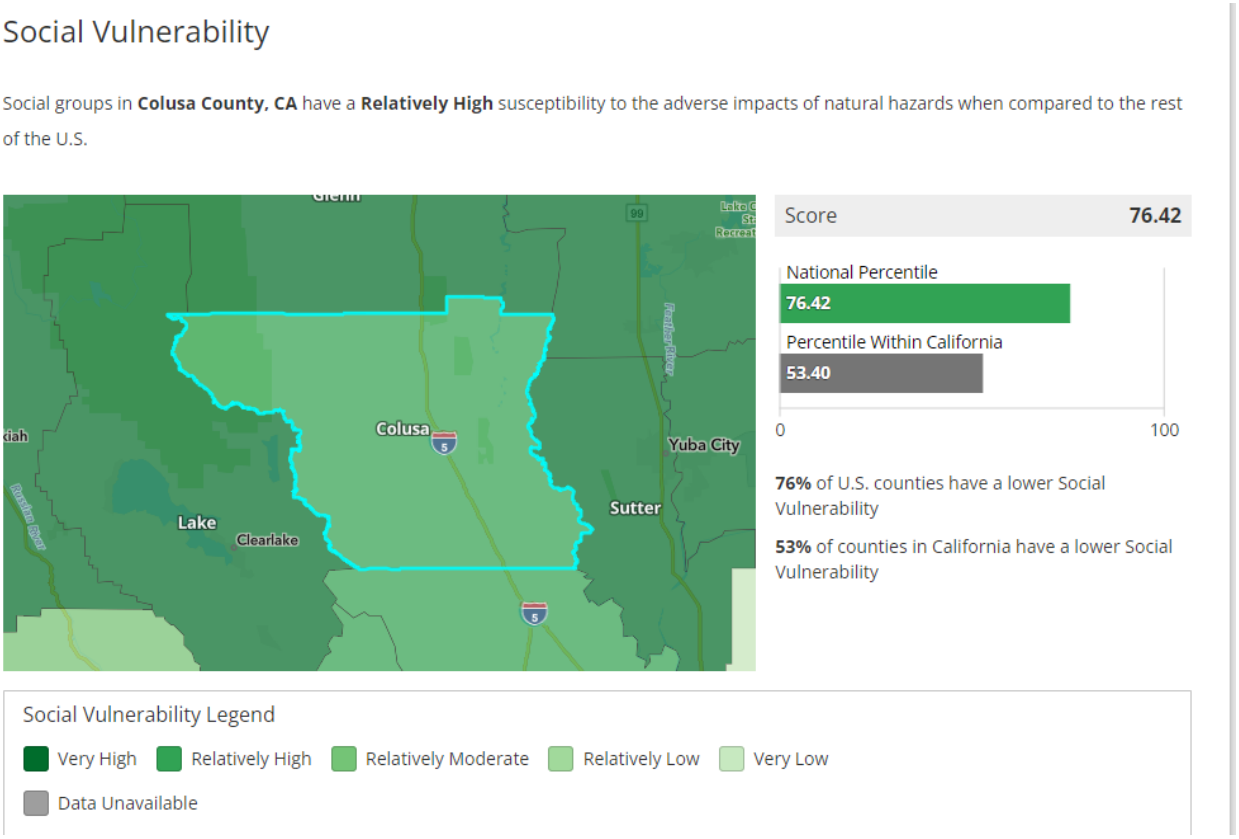
Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low
No Expected Annual Losses | Not Applicable | Insufficient Data

Composite Expected Annual Loss	**$71,260,808.48**
Composite Expected Annual Loss Rate National Percentile	**99.6**

Building EAL	**$7,109,815.34**	Population EAL	**0.20** fatalities
Building EAL Rate	**$1 per $600.42 of building value**	Population EAL Rate	**1 per 106.95K people**
Agriculture EAL	**$61,785,303.30**	Population Equivalence EAL	**$2,365,689.84**
Agriculture EAL Rate	**$1 per $10.28 of agriculture value**		

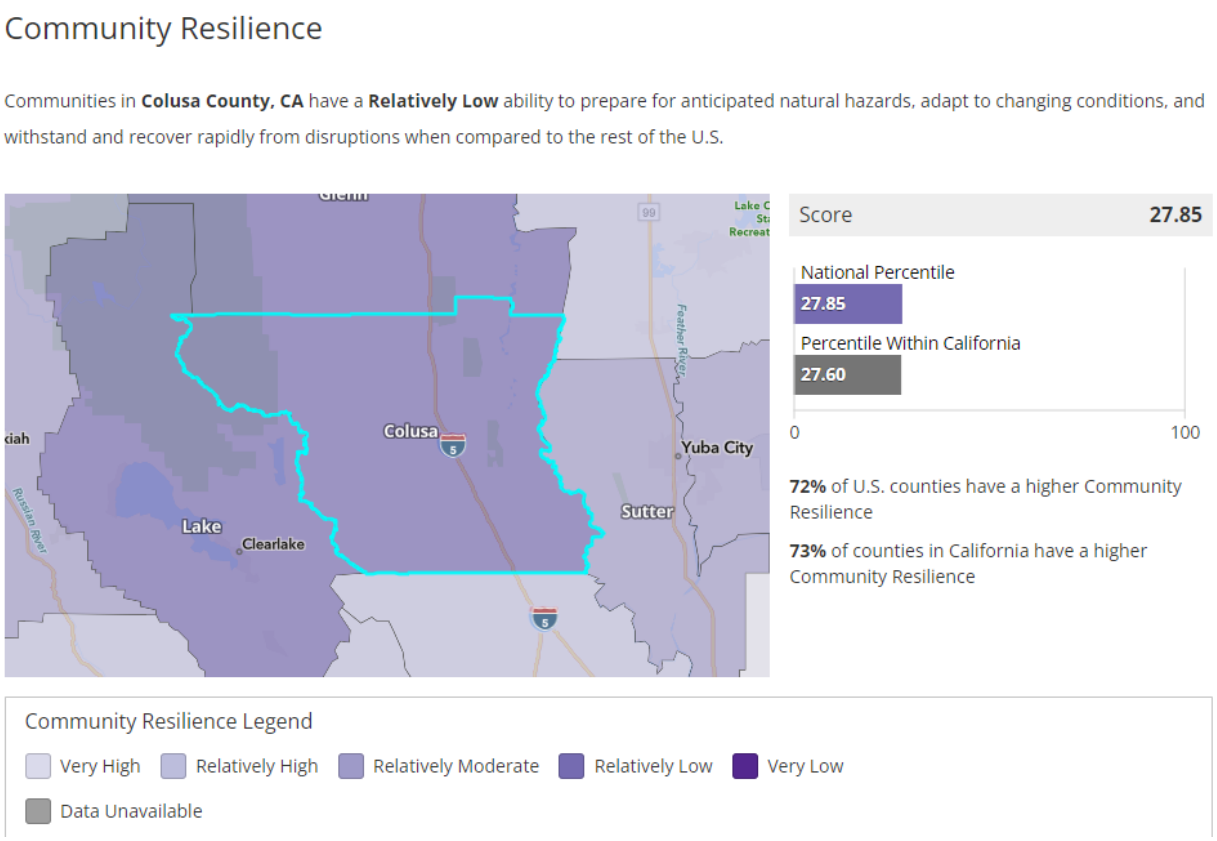
Source: FEMA National Risk Index, retrieved 3/26/2024.

Figure 4-13 FEMA National Risk Index – Social Vulnerability Map and Score for Colusa County



Source: FEMA National Risk Index, retrieved 3/26/2024.

Figure 4-14 FEMA National Risk Index – Community Resilience Map and Score for Colusa County



Source: FEMA National Risk Index, retrieved 3/26/2024.

Local Input

The County noted multiple types and locations of vulnerable populations, including those with access and functional needs, and associated issues.

- Colusa County has one migrant farm worker housing community at 400 Theatre Road, Williams, while all other special needs populations are dispersed throughout the County. The County has a number of Spanish speaking first responders, translation services and volunteers to serve the needs of the Williams Migrant Camp.
- There are a few senior care and skilled nursing care facilities in Colusa County, all within the jurisdictions of the cities of Colusa and Williams. The local Department of Health and Human Services works closely with the OES and First Responders to meet the needs of these communities during disaster events.

In addition, the Cortina Rancheria is located in the County. There are multiple issues that affect the vulnerability of that area of the County. That is discussed in their respective annex to this Plan Update.

Housing Element Special Populations

The County Planning Team noted that the Colusa County 2020-2028 Housing Element discusses special populations in the County. Households with special housing needs often have greater difficulty in finding decent and affordable housing. As a result, these households may experience a higher prevalence of overpaying, overcrowding, and other housing problems. These are discussed below.

Seniors

The County has seen an increase in the number of seniors, age 65 and older, as long-time residents continue to age. In 2017, approximately 1,699 persons in unincorporated Colusa County (15 percent) were 65 years and older. Of the senior population, 1,071 were 65 to 74, 480 were 75 to 84, and 148 were 85 or older. From 2010 to 2017, the 65 to 74 age group increased by 67 percent, the 75 to 84 age group increase by 17 percent, and the 85 years and older age group increased by 16 percent; this rate of increase is significantly greater than that of the overall population which increased by 1 percent.

Most senior households (over 65) own their home, 82 percent while 17 percent of senior households rent. There are no affordable senior housing complexes in unincorporated Colusa County. There is one long-term residential care facility for the elderly, Countryside Manor Guest Home (15 beds) in Williams. There are affordable senior apartments in the cities of Colusa and Williams. County staff have explored and encouraged several senior housing projects with landowners, but these projects have yet to move forward. However, there are three skilled care senior facilities in the Colusa area: the Colusa Regional Medical Center in Colusa; Valley West Care Center in Williams, and the Sun bridge Care Center in Willows.

Disabled Citizens

A "disability" includes, but is not limited to, any physical or mental disability as defined in California Government Code Section 12926. Physical, mental, and/or developmental disabilities could prevent a person from working, restrict a person's mobility or make caring for oneself difficult. Therefore, disabled persons often require special housing needs related to potential limited earning capacity, the lack of accessible and affordable housing, and higher health costs associated with disabilities. Colusa County has 730 residents that are defined as disabled according to the ACS Census Data.

Large Family Households

In unincorporated Colusa County, 501 households have five or more persons. On average, most of these large family households own their homes according to the Census, however, large households that rent have a disproportionate rate of housing problems including overcrowding, units lacking complete kitchen facilities, and units lacking complete plumbing facilities. In unincorporated Colusa County, there appears to be an adequate amount of housing units available to provide units with enough bedrooms both for larger households that own or rent their home. While there is not a shortfall of adequately sized units, there is only an excess of 11 four-bedroom units available for rent, which indicates that large families may have a difficult time finding housing units large enough to meet their needs due to limited choices.

Single Parent and Female-Headed Households

While the majority of households in the County are either married couple or single person households, 13 percent of family households are headed by a single male or single female. Single parent households are homes with children under the age of 18 at home and include both male and female headed households. These households generally have a higher ratio between their income and their living expenses. Therefore, finding affordable, decent, and safe housing is often more difficult for single parent and female-headed households. Additionally, single parent and female-headed households have special needs involving access to daycare or childcare, health care and other supportive services. There are 188 male heads of household with no wife present (5 percent of all households) and 285 female heads of household with no husband present (8 percent of all households).

Agricultural Workers

There is a significant amount of agricultural production in Colusa County. According to the 2013-2017 ACS Census, approximately 33 percent of all workers in unincorporated Colusa County were employed in occupations related to agriculture, forestry, fishing/hunting, and mining. This data does not indicate how many individuals are employed only in farm industries or if the employment is seasonal or permanent, however, it gives a beginning indication about this population. Agriculture continues to be Colusa County's major producing industry, however, the number of farm workers in Colusa County has declined over the last two decades from 5,356 in 1992 to 3,684 in 2002 to 3,058 in 2007. Migrant farm workers have also been included in the Census of Agriculture in 2002 and 2007. In 2002, 100 farms (26%) hired migrant workers. In 2007, 62 farms (18%) hired migrant workers. By assuming that the 268 farms hiring seasonal workers (less than 150 days) also hired migrant workers at the same ratio of farms hiring migrant workers there would be approximately 248 migrant workers in Colusa County in 2012.

There are four registered farm labor camps in Colusa County with a capacity for 70 persons. There is also a 100-unit seasonal camp located in Williams. While the number of farm workers has declined since 1997, farm workers and their families represent a significant portion of the County's population. It is not anticipated that there will be an increase in the number of farmworkers requiring housing, but the County should make an effort to continue to provide year-round and migrant housing opportunities.

Extremely Low Income

Providing housing for Extremely Low Income (ExLI) families and individuals is an issue for all jurisdictions within California. This group has the most potential to become homeless due to fluctuations in the economy and/or personal issues such as job loss and illness. The County currently estimates the total number of ExLI households at 417 and of this amount 135 households are seniors.

Existing ExLI housing units include the Alexander Apartments and Alexander Center which currently provide 85 units for the extremely low-income group. Colusa County's current zoning regulations allow for the use of mobile and modular homes (new and used) for single family residential uses by right in all zoning districts where residential uses are allowed. In addition, Colusa County does provide opportunities for multifamily units which may also provide ExLI units.

Homeless Persons

Homeless individuals and families have perhaps the most immediate housing need of any group. They also have one of the most difficult sets of housing needs to meet, due to both the diversity and complexity of the factors that lead to homelessness, and to community opposition to the siting of facilities that serve homeless clients. Similar to every other community in California, Colusa County has a portion of its population experiencing homelessness. Every two years, there is a Point in Time count (PIT) of those who are homeless on a selected day in January. The counts derived from this effort not only establish funding thresholds for federal and state funds, but they also provide a snapshot of who is experiencing homelessness in each community.

The 2019 PIT was able to count 57 persons in total. Traditionally, the PIT is considered to likely undercount the number of people who are homeless, since it relies on volunteers canvassing communities to find individuals who are willing to participate in the survey on that one day. Therefore, the number of homeless in Colusa County may be somewhat higher than shown. In addition to people and households that are homeless, there are also households at risk of becoming homeless due to various circumstances. The need for one-bedroom affordable units for single individuals will contribute significantly to long-term solutions.

Structures

Structures include buildings used for a variety of purposes and reflect the Colusa County Planning Area's existing built environment. Depending on the nature and extent of a hazard event or disaster, all structures may be exposed to some level of risk, where certain buildings or concentrations of buildings are more vulnerable. This section captures the structures, and associated land and contents values, which comprise the Colusa County Planning Area's and unincorporated Colusa County's existing built environment.

Parcel and Structure Inventory and Assessed Values

An inventory of structures located within the Colusa County Planning Area was developed utilizing data from the Colusa County Assessor's Office. It is based on the 2023 Assessor's data/Parcel layer provided by Colusa County GIS. This data represents best available data.

While conducting an inventory of structure assets within the Colusa County Planning Area is a key element of this asset inventory, understanding the total assessed value of structures and built environment is a starting point to understanding the overall value of identified assets in the Colusa County Planning Area. When the total assessed values are combined with potential values associated with other community assets such as area populations, public and private critical infrastructure, historic and cultural resources, and natural resources, and other identified assets, the big picture emerges as to what is potentially at risk and vulnerable to the damaging effects of natural hazards within the Colusa County Planning Area.

Methodology

Data from the Colusa County Assessor's Office is based on the 2023 Assessor's data is the basis for the inventory of assessed values for both improved and unimproved parcels within the Colusa County Planning Area. This data provides the land and improved 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 Colusa County and CalAtlas to support mapping and analysis of values at risk.

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 Colusa County Planning Area. 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 improvements are of greatest concern. Also, it is critical to note a specific limitation to the assessed values data within the Colusa County Planning Area, 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 likely significantly low and does not reflect current market, replacement, or true potential loss values for properties within the Colusa County Planning Area.

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.

Property Use Categories

The Colusa County Planning Area Assessor data used property use categories which provides detailed descriptive information about how each property is generally used, such as residential, commercial, or industrial. The property use codes were refined and categorized into the following property use categories and linked back to the Assessor data. The final property use categories for the Colusa County Planning Area include:

- Agricultural
- Commercial
- Government
- Industrial
- Institutional
- Miscellaneous
- Residential

Once property uses were grouped into categories, the number of total and improved parcels and land and improved values were inventoried for the Colusa County Planning Area by property use. ***Note***: The other value is present in the tables as a total value of the miscellaneous property values, such as personal property, mobile home personal property, fixture, and other exempt values. The total values in the analysis were then the summation of the land, improved, and other values.

Estimated Content Replacement Values

The Colusa County Planning Area 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, derived from Hazus, were utilized to develop more accurate loss estimates for the total assets inventory and for all mapped hazard analyses. FEMA's CRV factors estimate content values as a percent of improved structure value by property use. Table 4-9 shows the breakdown of the different property uses in the Colusa County Planning Area and their estimated CRV factors.

Table 4-9 Colusa County Planning Area – Content Replacement Factors by Property use

Colusa County Property Use Categories	Hazus Property Use Categories	Hazus Content Replacement Values
Agricultural	Agricultural	100%
Commercial	Commercial	100%
Government	Government	100%
Industrial	Industrial	150%
Institutional	Institutional	100%
Miscellaneous	Miscellaneous	100%
Residential	Residential	50%

Source: Hazus 6.1

Parcel and Structure Asset Inventory with Values Results

Values associated with land and improved structures were identified and summed in order to determine assessed values at risk in the Colusa County Planning Area. Together, the land and improved structure 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 4-10 shows the total values or exposure for the entire Colusa County Planning Area (using CRV multipliers from Table 4-9) broken out by jurisdiction. Table 4-11 shows the values for the unincorporated Colusa County broken out by property use. Tables showing the property use breakouts for the jurisdictions are included in their respective annexes to this LHMP Update.

Table 4-10 Colusa County Planning Area – Total Parcels (and Structures) by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Values	Estimated Contents Value	Total Value
City of Colusa	2,334	2,077	$144,303,544	$443,767,787	$49,228,543	$309,495,963	$946,795,837
City of Williams	1,755	1,477	$110,173,986	$349,462,550	$126,901,961	$254,199,840	$840,738,337

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Values	Estimated Contents Value	Total Value
Unincorporated Colusa County	10,882	5,598	$1,565,670,152	$918,573,263	$199,347,382	$758,464,131	$3,442,054,928
Grand Total	**14,971**	**9,152**	**$1,820,147,682**	**$1,711,803,600**	**$375,477,886**	**$1,322,159,934**	**$5,229,589,102**

Source: 2023 Colusa County Parcel/Assessor Data

Table 4-11 Colusa County Planning Area – Total Parcels (and Structures) by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	5,577	2,702	$1,347,205,591	$365,825,843	$114,218,069	$365,825,843	$2,193,075,346
Commercial	712	491	$77,142,322	$197,029,707	$53,137,045	$197,029,707	$524,338,781
Government	619	112	$42,416,392	$72,765,210	$39,492,655	$72,765,210	$227,439,467
Industrial	130	63	$24,815,691	$130,833,491	$129,088,295	$196,250,240	$480,987,717
Institutional	105	57	$3,878,678	$17,981,793	$11,215,942	$17,981,793	$51,058,206
Miscellaneous	561	35	$37,916,796	$17,246,754	$1,851,673	$17,246,754	$74,261,977
Residential	7,267	5,692	$286,772,212	$910,120,802	$26,474,207	$455,060,387	$1,678,427,608
Colusa County Planning Area Total	**14,971**	**9,152**	**$1,820,147,682**	**$1,711,803,600**	**$375,477,886**	**$1,322,159,934**	**$5,229,589,102**

Source: 2023 Colusa County Parcel/Assessor Data

The values for unincorporated Colusa County are broken out by property use category and are provided in Table 4-12. More information on parcels and structures at risk for each jurisdiction can be found in their respective annexes.

Table 4-12 Unincorporated Colusa County – Total Parcels (and Structures) by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	5,490	2,678	$1,324,956,575	$363,251,125	$113,557,305	$363,251,125	$2,165,016,130
Commercial	260	179	$20,969,259	$71,537,065	$32,023,644	$71,537,065	$196,067,033
Government	426	39	$31,957,809	$7,529,186	$37,449	$7,529,186	$47,053,630
Industrial	51	30	$9,988,390	$71,506,449	$41,684,579	$107,259,676	$230,439,094
Institutional	55	26	$1,306,968	$7,927,162	$3,449,752	$7,927,162	$20,611,044
Miscellaneous	532	29	$36,912,062	$5,097,569	$1,851,673	$5,097,569	$48,958,873
Residential	4,068	2,617	$139,579,089	$391,724,707	$6,742,980	$195,862,348	$733,909,124
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$758,464,131**	**$3,442,054,928**

Source: 2023 Colusa County Parcel/Assessor Data

Critical Facilities and Infrastructure

Beyond just structures, it is important to identify the critical facilities and infrastructure that are critical for life safety and the economy. Critical facilities commonly include all public and private facilities that a community considers essential for the delivery of vital services and for the protection of the community. They usually include emergency response facilities (fire stations, police stations, rescue squads, and emergency operation centers [EOCs]), custodial facilities (jails and other detention centers, long-term care facilities, hospitals, and other health care facilities), schools, emergency shelters, utilities (water supply, wastewater treatment facilities, and power), communications facilities, and any other assets determined by the community to be of critical importance for the protection of the health and safety of the population.

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 and safety 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 and (2) At-Risk Populations Facilities:

- **Essential Service Facility**: A facility in either the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the County, or fulfills important public safety, emergency response, and/or disaster recovery functions.
- **At-Risk Populations**: Pre-schools, public and private primary and secondary schools, before and after school care centers, daycare centers, group homes, and assisted living residential or congregate care facilities with multiple residents.

Critical facilities in the Colusa County Planning Area are shown on Figure 4-15. A summary of critical facilities in the Planning Area is shown in Table 4-13 and detailed in Table 4-14. Additional details of individual critical facilities can be found in Appendix F of this Plan Update.

Figure 4-15 Colusa County Planning Area – Critical Facilities

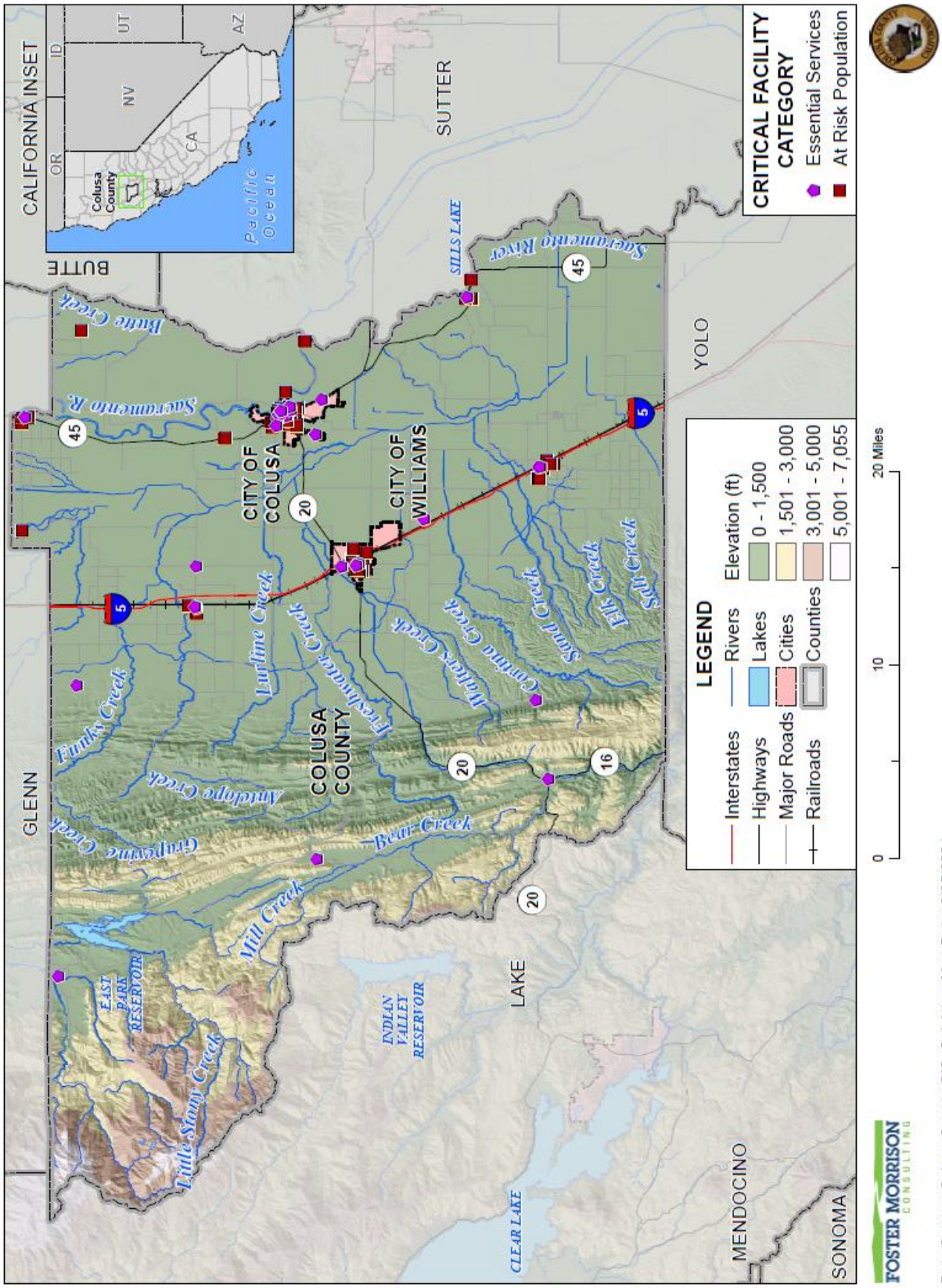


Table 4-13 Colusa County Planning Area - Critical Facilities by Jurisdiction and Critical Facility Category

Jurisdiction / Critical Facility Category	Facility Count
City of Colusa	
Essential Services Facilities	10
At Risk Population Facilities	40
City of Colusa Total	**50**
City of Williams	
Essential Services Facilities	5
At Risk Population Facilities	22
City of Williams Total	**27**
Unincorporated Colusa County	
Essential Services Facilities	13
At Risk Population Facilities	25
Unincorporated Colusa County Total	**38**
Grand Total	**115**

Source: Colusa County GIS

Table 4-14 Colusa County Planning Area - Critical Facilities by Jurisdiction and Critical Facility Category and Facility Type

Jurisdiction/ Critical Facility Category	Facility Type	Facility Count
City of Colusa		
Essential Services Facilities	Emergency Response	1
	Fire Station	2
	Medical	1
	Police Station	1
	Public Services	3
	Utility Facility	2
	Essential Services Facilities Total	**10**
At Risk Population Facilities	Apartment Complex	22
	Assisted-Living	1
	Hotel or Motel	2
	Jail	1
	Mobile Home Park	5
	School	8
	Senior Living Facility	1

Jurisdiction/ Critical Facility Category	Facility Type	Facility Count
	At Risk Population Facilities Total	**40**
City of Colusa Total		**50**
City of Williams		
Essential Services Facilities	Emergency Response	2
	Fire Station	1
	Public Services	1
	Utility Facility	1
	Essential Services Facilities Total	**5**
At Risk Population Facilities	Apartment Complex	4
	Hotel or Motel	8
	Migrant Housing	1
	Mobile Home Park	2
	School	4
	Senior Living Facility	3
	At Risk Population Facilities Total	**22**
City of Williams Total		**27**
Unincorporated Colusa County		
Essential Services Facilities	Native American Reservation	1
	Utility Facility	5
	Essential Services Facilities Total	**13**
At Risk Population Facilities	Apartment Complex	5
	Casino	1
	Hotel or Motel	1
	Mobile Home Park	9
	School	9
	At Risk Population Facilities Total	**25**
Unincorporated Colusa County Total		**38**
Grand Total		**115**

Source: Colusa County GIS

Community Lifelines

Assessing the vulnerability of the Colusa County Planning Area to natural hazards and disasters also involves reviewing and inventorying the community lifelines in place that could be affected. It is important to include these items in hazard discussions as the continuous operation of critical government and business functions is essential to human health and safety and/or economic security. Information on community lifelines include:

- Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.
- FEMA has developed a construct for objectives-based response that prioritizes the rapid stabilization of Community Lifelines after a disaster.
- The integrated network of assets, services, and capabilities that provide lifeline services are used day-to-day to support the recurring needs of the community and enable all other aspects of society to function.
- When disrupted, decisive intervention (e.g., rapid re-establishment or employment of contingency response solutions) is required to stabilize the incident.

For this Plan, Community Lifelines includes the following (as defined by FEMA):

- **Safety and Security** – Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Hydration, Shelter** – Food, Water, Shelter, Agriculture
- **Health and Medical –** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy –** Power Grid, Fuel
- **Communications** – Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation** – Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Material –** Facilities, HAZMAT, Pollutants, Contaminants
- **Water Systems** – Potable Water Infrastructure, Wastewater Management

In the Colusa County Planning Area, these community lifelines are all in place and functional as part of regular government operations. It should also be noted that these community lifelines collectively include many of the individual components of other community assets inventoried for this LHMP including structures and critical facilities and infrastructure.

Specific information on these community lifelines in the Colusa County Planning Area and how they may be affected by a hazard event or disaster are discussed in more detail in each hazard section below as well as in each jurisdictional annex to this Base Plan.

Natural, Historical, and Cultural Resources

Assessing the vulnerability of the Colusa County Planning Area to disaster also involves inventorying the natural, historic, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are 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, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

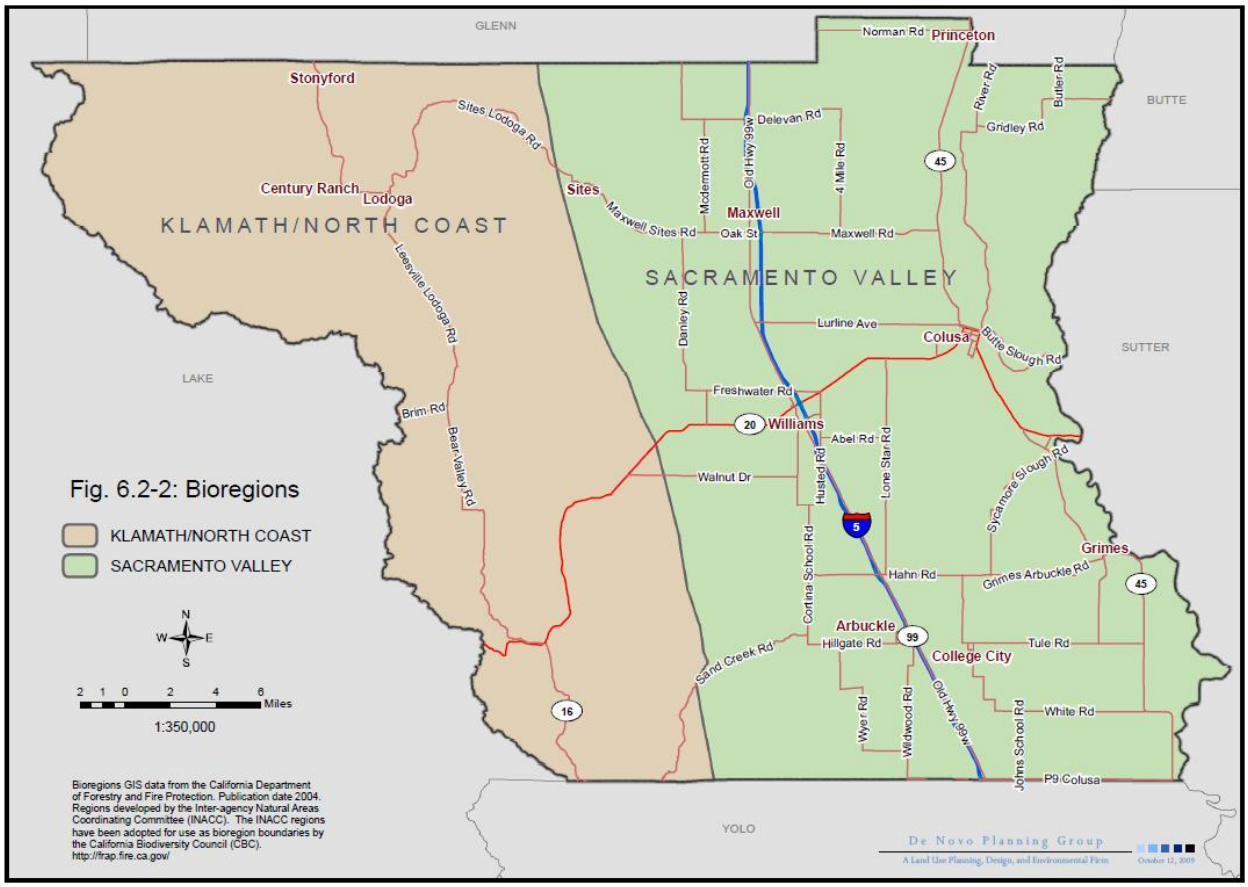
Natural Resources

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 wetlands areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

The County is defined by two different bioregions including the Sacramento Valley, and Klamath/North Coast. Figure 4-16 illustrates the boundaries of the bioregions within Colusa County. A brief description of each bioregion is presented below.

- **Sacramento Valley**. The Sacramento Valley Bioregion is a watershed of the Sierra Nevada that encompasses the northern end of the great Central Valley, stretching from Redding to the southeast corner of Sacramento County. The bioregion is generally flat and is rich in agriculture. The eastern portion of the County falls within this bioregion, which has a climate that is characterized by hot dry summers and cool wet winters. Oak woodlands, riparian forests, vernal pools, freshwater marshes, and grasslands provide the major natural vegetation of the bioregion. This bioregion is the most prominent wintering area for waterfowl, attracting significant numbers of ducks and geese to its seasonal marshes along the Pacific Flyway. Species include northern pintails, snow geese, tundra swans, sandhill cranes, mallards, grebes, peregrine falcons, heron, egrets, and hawks. Black-tailed deer, coyotes, river otters, muskrats, beavers, ospreys, bald eagles, salmon, steelhead, and swallowtail butterflies are some of the wildlife that are common in this bioregion.
- **Klamath/North Coast**. The Klamath/North Coast Bioregion in California's northwestern corner extends roughly one-quarter of the way down the 1,100-mile coast and east across the Coastal Range and into the Cascades. Much of this bioregion is covered by forest and is the state's wettest climate, with rainfall distribution varying widely from an average annual 38 to 80 or more inches. The western portion of the County falls within this bioregion, which is considered “Inland” with a climate that is drier with low rainfall in winter and hot, dry summers. Vegetation includes mixed conifer habitat of white fir, Douglas fir, ponderosa pine, Sierra lodgepole pine, incense cedar, sugar pine, red fir, Jeffrey pine, mountain hemlock, knobcone pine, western red cedar, red alder, redwood, tanoak, Pacific madrone, and chaparral. Wildlife in the bioregion includes deer, fox, black bear, mountain lion, California clapper rail, Aleutian Canada geese, elk, osprey, fisher, bank swallow, salmon, Otis blue butterfly, bald eagle, Point Arena mountain beaver, Swainson's hawk, willow flycatcher, western sandpiper, and Oregon silverspot butterfly.

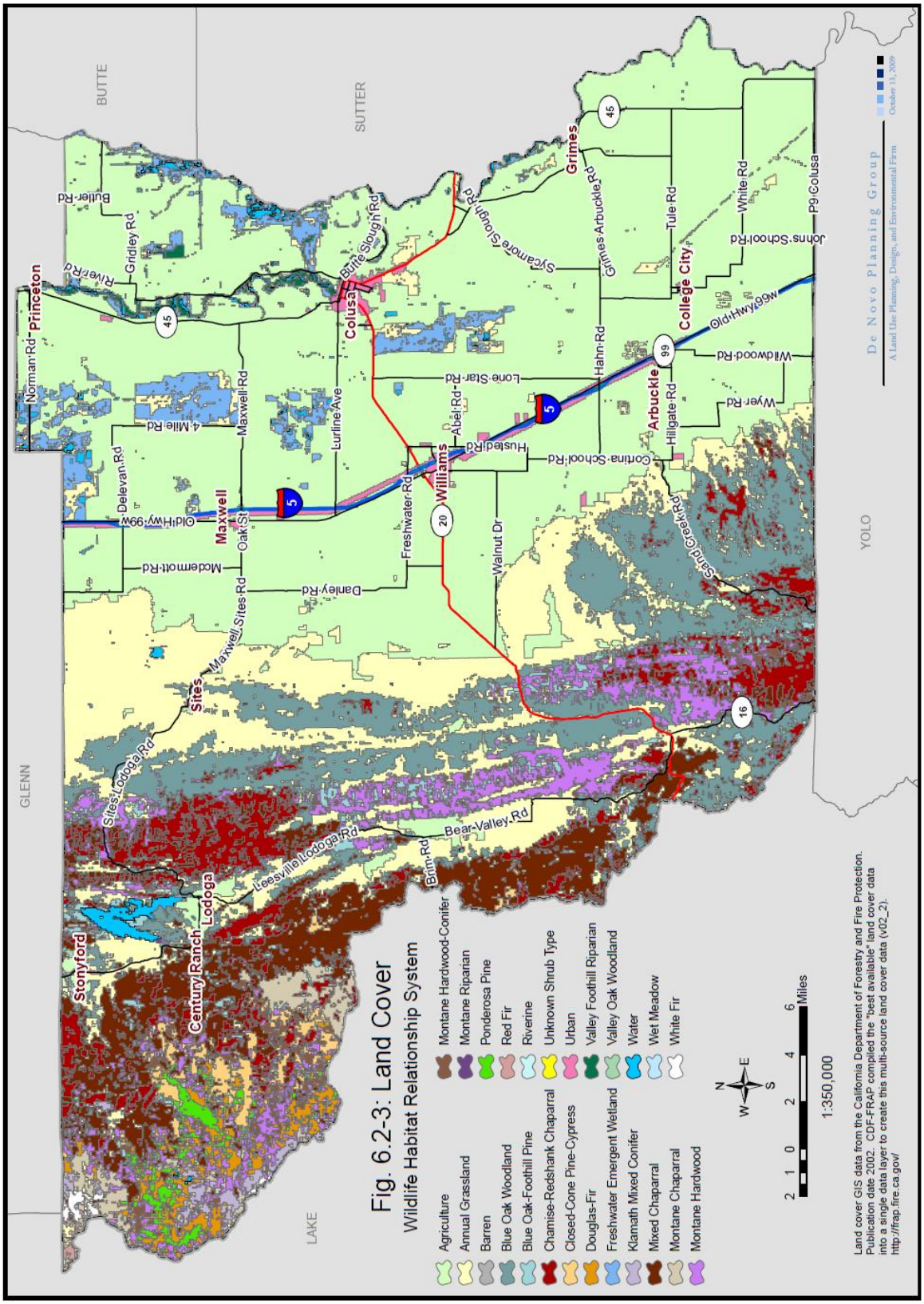
Figure 4-16 Colusa County – Bioregions



Source: 2010 Colusa County General Plan Background Report

Natural and agricultural communities both provide a variety of habitat for the biological resources in Colusa County. Sensitive habitats include those that are of special concern to resource agencies or those that are protected under federal, state, or local regulations. Colusa County is a biologically diverse part of the state. According to the California Wildlife Habitat Relationship System there are 24 cover types (wildlife habitat classifications) in Colusa County out of 59 found in the state. These include: Agricultural, Annual Grassland, Barren, Blue Oak Woodland, Blue Oak-Foothill Pine, Chamise-Redshank Chaparral, Closed-Cone Pine-Cypress, Douglas Fir, Fresh Emergent Wetland, Klamath Mixed Conifer, Mixed Chaparral, Montane Chaparral, Montane Hardwood, Montane Hardwood-Conifer, Montane Riparian, Ponderosa Pine, Red Fir, Riverine, Urban, Valley Foothill Riparian, Valley Oak Woodland, Water, Wet Meadow, and White Fir. Figure 4-17 illustrates the location of each cover type (wildlife habitat classification) within the County.

Figure 4-17 Colusa County – Land Cover and Wildlife Habitats



Source: 2010 Colusa County General Plan Background Report

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 Colusa County. A summary list of these species is found below in Table 4-15. Appendix E lists the name, federal status, state status, California Department of Fish and Wildlife status, and the California Rare Plant rank of species in Colusa County.

Table 4-15 Colusa County Planning Area – Summary of Special Status Species

Type	Number
Animals - Amphibians	3
Animals - Birds	32
Animals - Crustaceans	3
Animals - Fish	10
Animals - Insects	7
Animals - Mammals	15
Animals – Mollusks	3
Animals – Reptiles	3
Community – Terrestrial	8
Plants – Vascular	84

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 (USACE) as well as the California Department of Fish and Wildlife (CDFW). Where the waters provide habitat for federally endangered species, the U.S. Fish and Wildlife Service 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.

Fresh emergent wetland habitats occur in Colusa County on virtually all exposures and slopes, provided a basin or depression is saturated or at least periodically flooded. They are most common on level to gently rolling topography. They are found in various depressions or at the edge of rivers or lakes. Soils are predominantly silt and clay, although coarser sediments and organic material may be intermixed. In some areas organic soils (peat) may constitute the primary growth medium. Climatic conditions are highly variable and range from the extreme summer heat to winter temperatures well below freezing.

The US Fish and Wildlife Service has maps of wetlands in the United States. Those wetlands that fall in Colusa County are shown on Figure 4-18. They are detailed in Table 4-16 and are shown separated by jurisdiction. More information on the locations of wetlands in each City can be found in their respective annexes to this LHMP Update.

Figure 4-18 Colusa County Planning Area – Wetlands Locations

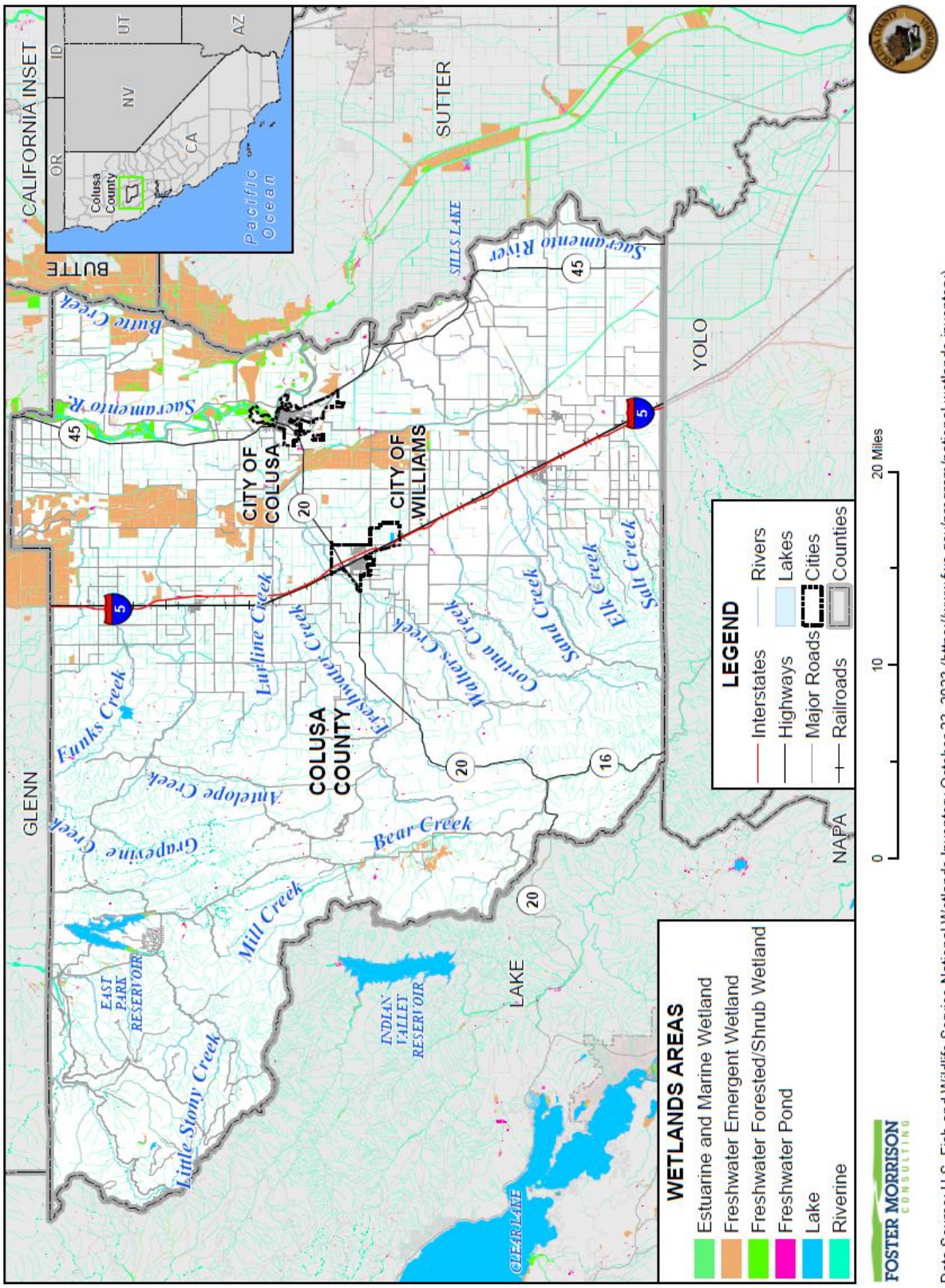


Table 4-16 Colusa County Planning Area – Wetlands

Jurisdiction/ Wetlands Area Type	Wetlands Count	Wetlands Area (in Acres)
City of Colusa		
Freshwater Emergent Wetland	27	56
Freshwater Forested/Shrub Wetland	12	87
Freshwater Pond	29	67
Lake	0	0
Riverine	52	11
Estuarine and Marine Wetland	0	0
City of Colusa Total	**120**	**221**
City of Williams		
Freshwater Emergent Wetland	1	1
Freshwater Forested/Shrub Wetland	0	0
Freshwater Pond	7	18
Lake	1	55
Riverine	102	27
Estuarine and Marine Wetland	0	0
City of Williams Total	**111**	**101**
Unincorporated Colusa County		
Freshwater Emergent Wetland	3,970	30,022
Freshwater Forested/Shrub Wetland	1,616	4,339
Freshwater Pond	773	748
Lake	34	1,722
Riverine	10,335	8,451
Estuarine and Marine Wetland	3	11
Unincorporated Colusa County Total	**16,731**	**45,294**
Grand Total	**16,962**	**45,616**

Source: USFWS 10/23/2023

Wetlands 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.

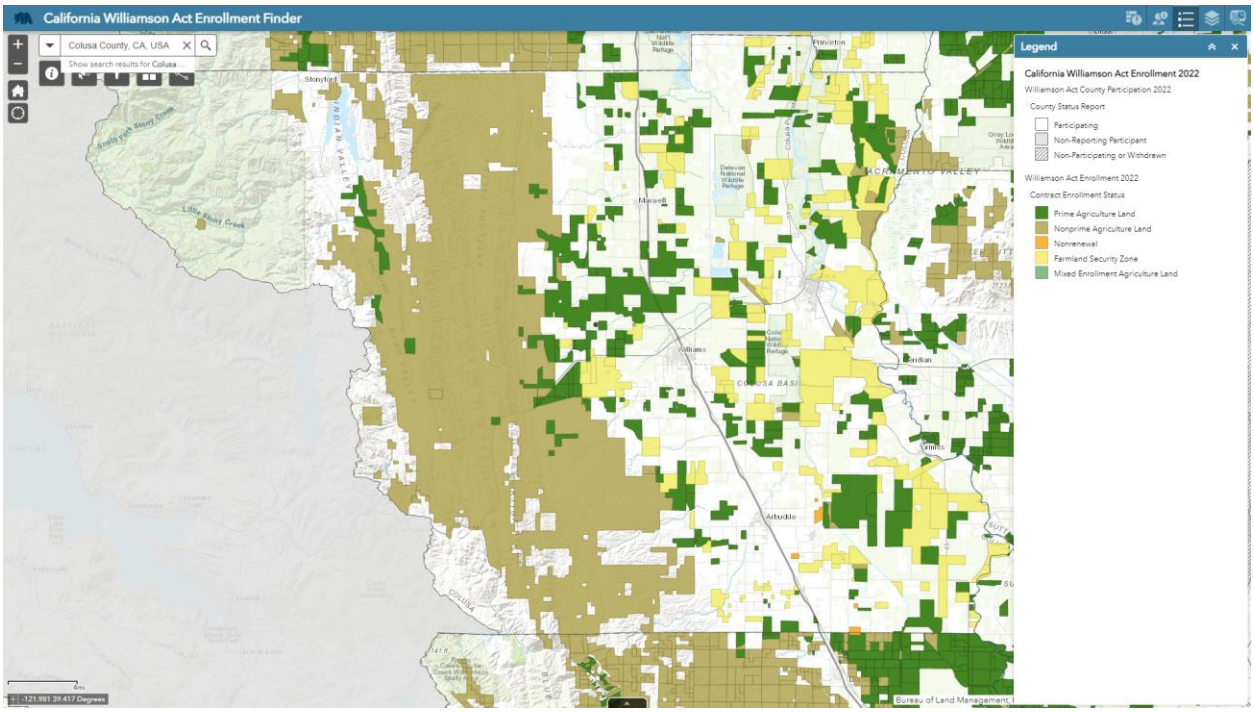
These natural floodplain functions associated with the natural or relatively undisturbed floodplain that moderates flooding, such as wetland areas, are critical for maintaining water quality, recharging groundwater, reducing erosion, redistributing sand and sediment, and providing fish and wildlife habitat.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

Farmlands

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. The County has designated areas as agricultural preserves within which the County will enter into contracts for the preservation of the land in agriculture. Locations from the most recent map (dated 2022) can be seen on Figure 4-19.

Figure 4-19 Colusa County – Williamson Act Lands



Source: California Department of Conservation. Retrieved 3/18/2022.

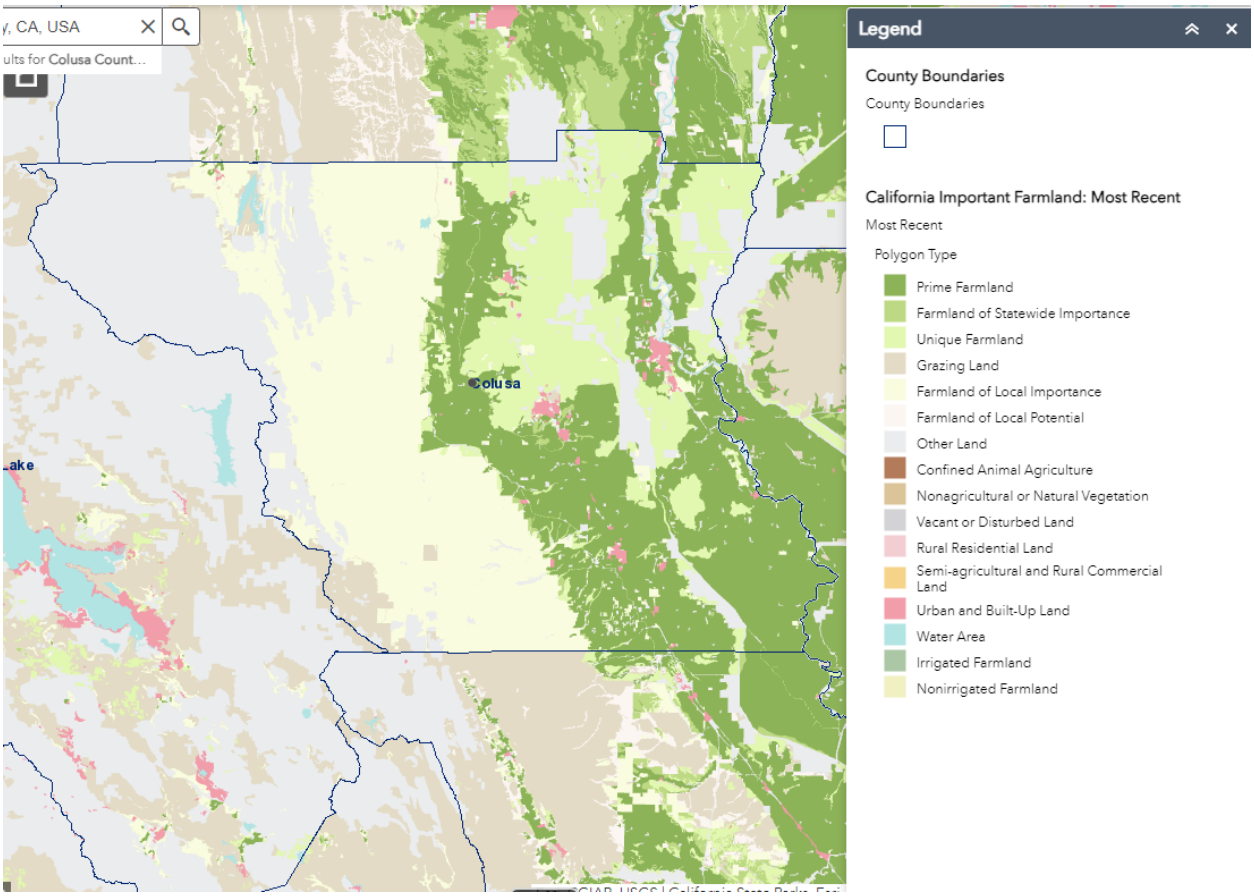
State Inventory of Important Farmland

The Farmland Mapping and Monitoring Program was established in 1984 to document the location, quality, and quantity of agricultural lands and conversion of those lands over time. The program provides impartial analysis of agricultural land use changes throughout California. For inventory purposes, several categories were developed to describe the qualities of land in terms of its suitability for agricultural production. The State Department of Conservation utilizes the following classification system:

- The Prime Farmland category describes farmland with the best combination of physical and chemical features able to sustain long term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.
- Farmland of Statewide Importance is farmland similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.
- Unique Farmland is farmland of lesser quality soils used for the production of the state's leading agricultural crops. This land is usually irrigated but may include non-irrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the four years prior to the mapping date.
- Farmland of Local Importance is either currently producing crops or has the capability of production. This farmland category is determined by each county's board of supervisors and a local advisory committee.

The 2022 maps are the most recent versions. These lands are shown in Figure 4-20.

Figure 4-20 Colusa County – Map of Important Farmlands 2022



Source: State of California Department of Conservation

Cultural and Historical Resources

Colusa 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 4-17.

Table 4-17 Colusa County Planning Area – Historical Resources

Resource Name (Plaque Number)	National Register	State Landmark	Point of Interest	Date Listed	City/ Community
Cecil Ranch (N2238)	X			5/14/2004	Grimes
Colusa Carnegie Library (N1657)	X			12/10/1990	Colusa
Colusa County Courthouse (890)		X		12/29/1975	Colusa
Colusa Grammar School (N632)	X			6/13/1978	Colusa
Colusa High School and Grounds (N434)	X			8/13/1976	Colusa
Colusa IOOF Hall / Odd Fellows Building (P505)			X	7/28/1977	Colusa
Grand Island Shrine (P329)	X		X	5/15/1974	Colusa
Letts Valley (736)		X		5/25/1960	Stonyford
Nowi Rancheria (N68)	X			3/24/1971	Grimes
Original Williams High School, Sacramento Valley Museum (P550)			X	6/6/1980	Williams
Swift's Stone Corral (238)		X		6/10/1936	Maxwell

Source: California Department of Parks and Recreation Office of Historic Preservation. Retrieved 3/18/2022.

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.

Economic Assets and Community Activities of Value

Assessing the vulnerability of the Colusa County Planning Area to natural hazards and disasters also involves inventorying the economic assets and community activities of value to the Colusa County Planning Area.

Economic Assets

After a disaster, economic resiliency is one of the major drivers of a speedy recovery. Each community has specific economic drivers. These include:

- Primary Economic Sectors
- Major employers
- Commercial Centers

In Colusa County, the agricultural industry is the primary economic asset. This includes many industries tied to agriculture – mills, canneries, nut processors, and ancillary ag industries. There is a small hotel base. Many of these hotels are full seasonally due to the presence of migrant workers. When the migrant camp fills, the hotels see increased usage. The Colusa Casino Resort does bring people to the area (though the Casino itself is revenue neutral to the County as it pays no income taxes).

More information on economic assets for the incorporated jurisdictions in the County can be found in the respective jurisdictional annexes to this Base Plan.

Community Activities of Value

Inventorying economic assets in the Colusa County Planning Area and their vulnerability to natural hazards and disasters also involves inventorying activities that have value to the community. This includes activities that are important to a community, like long-standing traditions such as a festival or fair. Some areas rely on seasonal industries to sustain them throughout the year. Many of these activities provide economic benefits to the Planning Area. A hazard event that cancels or shortens these can affect a community's livelihood and can make disaster recovery more difficult or prolonged. This includes activities such as:

- Festivals and Fairs
- Sporting Events
- Tourism

The County noted there were multiple larger events in the County that fall under these categories:

- Farm Show (February).
- County Fair (June).
- Duck Calling Contest (April or May).
- Tourism for fishing and hunting occurs. Striper fishing season is large. Hunting (waterfowl) also occurs as the County is in the Pacific Migratory Flyway.
- Stonyford Rodeo (May).
- Maxwell High School Rodeo (May).
- Lantern Festival (East Park Reservoir in April).

- Craft Fair (in November at the Colusa Fairgrounds).

More information on community activities of value can be found in the respective jurisdictional annexes to this Base Plan.

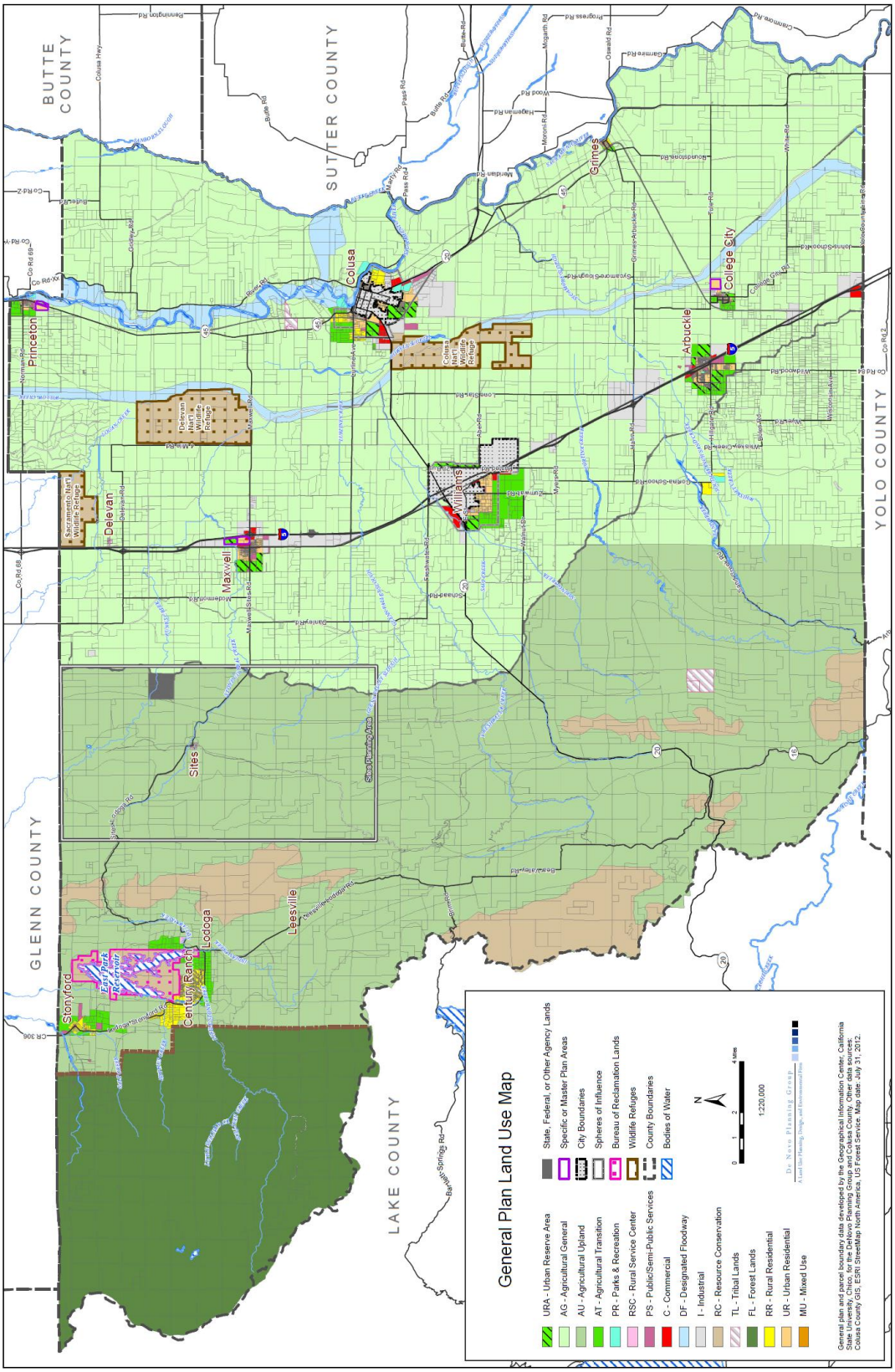
4.2.2. Growth and Development Trends

As part of the planning process, trends in growth and development, both current and future, were examined, both as a whole and in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability over time. This discussion focuses on unincorporated Colusa County.

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 2030 Colusa County General Plan Land Use Element (dated 2012). Figure 4-21 is sourced from the Land Use Element.

Figure 4-21 Colusa County General Plan Land Use Designations



Source: 2030 Colusa County General Plan Land Use Element

Population Projections

As indicated in the previous section, Colusa 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 Colusa County continuing through 2060. Table 4-18 shows the population projections for the County as a whole through 2060. As shown, populations are expected to shrink slowly over time. The average annual growth rate is expected to be -0.36%.

Table 4-18 Population Projections for the Colusa County Planning Area (incorporated and unincorporated), 2025-2060

	2025	2030	2035	2040	2045	2050	2055	2060
Colusa County	22,050	22,135	21,953	21,532	21,020	20,406	19,903	19,454

Source: California Department of Finance, P-1 Report

Development since 2018 Plan

The Colusa County Building Department sought to track total building permits issued since 2018 for unincorporated Colusa County. A summary of this development is shown in Table 4-19. Development by known flood and fire hazard areas is shown in Table 4-20. 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. 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 4-19 Unincorporated Colusa County Development 2018-2023 Summary

Property Use	2018	2019	2020	2021	2022	2023
Residential	18	5	29	23	28	27
Agricultural	12	13	12	11	14	23
Commercial/ Industrial	28	18	18	11	10	8
Total	**58**	**36**	**59**	**45**	**52**	**58**

Source: Colusa County Building Department and Planning Department

Table 4-20 Unincorporated Colusa County Development in Hazard Areas since 2018

Property Use	1% Annual Chance Flood	Wildfire Risk Area
Residential	7	7
Commercial	6	6
Industrial	2	8
Total	**15**	**21**

Source: Colusa County Building Department and Planning Department

Future Development Areas

It is important to review future development plans for the County. Future development should be sited in areas that are away from known hazard risks. If this is not possible, mitigation should be done to ensure that future development is protected against future hazards.

GIS Analysis

Colusa County provided 53 future development areas which were used as the basis for the inventory of future development for unincorporated Colusa County. These were mapped in GIS. Figure 4-22 show the locations of the future development areas. Figure 4-23 is a key to show more details on the future development areas shown on Figure 4-22. Table 4-21 shows the details of the future development areas by acreage and parcel count.

Figure 4-22 Unincorporated Colusa County – Future Development Areas

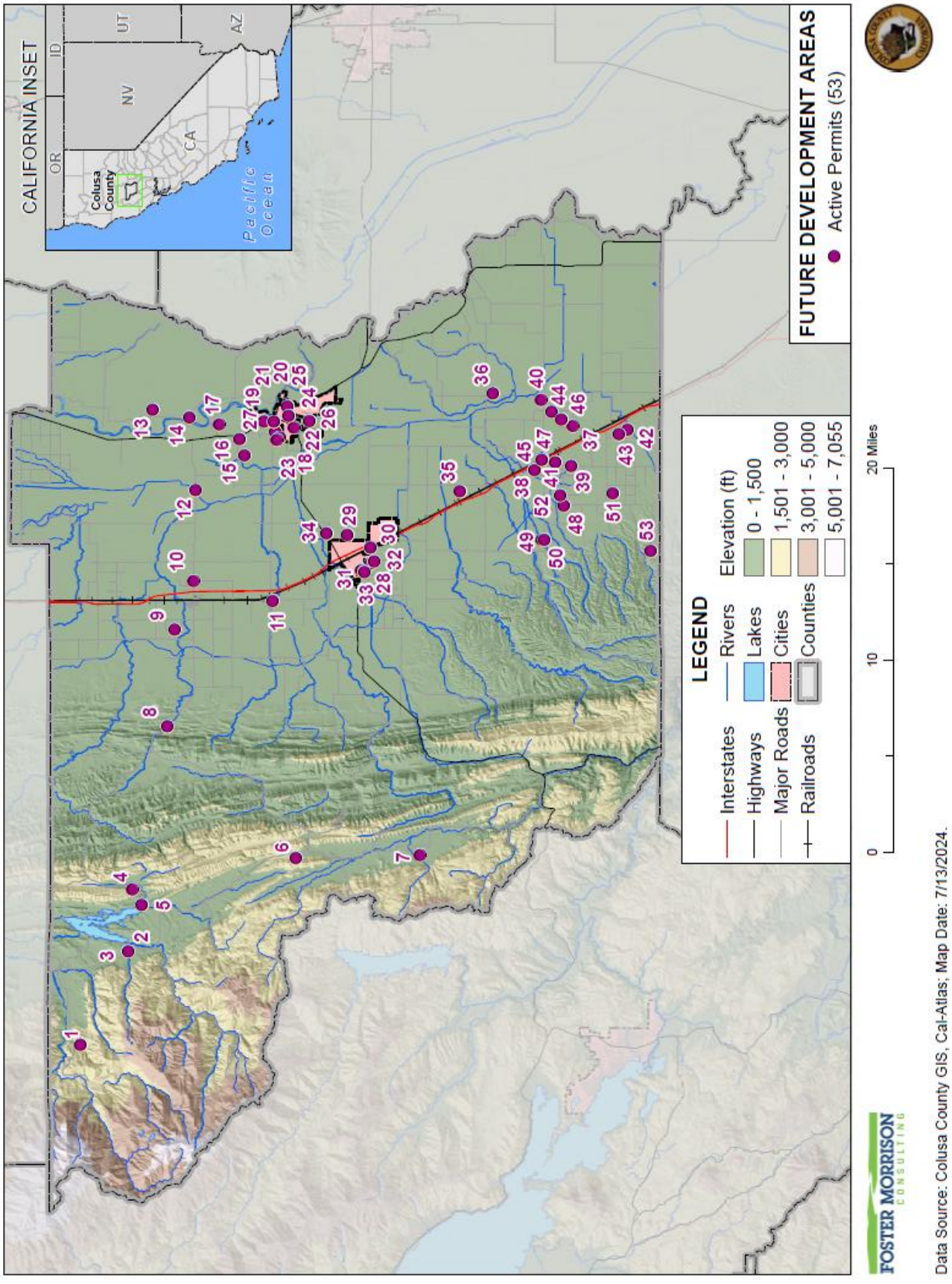


Figure 4-23 Unincorporated Colusa County – Future Development Locations Map Key

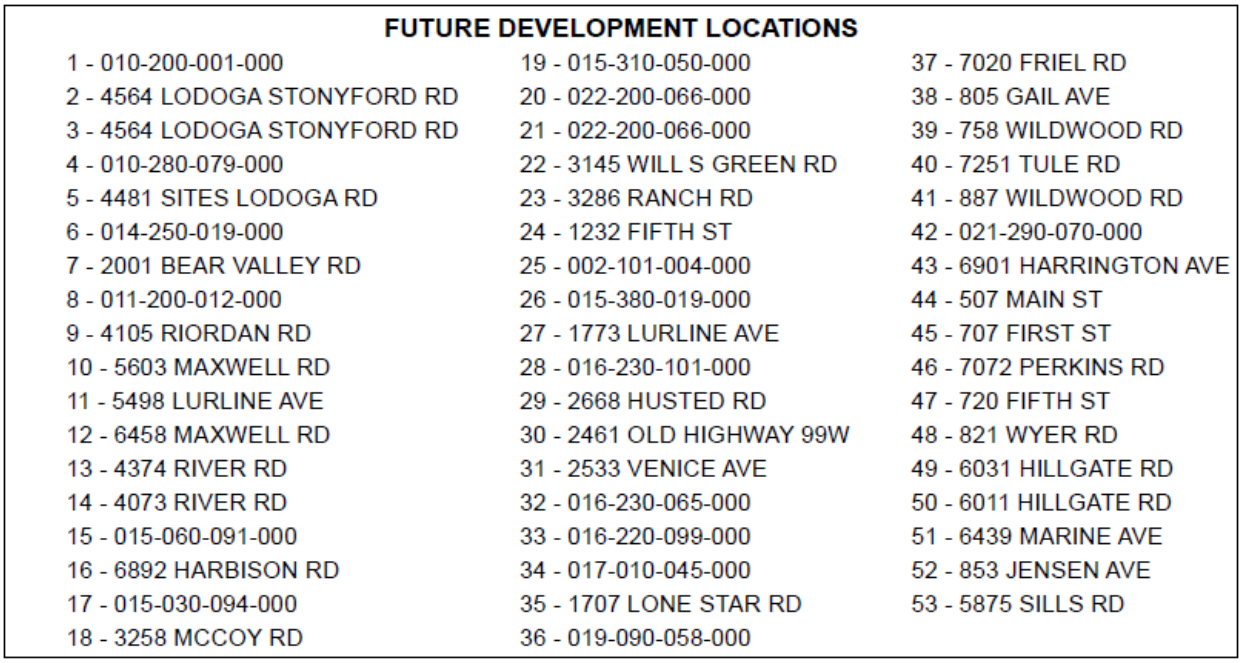


Table 4-21 Unincorporated Colusa County – Future Development Names, Parcels, and Acreages

Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
1	010-200-001-000	1	161.29
2	4564 LODOGA STONYFORD RD	1	2.49
3	4564 LODOGA STONYFORD RD	1	2.49
4	010-280-079-000	1	13.90
5	4481 SITES LODOGA RD	1	86.68
6	014-250-019-000	1	219.76
7	2001 BEAR VALLEY RD	1	637.09
8	011-200-012-000	1	282.12
9	4105 RIORDAN RD	1	76.26
10	5603 MAXWELL RD	1	30.89
11	5498 LURLINE AVE	1	12.18
12	6458 MAXWELL RD	1	319.89
13	4374 RIVER RD	1	402.44
14	4073 RIVER RD	1	10.32
15	015-060-091-000	1	497.11
16	6892 HARBISON RD	1	11.00
17	015-030-094-000	1	17.03

Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
18	3258 MCCOY RD	1	6.01
19	015-310-050-000	1	11.97
20	022-200-066-000	1	0.45
21	022-200-066-000	1	0.45
22	3145 WILL S GREEN RD	1	7.48
23	3286 RANCH RD	1	1.85
24	1232 FIFTH ST	1	0.60
25	002-101-004-000	1	4.48
26	015-380-019-000	1	1.00
27	1773 LURLINE AVE	1	3.40
28	016-230-101-000	1	2.49
29	2668 HUSTED RD	1	10.00
30	2461 OLD HIGHWAY 99W	1	8.53
31	2533 VENICE AVE	1	2.06
32	016-230-065-000	1	1.45
33	016-220-099-000	1	1.37
34	017-010-045-000	1	56.35
35	1707 LONE STAR RD	1	121.30
36	019-090-058-000	1	10.00
37	7020 FRIEL RD	1	9.92
38	805 GAIL AVE	1	0.38
39	758 WILDWOOD RD	1	25.08
40	7251 TULE RD	1	2.64
41	887 WILDWOOD RD	1	1.89
42	021-290-070-000	1	30.47
43	6901 HARRINGTON AVE	1	15.16
44	507 MAIN ST	1	0.47
45	707 FIRST ST	1	0.13
46	7072 PERKINS RD	1	9.29
47	720 FIFTH ST	1	0.55
48	821 WYER RD	1	10.79
49	6031 HILLGATE RD	1	9.65
50	6011 HILLGATE RD	1	9.72
51	6439 MARINE AVE	1	27.77
52	853 JENSEN AVE	1	9.92
53	5875 SILLS RD	1	618.41

Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
Grand Total		**53**	**3,816.40**

Source: Colusa County

4.3 Hazard Profiles and Vulnerability Assessment

44 CFR 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.
44 CFR §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.
44 CFR §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.
44 CFR §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.
44 CFR §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.
44 CFR §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. The Hazard Profiles set the stage for the Vulnerability Assessment, where the vulnerability is quantified, as data allows, for each of the identified hazards.

Hazard Profiles Methodology

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 Colusa County Planning Area and unincorporated Colusa County. Where known, this includes information on the hazard extent, location, seasonal patterns, speed of onset/duration, and magnitude and/or any secondary effects.
- **Past Occurrences**—This section contains information on historical incidents, including impacts where known. Hazard research, historical incident worksheets and other input from the Hazard Mitigation Planning Committee were used to capture information on past occurrences.
- **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 a 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 (as applicable). The possible influence of climate change on the hazard is discussed.

Vulnerability Assessment Methodology

With the Colusa County Planning Area's hazards identified and profiled, a vulnerability assessment was conducted to describe the vulnerability and impact that each hazard would have on the Colusa County Planning Area. 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 Colusa County Planning Area as a whole and specific to unincorporated Colusa County. The vulnerability assessment is done in the following format:

- ➢ **General Vulnerability Discussion** – An assessment of the vulnerability of Colusa County to each hazard is provided in addition to the estimate of the risk of future occurrence. This is followed by a general discussion of the hazard and its vulnerability on the Colusa County Planning Area. 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 one of 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.
- ➢ **Local Concerns** – This includes information on how the unincorporated Colusa County is uniquely affected by or vulnerable to each hazard. Information contained in this section also supports the resulting mitigation strategy for the unincorporated County. Local concerns sections specific to each of the other participating jurisdictions are included in their jurisdictional annexes to this plan
- ➢ **Assets at Risk** – A discussion of the assets at risk follows. This includes sections on: People and Populations, as well as Structures (including Critical Facilities and Infrastructure; and Natural, Historic,

and Cultural Resources). These are discussed in specific terms for mapped hazards, and in more general terms for those hazards that are unmapped.

- **Impacts** – A discussion on hazard impacts is included. Impacts describe how each hazard can affect the County and its assets. The type and severity of impacts reflect both the potential magnitude of the hazard and the vulnerability of the asset.
- **Future Conditions/Future Development** – A discussion of how future conditions will influence or affect the hazard over time is included here and considers factors related to climate change, changes in population patterns, and changes in land use and development. This section also discusses future development plans relative to each hazard as well as mitigating measures that should be considered in the development process. Future conditions and future development is addressed specifically for mapped hazards, and in more general terms for those hazards that are unmapped.

Existing Built Environment and Assets at Risk

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 assets 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 facilities, historic structures, and valued natural resources. Together, this information conveys the impact, or vulnerability, of the Colusa County Planning Area and unincorporated Colusa County to that hazard.

The vulnerability assessment identified six hazards in the Colusa County Planning Area for which specific geographical hazard areas have been defined and for which sufficient data exists to support a quantifiable vulnerability analysis. These six hazards are:

- Dam Failure
- Earthquake
- Flood: 1%/0.2%
- Landslide, Mudslides, and Debris Flows
- Levee Failure
- Wildfire

These hazards were analyzed using GIS, Colusa County data, and hazard data.

The vulnerability and potential impacts from the seven 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:

- Agricultural Hazards
- Climate Change
- Drought and Water Shortage
- Flood: Localized/Stormwater
- Severe Weather: Extreme Cold and Freeze
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rain and Storms
- Severe Weather: High Winds and Tornadoes
- Stream Bank Erosion

- Subsidence

Power Outages/Failure: A Common Vulnerability of all Hazards

An additional impact or vulnerability common to most all hazards is power outage or power failure. The US power grid crisscrosses the country, bringing electricity to homes, offices, factories, warehouses, farms, traffic lights and even campgrounds. According to statistics gathered by the Department of Energy, major blackouts are on the upswing. Over the past two decades, blackouts impacting at least 50,000 customers have increased 124 percent. The electric power industry does not have a universal agreement for classifying disruptions. Nevertheless, it is important to recognize that different types of outages are possible so that plans may be made to handle them effectively. Electric power disruptions can be generally grouped into two categories: intentional and unintentional.

Intentional Disruptions

There are four types of intentional disruptions:

- **Planned**: Some disruptions are intentional and can be scheduled based maintenance or upgrading needs.
- **Unscheduled**: Some intentional disruptions must be done "on the spot." in response to an emergency.
- **Demand-Side Management**: Some customers (i.e., on the demand side) have entered into an agreement with their utility provider to curtail their demand for electricity during periods of peak system loads.
- **Load Shedding**: When the power system is under extreme stress due to heavy demand and/or failure of critical components, it is sometimes necessary to intentionally interrupt the service to selected customers to prevent the entire system from collapsing, resulting in rolling blackouts.

The California Independent System Operator (CAISO) is tasked with managing the power distribution grid that supplies most of California, except in areas served by municipal utilities. CAISO is thus the entity that coordinates statewide flow of electrical supply. CAISO uses a series of stage alerts to the media based on system conditions. The alerts are:

- Stage 1 – reserve margin falls below 7 percent
- Stage 2 – reserve margin falls below 5 percent
- Stage 3 – reserve margin falls below 1.5 percent

Rotating blackouts become a possibility when Stage 3 is reached. Rotating outages and/or blackouts such as those experienced in 2000/2001 and 2006 can occur due to losses in transmission or generation and/or extremely severe temperatures that lead to heavy electric power consumption. Key California events include the following:

On January 17, 2001, CAISO declared a Stage 3 Emergency and notified the then Governor's Office of Emergency Services that PG&E was dropping firm load of 500 megawatts (MW) in Northern California leading to rolling blackouts. Cal OES, in turn, issued an Electrical Emergency Message to all Emergency Services Agencies to prepare for rolling blackouts. This scenario was repeated the following day, January 18, 2001, and again on March 19, 2001.

A July 2006 heat storm event affected the entire state as well as most of the West, producing record energy demand levels in California. The State was able to avoid rotating outages due to a combination of favorable factors that included no major transmission outages, lower than typical generator outages, significant customer response to pleas for energy conservation, high imports from the Pacific Northwest despite unusually high loads, outstanding cooperation among western control area operators, and prompt response to fires that potentially threatened major interties. However, the event brought to light the vulnerability of the electric distribution system, as over 3,500 distribution transformers failed, leaving over two million customers without power at various times over the ten-day event, many for several hours and a small minority for up to three days.

In 2020, the state battled both extreme heat and wildfires. As a result of extreme heat, the CAISO declared a Stage 3 emergency. PG&E initiated rotating outages in August at the request of California's grid operator. The outages, which impacted 220,000 customers, occurred during periods of high heat. These rolling blackouts lasted less than a week.

Unintentional Disruptions

Unintentional or unplanned disruptions are outages that come with essentially no advance notice. This type of disruption can be the most problematic. The following are categories of unplanned disruptions:

- Accident by the utility, utility contractor, or others
- Malfunction or equipment failure
- Equipment overload (utility company or customer)
- Reduced capability (equipment that cannot operate within its design criteria)
- Tree contact other than from storms
- Vandalism or intentional damage
- Weather, including lightning, wind, earthquake, flood, and broken tree limbs taking down power lines
- Wildfire that damages transmission lines

Public Safety Power Shutoff

A new intentional disruption type of power shortage/failure event has recently occurred in California. In recent years, several wildfires have started as a result of downed power lines or electrical equipment. This was the case for the Camp Fire in 2018. As a result, California's three largest energy companies (including PG&E), at the direction of the California Public Utilities Commission (CPUC), coordinated to prepare all Californians for the threat of wildfires and power outages during times of extreme weather. To help protect customers and communities during extreme weather events, electric power may be shut off for public safety in an effort to prevent a wildfire. This is called a Public Safety Power Shutoff (PSPS).

Public Safety Power Shutoff Criteria

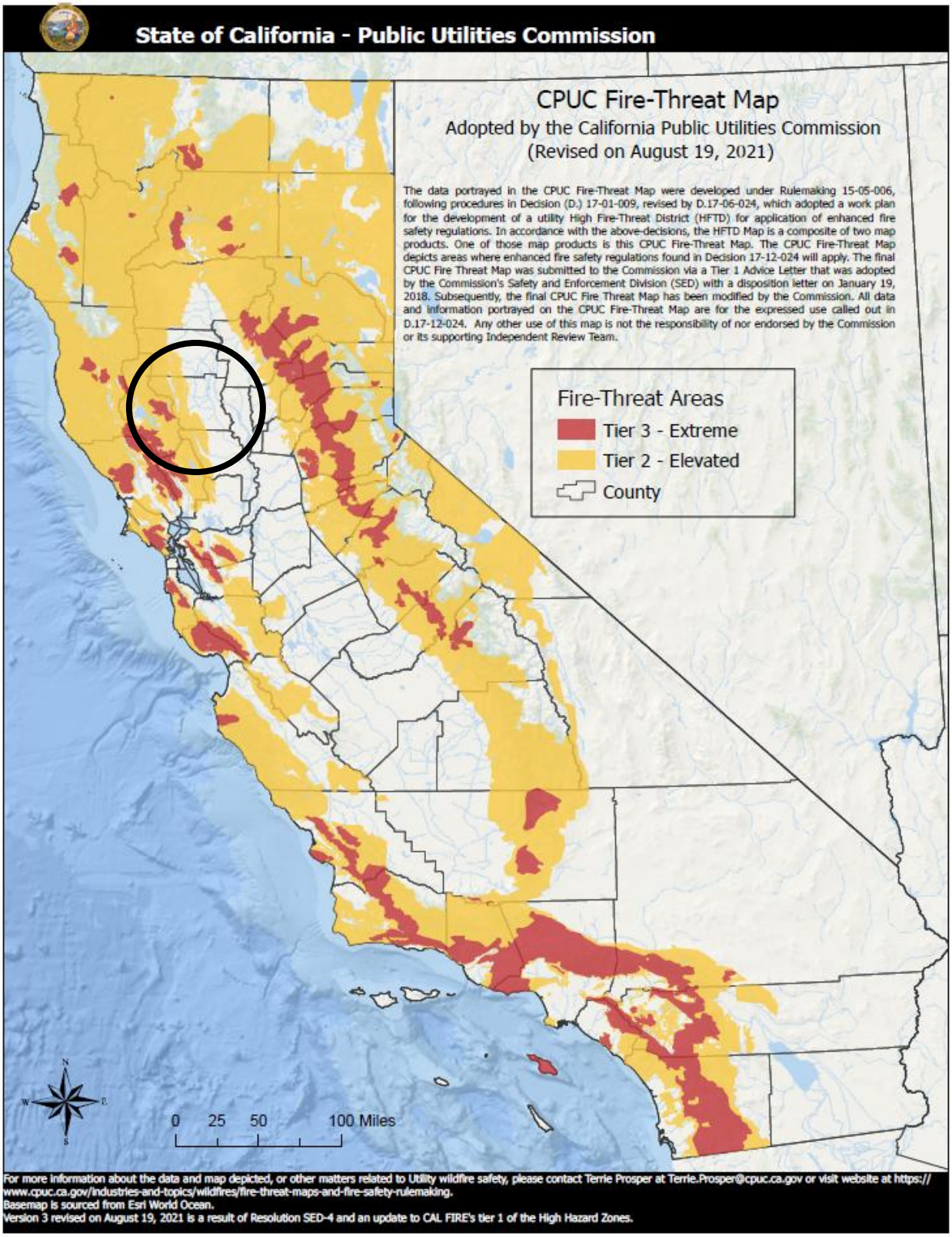
The Wildfire Safety Operations Center (WSOC) monitors fire danger conditions across PG&E's service area, including PSPS conditions. These factors include:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels generally 20% and below

- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry fuel on the ground and live vegetation (moisture content)
- On-the-ground, real time observations from PG&E's WSOC and field observations from PG&E crews

The most likely electric lines to be considered for shutting off for safety will be those that pass through areas that have been designated by the CPUC as at elevated (Tier 2) or extreme (Tier 3) risk for wildfire (seen on Figure 4-24). This includes both distribution and transmission lines. The specific area and number of affected customers will depend on forecasted weather conditions and which circuits PG&E needs to turn off for public safety. Although a customer may not live or work in a high fire-threat area, their power may also be shut off if their community relies upon a line that passes through an area experiencing extreme fire danger conditions. This means that any customer who receives electric service from PG&E should be prepared for a possible PSPS. PSPS events, while preventative in nature, can cause a variety of issues related to the lack of power to those impacted by the PSPS. For the Colusa County Planning Area, a significant concern is the impact to their communication systems as well as on other critical infrastructure and services. PSPS events also cause concerns for certain vulnerable populations. As seen on Figure 4-24, Colusa County has areas inside the Tier 2 and Tier 3 areas, as well as areas outside of them.

Figure 4-24 State of California Tier 2 and 3 Areas



PG&E noted that extreme weather threats can change quickly. When possible, PG&E will provide customers with advance notice prior to turning off the power, as well as updates until power is restored. Timing of notifications (when possible) are:

- Approximately 48 hours before power is turned off
- Approximately 24 hours before power is turned off
- Just before power is turned off
- During the public safety outage
- Once power has been restored

According to records provided by jurisdictions in the Colusa County Planning Area, there have been past PSPS events.

- 2018 – 0
- 2019 – 3
- 2020 – 2
- 2021 – 3
- 2022 – 0
- 2023 – 1
- 2024 – 1

These are also discussed in each jurisdiction's respective annex to this Base Plan.

It was noted that PG&E is working to enhance its power network with Enhanced Powerline Safety Settings (EPSS) capable lines. EPSS are advanced safety settings. They allow PG&E powerlines to automatically turn off power within one-tenth of a second. This can happen when there is a hazard, like a tree branch falling into a powerline, which can cause a fire. These settings are in high fire-risk and surrounding areas. These have not yet been installed in and near the Colusa County area, as PG&E focuses on other very high fire hazard areas in its service territory first. It is thought these EPSS capable lines will eventually come to the Colusa County Planning Area.

Climate Change and Power Outages/Failures (Energy Shortage)

Changing climate is expected to bring more frequent and intense natural disasters. Key climate parameters are starting to move outside of historically observed variability at a rate that makes historical data a poor predictor of future climate. For example, the warmest years on record in California occurred in 2014, 2015, 2016, and 2019. 2023 was a remarkably hot year as well. In addition, the 2016-2017 year broke the record as the wettest ever recorded in the northern Sierra Nevada Mountains.

Changes in temperatures, precipitation patterns, extreme events, and sea level rise have the potential to decrease the efficiency of thermal power plants and substations, decrease the capacity of transmission lines, render hydropower less reliable, spur an increase in electricity demand, and put energy infrastructure at risk of flooding.

With climate warming, higher costs from increased demand for cooling in the summer are expected to outweigh the decreases in heating costs in the cooler seasons. Hotter temperatures in California will mean

more energy (typically measured in "cooling-degree days") needed to cool homes and businesses both during heat waves and on a daily basis, during the daytime peak of the diurnal temperature cycle. During future heat waves, historically cooler coastal cities (e.g., San Francisco and Los Angeles) are projected to experience greater relative increases in temperature, such that areas that never before relied on air conditioning will experience new cooling demands.

Secondary impacts of energy shortages are most often felt by vulnerable populations. For example, those who rely on electric power for life-saving medical equipment, such as respirators, are extremely vulnerable to power outages. Also, during periods of extreme heat emergencies, the elderly and the very young are more vulnerable to the loss of cooling systems requiring power sources.

Additional impacts from a power disruption can also affect remote areas. This can affect evacuation messaging and coordination difficulties, and a reduction in firefighting capabilities due to lack of water access in more remote areas (especially for those on wells).

Hazard Profiles and Vulnerability Assessment by Hazard

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 Colusa County's Planning Area'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 HMPC is integrated into this section with information from other data sources. The data sources listed below formed the basis for this Hazard Profiles portion of the 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.

- 2010 General Plan Background Report
- 2012 Colusa County General Plan
- 2012 Sacramento River Individual Agency Summary Reports
- 2017 California Adaptation Planning Guide
- 2018 Colusa County LHMP Update
- 2020 US Census Bureau Average Household Size
- 2021 California Climate Adaptation Study
- 2021 Colusa County Community Wildfire Protection Plan
- 2021 Colusa County Groundwater Sustainability Report
- 2023 Colusa County Parcel/Assessor Data
- 2023 Fire Plan
- 2023 State of California Hazard Mitigation Plan
- 2024 Colusa County Flood Insurance Study
- Cal Adapt – Extended Drought Scenarios
- CAL FIRE (FHSZ SRA 2024, FRA & LPA 2007)
- CAL FIRE Fire History (4/13/2018)
- CAL FIRE Wildfire History Database

- Cal-Adapt
- Cal-Adapt – Number of Extreme Heat Days by Year
- Cal-Adapt – Precipitation: Decadal Averages Map
- Cal-Adapt – Temperature: Decadal Averages Map
- Cal-Atlas
- California Climate Adaptation Strategy
- California Department of Conservation, Office of Mine Reclamation
- California Department of Public Health
- California Department of Water Resources
- California Department of Water Resources 2012-2016 California Drought: Historical Perspective
- California Department of Water Resources Best Available Maps
- California Department of Water Resources Division of Safety of Dams
- California Department of Water Resources Groundwater Information Center
- California Division of Mines and Geology
- California Geological Survey
- California Geological Survey
- California Invasive Plant Council
- California Natural Resource Agency
- California Office of Emergency Services
- California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources.
- Climate Change and Health Profile Report – Colusa County
- Climate Change Impacts in the United States
- Colusa County Agricultural Commissioner
- Colusa County Agricultural Commissioner Crop Reports (2018-2023)
- Colusa County Digital Flood Insurance Rate Map
- Colusa County Emergency Management
- Colusa County Emergency Operations Plan
- Colusa County Flood Insurance Study
- Colusa County General Plan Background Report
- Colusa County Geographic Information Services
- Colusa County Housing Element
- DSOD/Cal OES/NID Dam Status 03/24
- Enhanced Fujita Scale. National Oceanic and Atmospheric Administration Storm Prediction Center.
- Federal Emergency Management Agency – Disaster Declaration Database
- Federal Emergency Management Agency – National Flood Hazard Layer
- Federal Emergency Management Agency – Wind Zones in the United States
- Federal Emergency Management Agency: Building Performance Assessment: Oklahoma and Kansas Tornadoes
- Federal Emergency Management Agency: Multi-Hazard Identification and Risk Assessment.
- Galloway, Jr Dr. Gerald E. Levees in History: The Levee Challenge. Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.
- Hazus-MH 6.1
- Intergovernmental Panel on Climate Change
- 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

- LFPZ BAM (2023)
- Multi-Hazard Identification and Risk Assessment, FEMA 1997
- National Aeronautics and Space Administration
- National Center for Atmospheric Research
- National Climate Assessment
- National Climatic Data Center Storm Events Database.
- National Drought Mitigation Center
- National Earthquake Information Center
- National Flood Insurance Program
- National Integrated Drought Information System
- National Inventory of Dams
- National Levee Database
- National Oceanic and Atmospheric Administration Storm Prediction Center
- National Oceanic and Atmospheric Administration's National Climatic Data Center
- National Park Service
- National Performance of Dams Program
- National Weather Service
- National Weather Service HeatRisk
- National Weather Service XMAC site
- Public Policy Institute of California. If drought continues: Environment and poor rural communities most likely to suffer. [press release].
- Science Magazine
- State of California Department of Conservation Farmland Mapping and Monitoring Program
- Susceptibility to Deep-Seated Landslides map – CSG Map Sheet 58 (05/2011)
- Underwood, E. Models predict longer, deeper US droughts. Science, 347(6223) 707 DOI: 10.1126/science.347.6223.707. 2015.
- United State Geologic Survey. Earthquake Intensity Zonation and Quaternary Deposits, Miscellaneous Field Studies Map 9093, 1977.
- US Army Corps of Engineers
- US Bureau of Reclamation
- US Department of Agriculture
- US Department of Agriculture – Farm Service Agency Secretarial Disasters Declarations
- US Department of Transportation Pipeline and Hazardous Materials Safety Administration
- US Drought Monitor
- US Farm Service Agency
- US Fish and Wildlife Service
- US Forest Service
- US Geological Survey – Biological Resource Division
- US Geological Survey – Volcanic Ash: Effect & Mitigation Strategies
- US Geological Survey Earthquake Intensity Zonation and Quaternary Deposits, Miscellaneous Field Studies Map 9093, 1977
- US Geological Survey Emergency Assessment of Post-Fire Debris Flow Hazards
- US Geological Survey Open File Report 2015-3009
- US Geological Survey Publication 2014-3120
- US Natural Resource Conservation Service
- USA Today

- USGS Quaternary Faults 03/24
- Vaisala National Lightning Detection Network
- Western Regional Climate Center

4.3.1. Severe Weather: General

Severe weather is generally any destructive weather event, but usually occurs throughout the Colusa County Planning Area as temperature extremes, localized storms that bring heavy rain and strong winds, and other extreme weather events.

The National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC) has been tracking severe weather since 1950. Their 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 202 severe weather events that occurred in Colusa County between January 1, 1950, and August 31, 2023. Table 4-22 summarizes these events.

*Table 4-22 NCDC Severe Weather Events for Colusa County 1950-8/31/2023**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Cold/Wind Chill	2	0	0	0	0	$0	$0
Dense Fog	3	0	7	0	1	$0	$0
Drought	58	0	0	0	0	$0	$0
Excessive Heat	21	0	0	0	0	$0	$0
Flash Flood	1	0	0	0	0	$0	$0
Flood	13	0	0	0	0	$32,900,000	$0
Frost/Freeze	2	0	0	0	0	$0	$0
Funnel Cloud	2	0	0	0	0	$0	$0
Hail	1	0	0	0	0	$0	$0
Heat	17	0	0	0	0	$0	$0
Heavy Rain	5	0	0	0	0	$0	$0
Heavy Snow	5	0	0	0	0	$100,000	$0
High Wind	22	0	0	0	0	$35,000	$0
Strong Wind	7	0	0	0	0	$50,000	$0
Thunderstorm Wind	2	0	0	0	0	$0	$0
Tornado	4	0	0	0	0	$70,000	$0
Wildfire	13	7	1	37	5	$0	$0
Winter Storm	21	0	0	0	0	$0	$0
Winter weather	3	0	0	0	0	$0	$0
Total	**202**	**7**	**8**	**37**	**6**	**$33,155,000**	**$0**

Source: NCDC

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

The NCDC table above summarizes severe weather events that occurred in Colusa County. Only a few of the events actually resulted in federal and state 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. While the HMPC recognizes these inconsistencies, they see the value this data provides in depicting the County's "big picture" hazard environment.

As previously mentioned, most all of Colusa County's federal and state disaster declarations have been a result of severe weather. For this Plan Update, severe weather is discussed in the following subsections:

- Extreme Cold and Freeze
- Extreme Heat
- Heavy Rains and Storms
- High Winds and Tornadoes

4.3.2. Severe Weather: Extreme Cold and Freeze

Hazard Profile

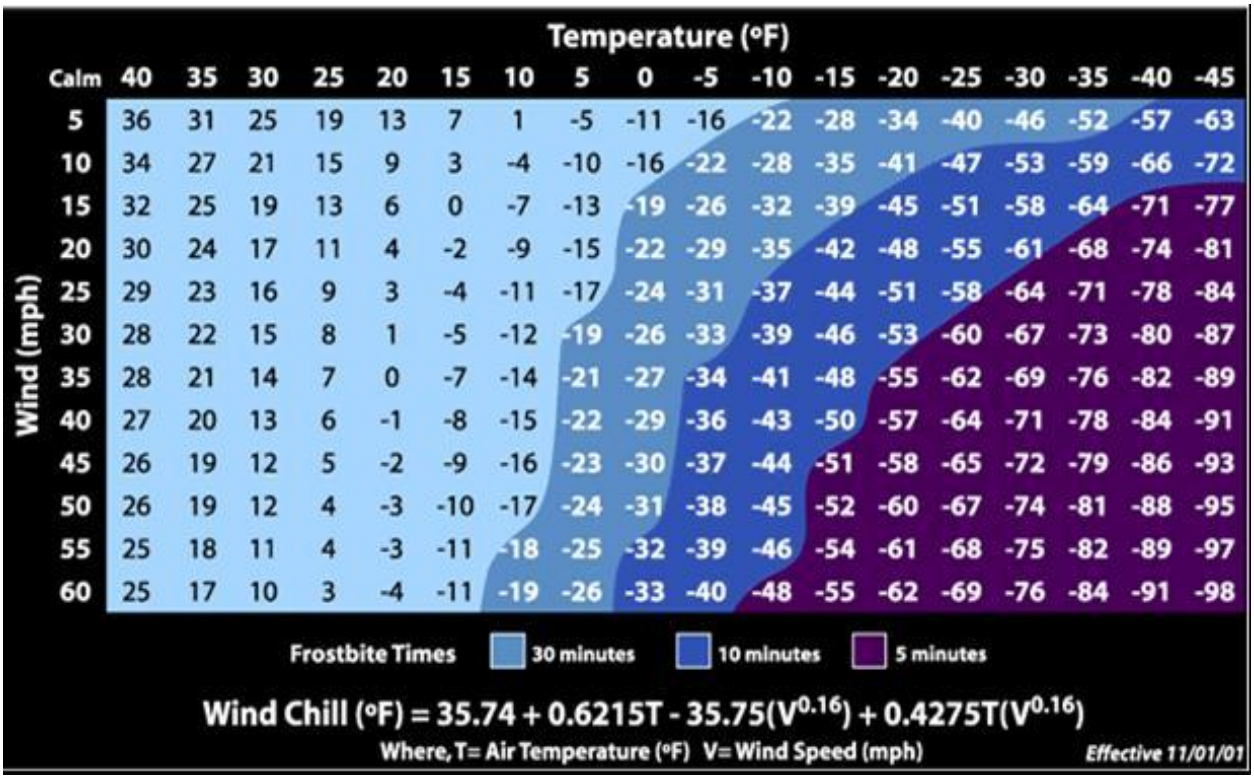
This hazard profile contains multiple sections that detail how this hazard can affect the Colusa County Planning Area and unincorporated Colusa County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect or influence this hazard.

Hazard/Problem Description

According to the National Weather Service (NWS) and the Western Regional Climate Center (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. The effects of freezing temperatures on agriculture in Colusa County are discussed further in Section 4.3.6 Agricultural Hazards.

In 2001, the NWS implemented an updated Wind Chill Temperature index (shown in Figure 4-25), 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 4-25 Wind Chill Temperature Chart



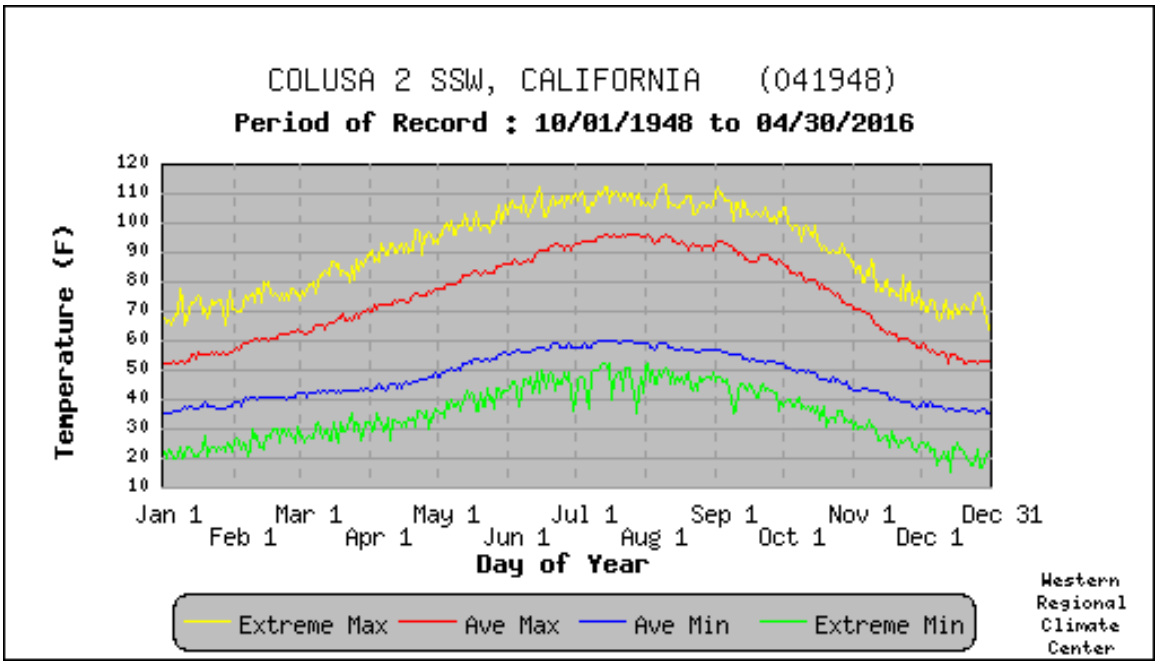
Source: National Weather Service

The WRCC and NWS maintain data on weather normal and extremes in the western United States. Each of these data sources maintain data in slightly different ways. Data from the WRCC stopped being collected in April of 2016. NWS covers the entire time period to present. Therefore, both data sets are shown below. WRCC and NWS data for the County is summarized below.

Colusa County—WRCC Colusa 2 SSW Weather Station, Period of Record 1948 to 2016

According to the WRCC, in Colusa County monthly average minimum temperatures from November through April range from the mid-30s to mid-40s. The lowest recorded daily extreme was 15°F on December 12, 1972. In a typical year, minimum temperatures fall below 32°F on 25.1 days with no days falling below 0°F. Table 4-23 shows the record low temperatures by month for Colusa County. Average daily temperatures for Colusa County are shown in Figure 4-26. Snowfall is rare in the County and occurs infrequently in upper elevations of the County.

Figure 4-26 Colusa County— Colusa Daily Temperature Averages and Extremes 1948 to 2016



Source: Western Regional Climate Center

Table 4-23 Colusa County – Colusa Record Low Temperatures 1948 to 2016

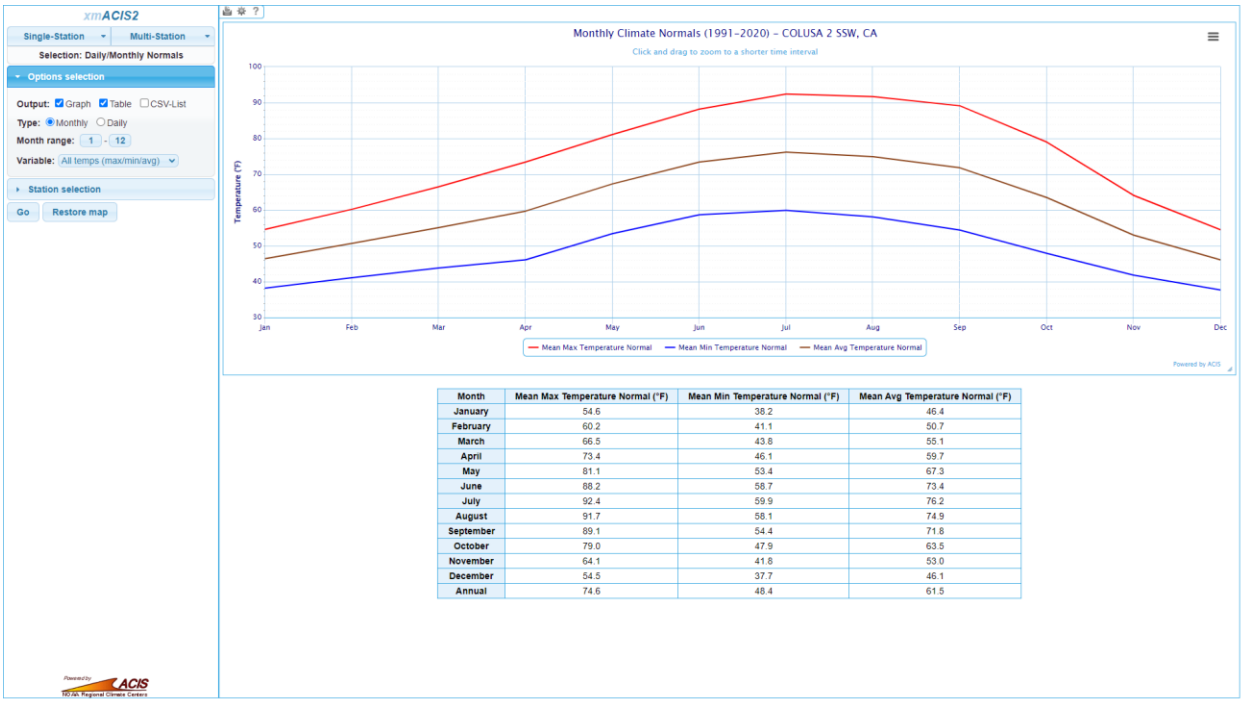
Month	Record Low	Date	Month	Record Low	Date
January	20°	1/5/1950	July	40°	7/17/1987
February	21°	2/7/1989	August	43°	8/22/1983
March	25°	3/3/1966	September	35°	9/9/1983
April	26°	4/10/1953	October	31°	10/20/1949
May	34°	5/4/1975	November	22°	11/29/1948
June	38°	6/6/1984	December	15°	12/14/1972

Source: Western Regional Climate Center

Colusa County—NWS Colusa 2 SSW Weather Station, Period of Record 1948 to 2024

According to the NWS, monthly average minimum temperatures in the coldest months (December through February) range from the mid-30s to mid-40s. The lowest recorded daily extreme was 14°F on December 16, 2022. Figure 4-27 shows the average daily low temperatures and extremes for the County. Table 4-24 shows the record low temperatures for the County.

Figure 4-27 Colusa County –Colusa 2 SSW Daily Temperature Averages and Extremes, 1991-2020



Month	Mean Max Temperature Normal (°F)	Mean Min Temperature Normal (°F)	Mean Avg Temperature Normal (°F)
January	54.6	38.2	46.4
February	60.2	41.1	50.7
March	66.5	43.8	55.1
April	73.4	46.1	59.7
May	81.1	53.4	67.3
June	88.2	58.7	73.4
July	92.4	59.9	76.2
August	91.7	58.1	74.9
September	89.1	54.4	71.8
October	79.0	47.9	63.5
November	64.1	41.8	53.0
December	54.5	37.7	46.1
Annual	74.6	48.4	61.5

Source: National Weather Service XMAC site. Retrieved 3/19/2024

Table 4-24 Colusa County – Colusa Record Low Temperatures 1948 to 2024

Temperature	Date
14.0°	12/16/2022
14.0°	12/15/2022
15.0°	12/19/2022
15.0°	12/18/2022
15.0°	12/14/1972
15.0°	12/11/2023
17.0°	12/10/2023
17.0°	12/9/2023
17.0°	12/14/2022
17.0°	12/28/1956

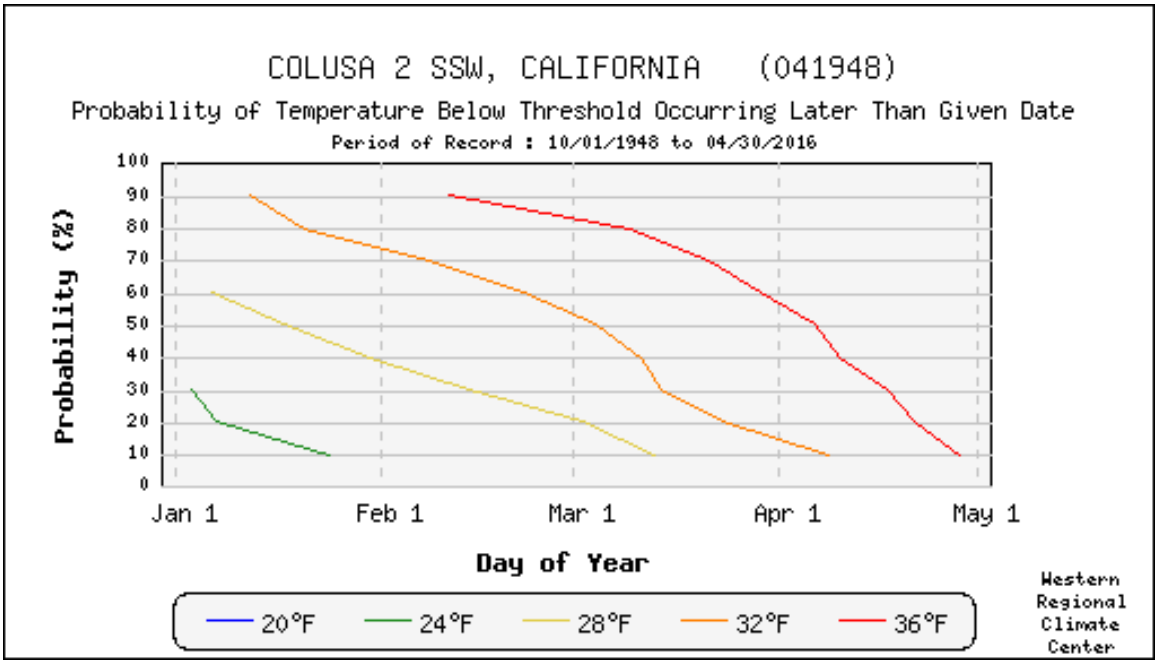
Source: National Weather Service XMAC site. Retrieved 3/19/2024

Location and Extent

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. Extreme cold can affect agricultural products in the County. Freeze damages reduce the values of agricultural crops. While there is no scale (i.e. Richter, Enhanced Fujita) to measure the effects of freeze,

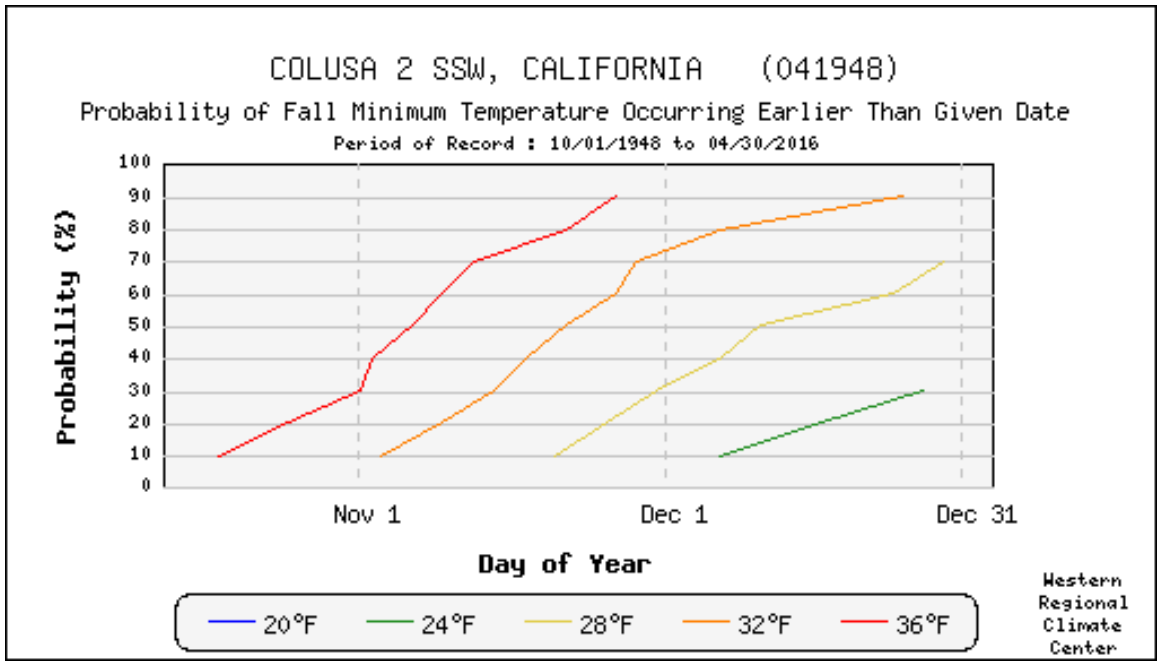
temperature data from the County from the WRCC indicates that there are 25.1 days that fall below 32°F. Freeze has a slow onset and can generally be predicted in advance for the County. Freeze events can last for hours (in a cold overnight), or for days to weeks at a time. Figure 4-28 and Figure 4-29 show the probabilities in the County of freeze for both spring and fall. There has not been a past occurrence of freeze in the months of May through September.

Figure 4-28 Colusa County – Colusa Spring Freeze Probabilities



Source: Western Regional Climate Center. Retrieved 3/19/2024.

Figure 4-29 Colusa County – Fall Freeze Probabilities



Source: Western Regional Climate Center. Retrieved 3/19/2024.

Past Occurrences

Disaster Declaration History

The County has had two past federal and three past state disaster declarations for extreme cold and freeze. Table 4-25 shows the dates of the disaster declarations. More information on USDA disaster declarations (in 2017 and twice in 2022) from cold and freeze can be found in Table 4-42 in the Past Occurrences in Section 4.3.6.

Table 4-25 Colusa County – Federal and State Disaster Declarations for Freeze 1950-2018

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Freeze	2	1972, 1990	3	1970, 1972, 1990

Source: Cal OES, FEMA

NCDC Events

The NCDC data shows 4 extreme cold and freeze incidents for Colusa County since 1993. Information for these events is shown in Table 4-26.

*Table 4-26 NCDC Cold and Freeze Events for Colusa County 1950-8/31/2023**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Cold/Wind Chill	2	0	0	0	0	$0	$0
Frost/Freeze	2	0	0	0	0	$0	$0
Total	**4**	**0**	**0**	**0**	**0**	**$ 0**	**$0**

Source: NCDC

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

Hazard Mitigation Planning Committee Events

The HMPC noted that cold and freeze events occur on a regular basis in the winter months in the County. The following specific events were noted by the HMPC:

February 2022 - Colusa experienced record low temperatures in February of 2022. These lows were especially devastating due to the length of time the temperatures stayed below freezing. Multiple monitors throughout the county registered 23.8° F for 9 hours. For 5 days, the icy weather persisted during the peak of the non-peril bloom.

Goat Mountain 2023 Winter Storm - Goat Mountain Road is a mountainous, rural gavel road, located in western Colusa County. The subject location is approximately 20 wide with a 24" corrugated galvanized culvert. The culvert failed during the event which was exasperated by the recurrence of natural spring in the toe of the roadway cutback up gradient of the culvert failure. The spring then began saturating the remaining road prism at the culvert failure, destabilizing the entire slope. In order to preserve the roadway, a 'French Drain' was installed up gradient of the failed culvert to intercept the subsurface water from the spring. This water was then directed across the road and away from the failed 24' culvert by way of a new 18" culvert. The 24" cross culvert was replaced and both the new 18" and 24" culverts were backfilled with native material and class II road base.

Likelihood of Future Occurrence

Highly Likely—Extreme cold and freeze are likely to continue to occur annually in the Colusa County Planning Area. According to the WRCC, in a typical year, minimum temperatures fall below 32°F on 25.1 days. This equates to a likelihood of future occurrences being considered highly likely.

It is likely that climate change will decrease the chance of future occurrence as well as future impacts. More information on climate change and extreme cold and freeze can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Extreme Cold and Freeze

According to the 2021 California Climate Adaptation Study (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 the Colusa County Planning Area each year. It can impact key assets in the Planning Area. The whole of the Planning Area has some measure of vulnerability to extreme cold and freeze. An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The varying elevations in the County, in part, determine the extent to which a given area is affected by freeze and cold. The agricultural industry is especially vulnerable to extreme temperatures. Freezing temperatures can cause significant loss to crops. Historically, extreme cold and freeze have caused losses to agricultural crops and have resulted in several USDA disaster declarations including the ones noted above in the Past Occurrences section.

Assets at Risk

Assets at risk from extreme cold and freeze include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

All populations within the Colusa County Planning Area are vulnerable to extreme cold and freeze, but this hazard generally affects people spending large amounts of time outside. Prolonged exposure to cold can cause frostbite or hypothermia and can be life-threatening. Vulnerable populations to cold and freeze include the unhoused; individuals who exercise or train outdoors; outdoor workers; individuals that lack the resources to afford heat; and the young, old, or medically fragile individuals that are more susceptible to cold related impacts. In addition to vulnerable populations, pets and livestock are at risk to freeze and cold.

Structures

Structures in the Colusa County Planning Area have some measure of risk from extreme cold and freeze. Buildings in the upper elevations of the County can be affected directly by freeze; pipes that feed buildings can be damaged during periods of extreme cold and cause water damage and other related impacts to a structure. Structures can also be damaged by downed trees during freeze and winter storm events.

Critical Facilities and Infrastructure

Winter storms (though rare in the County) typically involve snow and ice, occasionally accompanied by high winds, which can cause downed trees and power lines, power outages, accidents, and road closures. Transportation networks, communications, and utilities infrastructure are the most vulnerable physical assets in the County. Depending on the facility type and function, critical facilities and infrastructure may be affected directly by freeze and extreme cold events. Damage to pipes that feed buildings can be damaged during periods of extreme cold. Other equipment may also be affected. Infrastructure such as roads, highways, and bridges can become slippery, causing accidents and road closures.

Community Lifelines

Secondary impacts of freeze can affect the supporting mechanisms or systems of a community's infrastructure. For example, when extreme cold is coupled with high winds or ice storms, power lines may be downed, resulting in an interruption in the transmission of that power shutting down electric furnaces, which may lead to frozen pipes in homes and businesses. Community lifelines are likely to be affected to some degree by extreme cold and freeze events. Impacts to these lifelines include:

- **Safety and Security** – Police and fire personnel may see additional demand during periods of extreme cold.
- **Food, Hydration, Shelter** – Warming centers and other public shelters will need to be open and staffed.
- **Health and Medical** – Though rare, hypothermia may cause additional strains on medical facilities in the area.
- **Energy** – Freezing rain can cause power outages as power lines get heavy from the additional weight of ice.
- **Water Systems** – Water lines (both fresh and wastewater) above ground can freeze, causing burst pipes. This is true when temperatures are below freezing for a longer period of time.

Due to the limited nature of extreme cold and freeze in the Colusa County Planning Area, community lifelines are unlikely to be overwhelmed.

Natural, Historic, and Cultural Resources

Depending on how low the temperatures go and the duration of an extreme cold and freeze event, natural resources in the Colusa County Planning Area may be affected. During periods of freeze, trees in the Planning Area may be damaged. This is especially true if a freeze occurs during a winter storm with winds and precipitation. Other natural resources like wildlife may be at risk during a period of freeze. While it is rare for buildings to be affected directly by freeze, damages to pipes that feed historic buildings can be damaged during periods of extreme cold and cause additional impacts to the structures.

Economic Assets and Community Activities of Value

Many economic assets within the Colusa County Planning Area are not highly vulnerable to extreme cold events. However, during periods of extreme cold and freeze, the economy may slow as people stay home or inside. The greatest economic asset at risk is the agricultural industry. The varying elevations in the County, in part, determine the extent to which a given area is affected by freeze and cold. The agricultural industry is especially vulnerable to extreme temperatures. Freezing temperatures can cause significant loss to crops. Historically, extreme cold and freeze have caused losses to agricultural crops and have resulted in several USDA disaster declarations in Colusa County. Additionally, commercial business revenue, including taxable shopping revenue may be reduced during periods of extreme cold (though this is expected to be limited in Colusa County). Extreme cold and freeze causes power costs borne by individuals and businesses in the Colusa County Planning Area to increase, which reduces the amount of money available to circulate inside the local economy. Community activities of value may see a reduction in attendance, impacting revenues associated with these events, especially those that occur outdoors.

Impacts from Severe Weather: Extreme Cold and Freeze

Extreme cold and freeze can affect critical facilities and infrastructure, down trees, break pipes, and can be a life safety issue. Transportation networks, communications, and utilities infrastructure are often the most vulnerable physical assets in the Colusa County Planning Area. Infrastructure such as roads and utilities are at risk to freezing temperatures, causing failures and hazardous road conditions. When extreme cold is coupled with high winds and freezing storms, power lines may be downed, resulting in power outages and an interruption of utilities and critical services. During periods of extremely low or prolonged cold temperatures, other impacts to the Planning Area include can include interruption in business and school activities.

The elderly, the young, and those experiencing medical issues are often more vulnerable to temperature extremes, but anyone can be affected. Exposure to cold temperatures can cause hypothermia and frostbite. Those exercising or recreating outdoors, outdoor workers, and the unhoused may be at a higher risk.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on these factors for Colusa County include the following:

- Climate change is unlikely to exacerbate extreme cold and freeze and their associated impacts to the County.
- The population of Colusa County is expected to decrease as time progresses. Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Changes in populations patterns should also be considered. Especially

vulnerable individuals to this hazard include older adults, children, migrant farm workers, those below the poverty line and the unhoused. During hazard events, existing inequities can get worse, and these groups are the most likely to be affected and may require extra assistance. Planning for population changes will help to decrease the County's overall vulnerability. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of population growth and continued planning for future hazard conditions.

- Land use planning should be proactive to address future hazard conditions. County building codes are in effect to reduce this risk and should be updated as necessary to continue to address future freeze and extreme cold conditions. Due to adherence to protective building codes, changes in land use and development will likely not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development built to code should be able to withstand extreme cold and freeze. Current building codes provide such provisions for new construction. Older buildings and infrastructure should be evaluated to ensure that extreme cold and freeze will not cause negative impacts. Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements such as building codes are followed, and varying needs for different demographic groups that reside within the County are considered can help make for a more resilient community.

4.3.3. Severe Weather: Extreme Heat

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect the Colusa County Planning Area. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect or influence 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. Recently in California, records were set across the state during a July 2024 heat event. 2023 was considered the hottest on record. Extreme heat can also affect the agricultural industry. Extreme heat as it affects agriculture in Colusa County is discussed further in the agricultural hazards discussion in Section 4.3.6.

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, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to extreme heat.

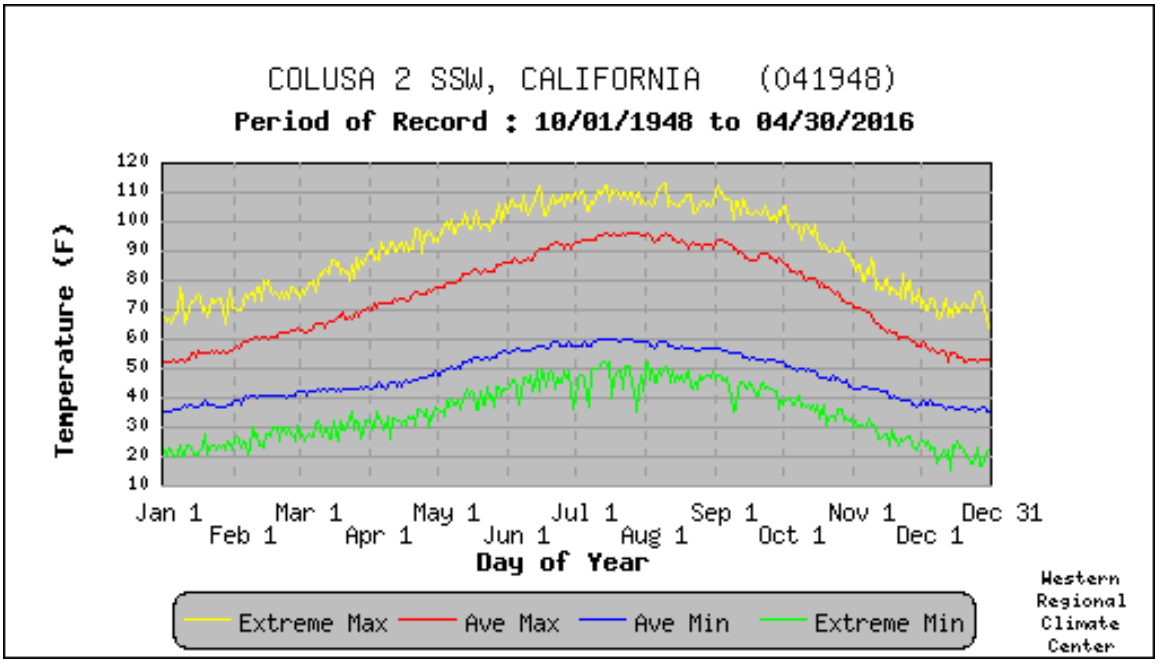
Location and Extent

Extreme heat events occur on a regional basis. Extreme heat can occur in any location of the County. All portions of the County are at risk to extreme heat. Extreme heat occurs throughout the Planning Area primarily during the summer months. The Western Regional Climate Center (WRCC) and National Weather Service (NWS) maintain data on weather normal and extremes in the western United States. Each of these data sources maintain data in slightly different ways. Data from the WRCC stopped being collected in April of 2016. NWS covers the entire time period to present. Therefore, both data sets are shown below. WRCC and NWS data for the County is summarized below.

Colusa County— WRCC Colusa 2 SSW Weather Station, Period of Record 1948 to 2016

According to the WRCC, in Colusa County, monthly average maximum temperatures in the warmest months (May through October) range from the mid-70s to the low 90s. The highest recorded daily extreme was 113°F on August 9, 1978. In a typical year, maximum temperatures exceed 90°F on 88.9 days. Figure 4-30 shows the average daily high temperatures and extremes for the County. Table 4-27 shows the record high temperatures by month for the County.

Figure 4-30 Colusa County— Colusa Daily Temperature Averages and Extremes 1948 to 2016



Source: Western Regional Climate Center. Retrieved 3/19/2024

Table 4-27 Colusa County – Colusa Record High Temperatures 1948 to 2016

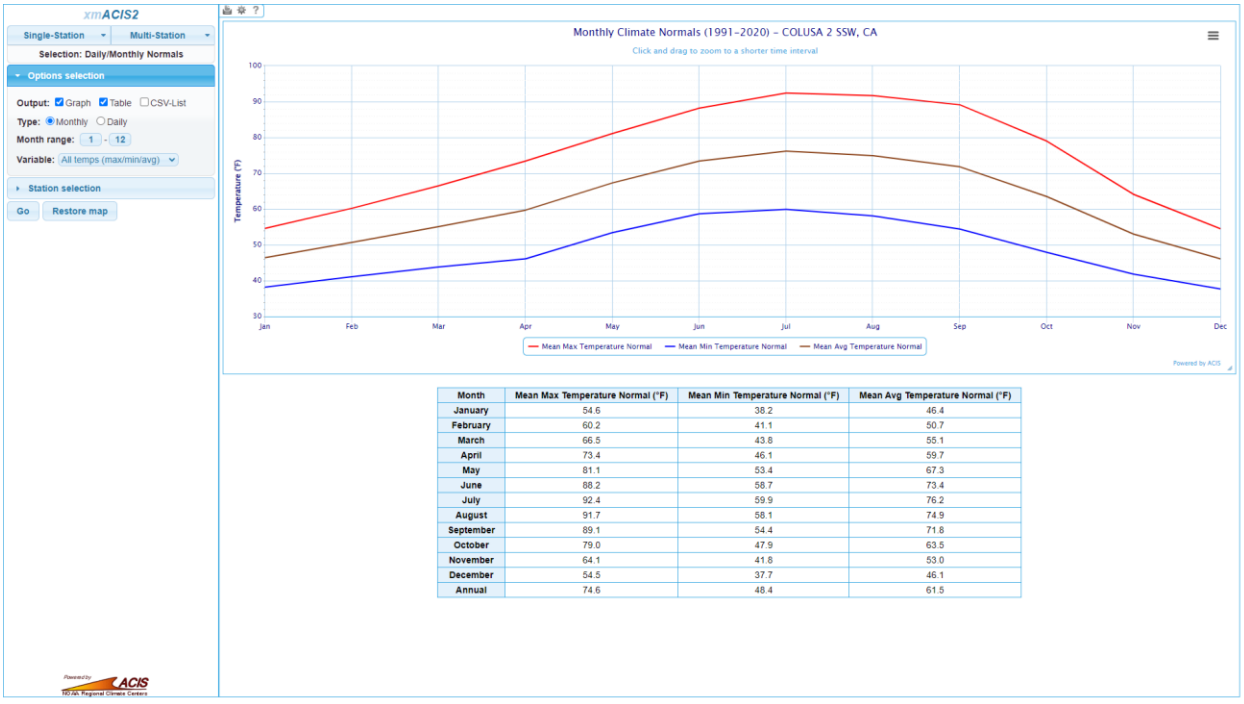
Month	Record High	Date	Month	Record High	Date
January	78°	1/8/1962	July	112°	7/14/1972
February	80°	2/14/1977	August	113°	8/9/1978
March	89°	3/31/1966	September	112°	9/2/1950
April	98°	4/21/2009	October	105°	10/2/2001
May	106°	5/31/1950	November	89°	11/27/1949
June	112°	6/15/1961	December	76°	12/26/1967

Source: Western Regional Climate Center

Colusa County—NWS Colusa 2 SSW Weather Station, Period of Record 1948 to 2024

According to the NWS, monthly average maximum temperatures in the warmest months (May through October) range from the mid-70s to the low 90s. The highest recorded daily extreme was 113°F on August 9, 1978. Figure 4-31 shows the average daily high temperatures and extremes for the County. Table 4-24 shows the record low temperatures for the County.

Figure 4-31 Colusa County –Colusa 2 SSW Daily Temperature Averages and Extremes, 1991-2020



Month	Mean Max Temperature Normal (°F)	Mean Min Temperature Normal (°F)	Mean Avg Temperature Normal (°F)
January	54.6	38.2	46.4
February	60.2	41.1	50.7
March	66.5	43.8	55.1
April	73.4	46.1	59.7
May	81.1	53.4	67.3
June	88.2	58.7	73.4
July	92.4	59.9	76.2
August	91.7	58.1	74.9
September	89.1	54.4	71.8
October	79.0	47.9	63.5
November	64.1	41.8	53.0
December	54.5	37.7	46.1
Annual	74.6	48.4	61.5

Source: National Weather Service XMAC site. Retrieved 3/19/2024

Table 4-28 Colusa County – Colusa Record High Temperatures 1948 to 2024

Temperature	Date
114.0°	9/7/2022
113.0°	8/10/1978
113.0°	8/9/1978
112.0°	9/6/2022
112.0°	8/8/1978
112.0°	7/15/1972
112.0°	7/14/1972
112.0°	6/15/1961
112.0°	9/2/1950
111.0°	7/4/1991

Source: National Weather Service XMAC site. Retrieved 3/19/2024

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 2018/2023 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 NWS has in place a system 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 4-29.

Table 4-29 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 shows 38 extreme heat incidents for Colusa County since 1993. Information for these events are shown in Table 4-30.

*Table 4-30 NCDC Extreme Heat Events in Colusa County 1993 to 8/31/2023**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Excessive Heat	21	0	0	0	0	$0	$0
Heat	17	0	0	0	0	$0	$0
Total	**38**	**0**	**0**	**0**	**0**	**$ 0**	**$0**

Source: NCDC

*Deaths, injuries, and damages are for the entire event, and may not be exclusive to the County.

Hazard Mitigation Planning Committee Events

2014 to 2016 – The HMPC did indicate that between 2014 and 2016, some trees within the County experience Sudden Limb Drop which can occur during hot weather.

2022 – a heat dome settled over the County. It ruined the quality (but not the production) of the walnut crop. There were limits on charging electric cars due to brownouts. Requirements were removed for air pollution so generators could be run longer. The Sacramento Basin could run their generators longer because of grid issues. Fortunately for Colusa County, the rural nature of the County meant that only minor air quality issues occurred.

Likelihood of Future Occurrence

Highly Likely—Temperature extremes are likely to continue to occur annually in the Colusa County Planning Area. Temperatures at or above 90°F are common most summer days in the County. It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and extreme heat can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Extreme Heat

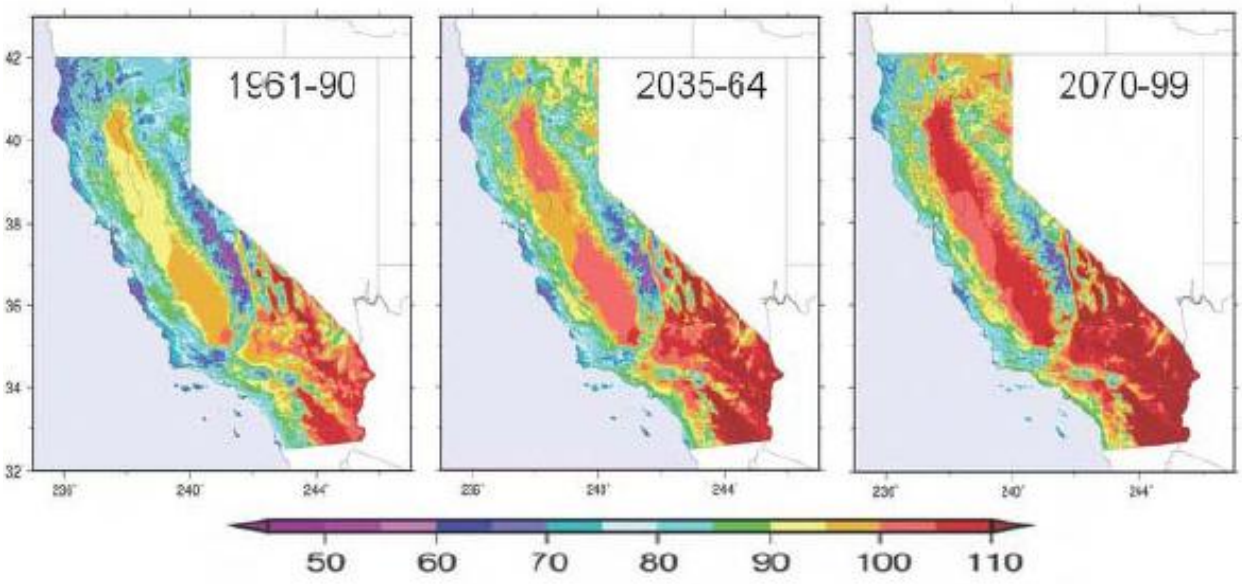
Climate change and its effect on extreme heat in the County has been discussed by three sources:

- California Climate Adaptation Strategy (CAS) – 2021
- Climate Change and Health Profile Report –Colusa County
- Cal-Adapt

Climate Adaptation Strategy

The 2021 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 4-32.

Figure 4-32 California Historical and Projected Temperature Increases – 1961 to 2099



Source: Dan Cayan; California Climate Adaptation Strategy

As temperatures increase, California and Colusa 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 2021 CAS report and the 2023 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 illnesses and deaths related to extreme heat in Colusa County.

Climate Change and Health Profile Report – Colusa County

The CCHPR noted for Colusa 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 add to the heat load of buildings in urban areas and exacerbate existing urban heat islands adding to the risk of high ambient temperatures.

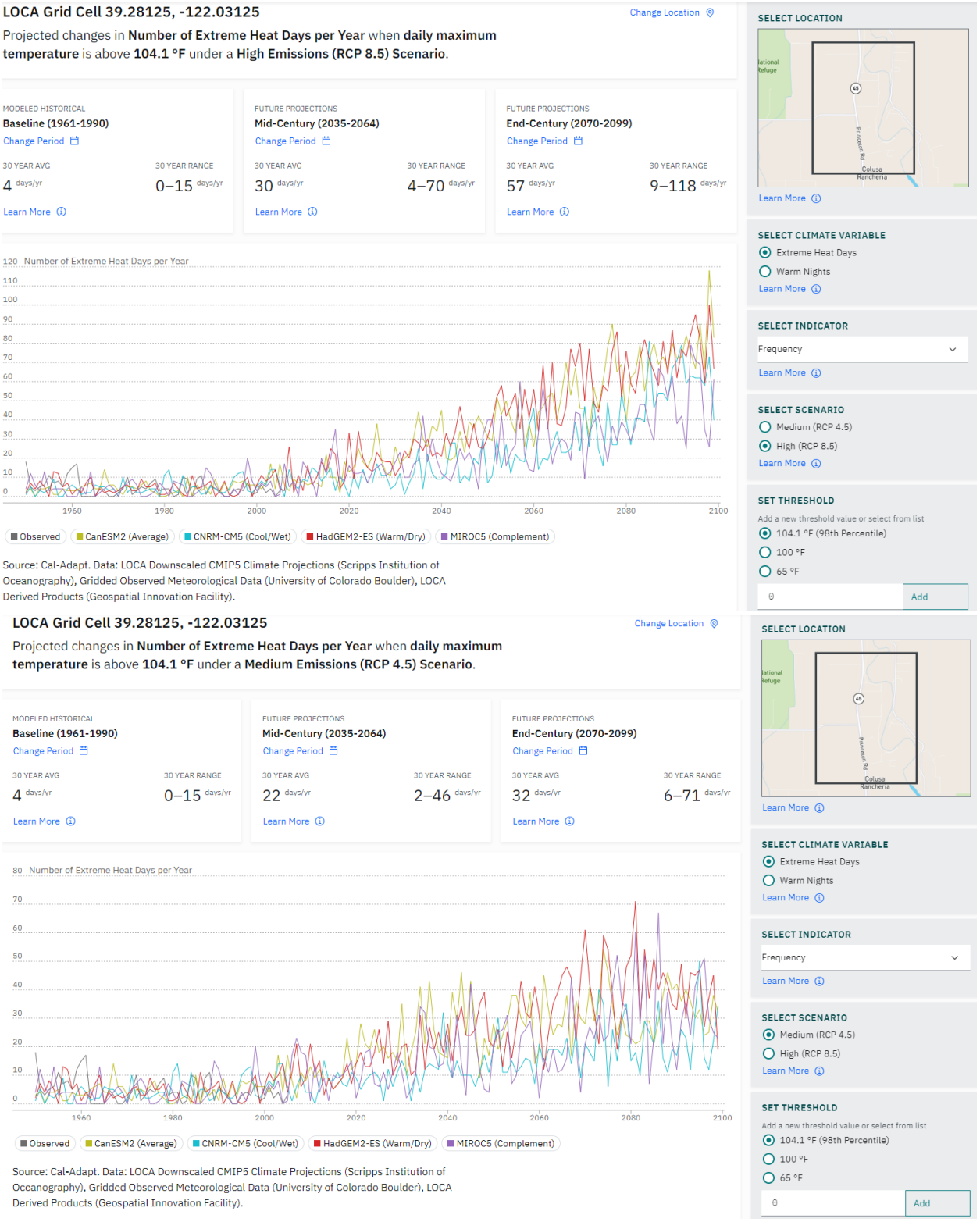
Cal-Adapt

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 Colusa County Planning are shown in Figure 4-33. 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 Colusa 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 Colusa County under the RCP 4.5 scenario in which emissions peak around 2040, then decline.

Figure 4-33 Colusa County – Future Temperature Estimates in Low and High Emission Scenarios



Source: Cal-Adapt – Number of Extreme Heat Days by Year. Retrieved 3/5/2024.

Vulnerability Assessment

Vulnerability—Medium

Extreme heat is becoming more frequent, intense, longer lasting and geographically widespread. Extreme heat occurs on an annual basis in the Colusa County Planning Area. In recent years, compounded by climate change conditions, summer months continue to get a bit hotter.

The whole of the Planning Area has some measure of vulnerability to extreme heat. An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The HMPC noted that extreme heat can cause crop damages. These can be substantial if extreme heat occurs during periods of plant susceptibility to heat. Extreme heat contributes to PSPS and wildfire issues in the County. Heat domes have settled over the County in the past, which have caused the County to open cooling centers.

Assets at Risk

Assets at risk from extreme heat include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

All populations within the Colusa County Planning Area are vulnerable to extreme heat, but it generally affects people spending large amounts of time outside or without means of cooling indoor structures. During extended periods of high temperatures, extreme heat may overload the demands for electricity to run air conditioners and can present health concerns to individuals. When interruptions in power occur during extreme heat, the risk of heat related illnesses and deaths increase. Extreme heat is a significant concern to vulnerable populations. The unhoused; individuals who exercise or train outdoors; outdoor workers; individuals that lack the resources to afford heat; and the young, old, or medically fragile individuals that are more susceptible to heat related impacts. In addition to vulnerable populations, pets and livestock are at risk to extreme heat conditions.

Structures

Extreme heat normally does not generally impact structures, but individuals working in structures may be affected during periods of extended heat, especially in structures that might not be equipped with air conditioning or other means of cooling. In the Colusa County Planning Area, extreme heat has caused interruptions to power in the past. Also depending on the structure, sensitive contents such as IT equipment can be impacted, especially if a power outage occurs.

Critical Facilities and Infrastructure

Depending on their type and function, critical facilities and infrastructure can also be affected by extreme heat. Interruptions in power caused by extreme heat can lead to system failures. Schools without air conditioning may have to close or operate on a reduced schedule.

Community Lifelines

Community lifelines are likely to be affected to some degree by extreme heat events. Impacts to these lifelines include:

- **Safety and Security** – Police and fire personnel may see additional demand during periods of extreme heat. This may also cause emergency responders to be exposed to the effects of higher heat.
- **Food, Hydration, Shelter** – Water distribution may need to occur during extreme heat events. Cooling centers and other public shelters will need to be open and staffed.
- **Health and Medical** – Heat stroke and exhaustion may occur with greater frequency. This can cause EMS and medical personnel to have a large influx of those needing medical attention.
- **Energy** – Power outages can occur in extreme heat situations. Power outages during extreme heat can cause air conditioning systems to go offline, causing injuries or deaths. PSPS events can also occur during times of extreme heat, causing the electric grid to temporarily go offline.
- **Communication**s – Communication infrastructure may be impacted during extreme heat events. Alert warnings and messages may need to be given to the general public. These systems can be temporarily overloaded during emergency events. They also could be affected during related power outages. Communications and IT equipment located inside these facilities may also be at risk to extreme heat.
- **Water Systems** – Water and wastewater systems can be taxed during extreme heat events.

While community lifelines can be affected by extreme heat events, they are not likely to be overwhelmed with the exception of the power grid. As discussed above, extreme heat can contribute to power interruptions and outages that can lead to additional impacts and concerns. Backup power sources should be in place to keep critical facilities and community lifelines online and functioning.

Natural, Historic, and Cultural Resources

Park areas and natural resource assets in the Colusa County Planning Area may be vulnerable during periods of extreme heat. These include turfed areas; landscapes, trees, wildlife and habitat areas, and wetlands and marsh lands. Recently, trees were lost in areas of Colusa County that were weakened by drought and extreme heat. Extreme heat may also cause drought-like conditions, contributing to other issues. For example, several weeks of extreme heat increases evapotranspiration and reduces moisture content in

vegetation, leading to higher wildfire vulnerability in the region for that time period, even if the rest of the season is relatively moist. Historic and cultural resources are not expected to be affected by extreme heat.

Economic Assets and Community Activities of Value

Most economic assets within the Colusa County Planning Area are not vulnerable to extreme heat events. One of the larger economic drivers in Colusa County is the agricultural sector. During periods of extreme temperatures, crops may be damaged. This is discussed in more detail in Section 4.3.6. During periods of extreme heat, the economy may slow as people stay home or inside. Commercial business revenue, including taxable shopping revenue may be lost during periods of extreme heat. Additionally, extreme heat causes power costs borne by individuals and businesses in the Planning Area to increase, which reduces the amount of money available to circulate inside the local economy. Community activities of value may see a reduction in attendance, impacting revenues associated with these events, especially those that occur outdoors. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Impacts from Severe Weather: Extreme Heat

The County experiences temperatures in excess of 100°F during the summer and fall months. The temperature moves to 105-115°F in rather extreme situations. During these times, drought conditions may worsen and the Planning Area may see an increase in dry fuels contributing to wildfires. Also, power outage and PSPS events may occur during these times as well. Health issues are the primary concern with this hazard with vulnerable populations at greater risk, although economic impacts can also be an issue. Air quality can also be an issue during extreme heat.

Extreme heat may also cause drought-like conditions. For example, several weeks of extreme heat increases evapotranspiration and reduces moisture content in vegetation, leading to higher wildfire vulnerability for that time period even if the rest of the season is relatively moist. Drought is discussed further in Section 4.3.9 and wildfire in Section 4.3.17. Extreme heat can also contribute to initiation of PSPS events.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future extreme heat conditions and associated impacts and vulnerability of the County.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population is expected to decrease for Colusa County; however, the vulnerability to this hazard may increase as the senior citizen population continues to reside in and age within the communities of the County. Along with this, low income and the unhoused

population are at risk to extreme heat which can put strain on emergency services and shelters. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.

- Land use planning should be proactive to address future hazard conditions. County building codes are in effect to reduce this risk and should be updated as necessary to continue to address future extreme heat conditions. Due to adherence to protective building codes, changes in land use and development will likely not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development in the County will take extreme heat into account. Backup generators are currently in use at many County facilities, and additional generators and backup power sources are being sought for other locations. One way to reduce the negative impacts of an extreme heat event is to develop a comprehensive heat response plan that combines individual strategies into an integrated approach. Components of such a plan might include forecasting and monitoring, education and awareness, and heat wave preparedness and response.

In addition to a comprehensive heat response plan, local officials can help areas adapt to extreme heat in the short-term by improving the resilience of infrastructure. Transportation planners can protect or modify roads, bridges, and other structures—for example, by using materials that are more resilient and heat tolerant—to help these systems withstand higher temperatures and reduce service disruptions. They can also implement energy efficiency and conservation efforts to reduce stress on electricity systems during heat waves and help avoid power outages.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements such as building codes are followed, and varying needs for different demographic groups that reside within the County are considered can help make for a more disaster resilient community.

4.3.4. Severe Weather: Heavy Rains and Storm

Hazard Profile

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

Hazard/Problem Description

Storms in the Colusa County Planning Area occur throughout the Planning Area and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. 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 Colusa County area falls mainly in the fall, winter, and spring months.

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. With the increased growth of the area, the lack of adequate drainage systems 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.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the County. All portions of the County are at risk to heavy rains. Most of these rains occur during the winter months, as discussed below.

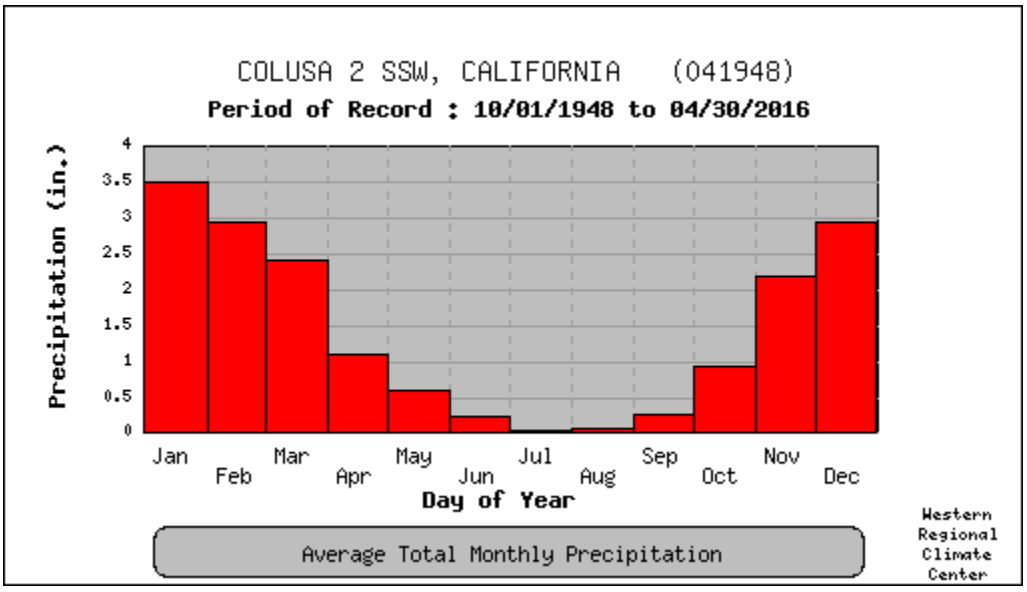
There is no scale by which heavy rains are measured – usually it is measured in terms of rainfall amounts. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms in California is often short, ranging from minutes to hours. This can cause localized flooding, which is discussed in more detail in Section 4.3.12.

The Western Regional Climate Center (WRCC) and National Weather Service (NWS) maintain data on weather normal and extremes in the western United States. Each of these data sources maintain data in slightly different ways. Data from the WRCC stopped being collected in April of 2016. NWS covers the entire time period to present. Therefore, both data sets are shown below. WRCC and NWS data for the County is summarized below.

Colusa County—WRCC Colusa 2 SSW Weather Station, Period of Record 1948 to 2016

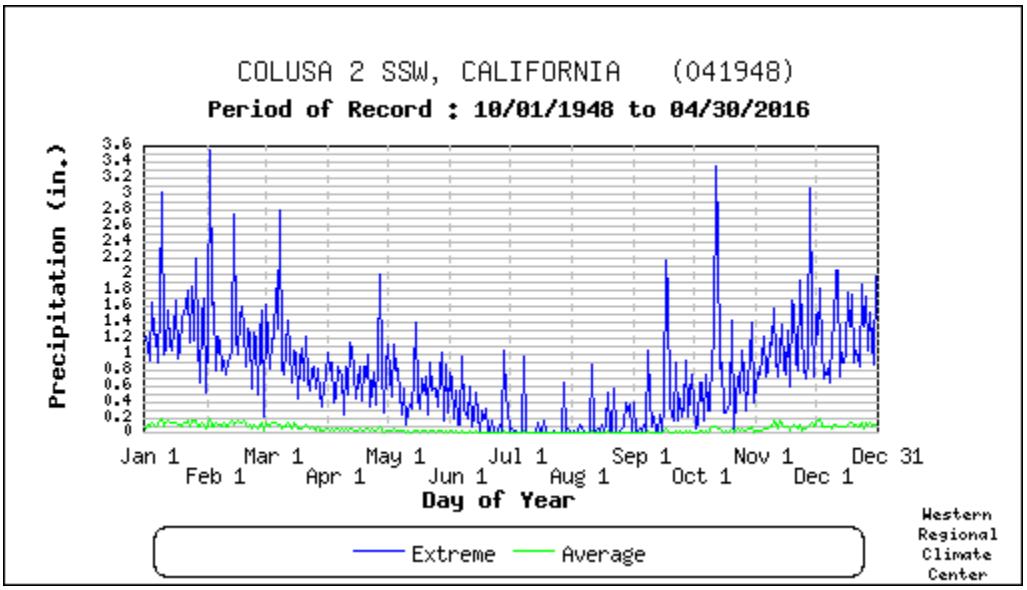
According to the WRCC, average annual precipitation in Colusa County is 16.22 inches per year. The highest recorded annual precipitation is 35.68 inches in 1983; the highest recorded precipitation for a 24-hour period is 3.56 inches on February 2, 1998. The lowest recorded annual precipitation was 4.20 inches in 1976. Average monthly precipitation for Colusa County is shown in Figure 4-34. Daily average and extreme precipitations are shown in Figure 4-35.

Figure 4-34 Colusa County—Colusa Monthly Average Total Precipitation 1948 to 2016



Source: Western Regional Climate Center. Retrieved 3/19/2024

Figure 4-35 Colusa County—Colusa Daily Average and Extreme Precipitation 1948 to 2016

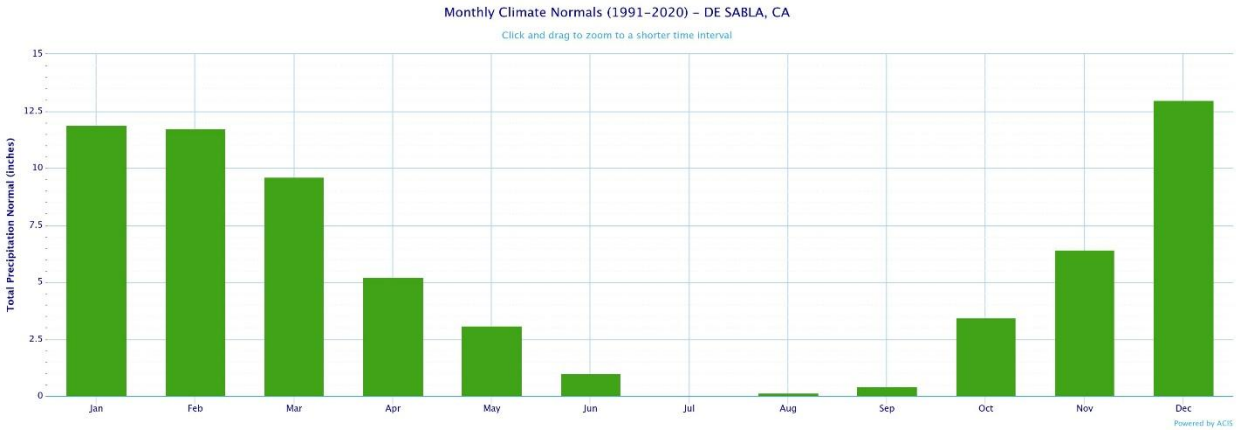


Source: Western Regional Climate Center. Retrieved 3/19/2024.

Colusa County—NWS Colusa 2 SSW Weather Station, Period of Record 1948 to 2024

According to the NWS, average annual precipitation in Colusa County is 16.2 inches per year. Average monthly precipitation for Colusa County is shown in Figure 4-36. One day extreme precipitations are shown on Table 4-31.

Figure 4-36 Colusa County— Colusa Monthly Average Total Precipitation 1991 to 2020



Source: National Weather Service XMAC site. Retrieved 3/18/2024.

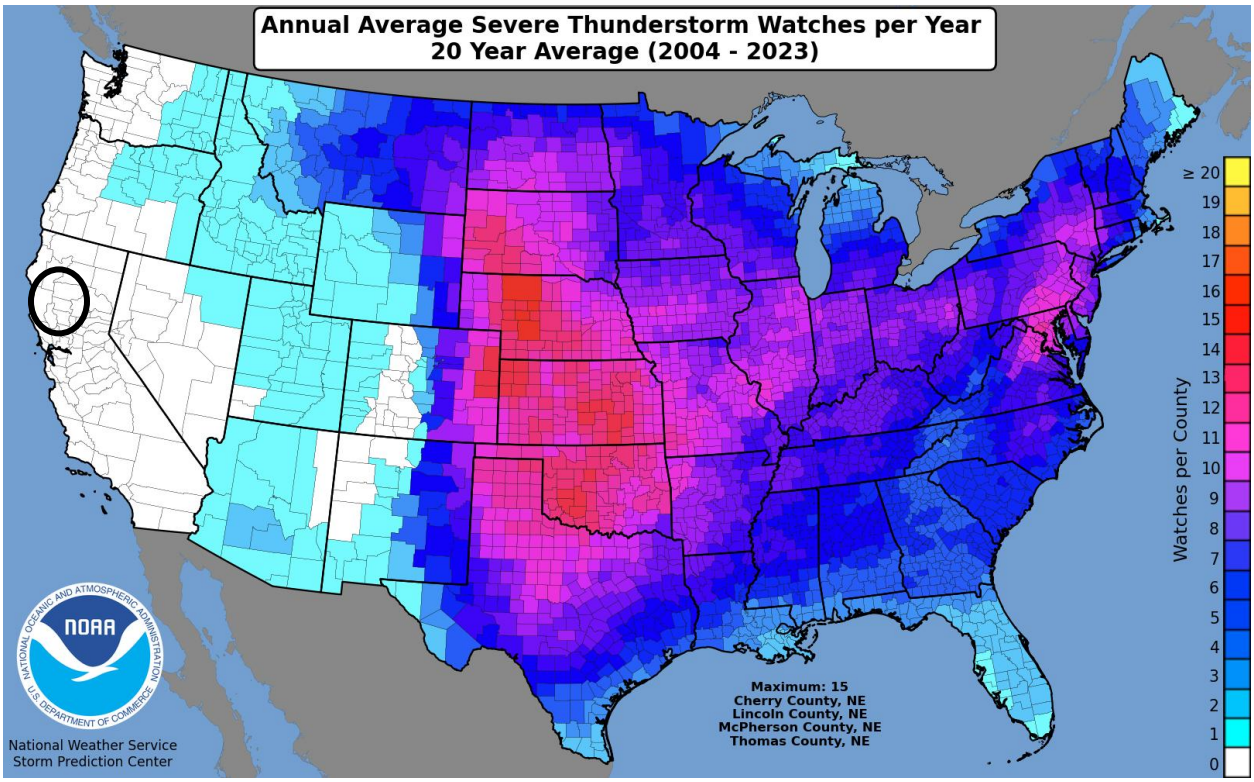
Table 4-31 Colusa County – Colusa 24 Hour Rainfall Extremes from 1948 to 2024

One Day Rainfall Totals	Date
3.56	2/2/1998
3.35	10/2/1962
3.07	11/28/1970
3.03	1/9/1995
2.80	3/8/1995
2.74	2/14/1986
2.50	2/18/2017
2.45	10/13/1962
2.31	2/14/2019
2.20	1/26/2008

Source: National Weather Service XMAC site. Retrieved 3/18/2024.

The NOAA Storm Prediction Center tracks thunderstorm watches on a county basis. Figure 4-37 shows thunderstorm watches in Colusa County and the United States for a 20-year period between 2004 and 2023.

Figure 4-37 Colusa County – Average Thunderstorm Watches per Year (2004 to 2023)



Source: NOAA Storm Prediction Center. Retrieved 3/5/2024.

Hail

Hail can occur throughout the Planning Area during storm events, though it is rare in the County. 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 Colusa 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 4-32 indicates the hailstone measurements utilized by the National Weather Service.

Table 4-32 Hailstone Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter

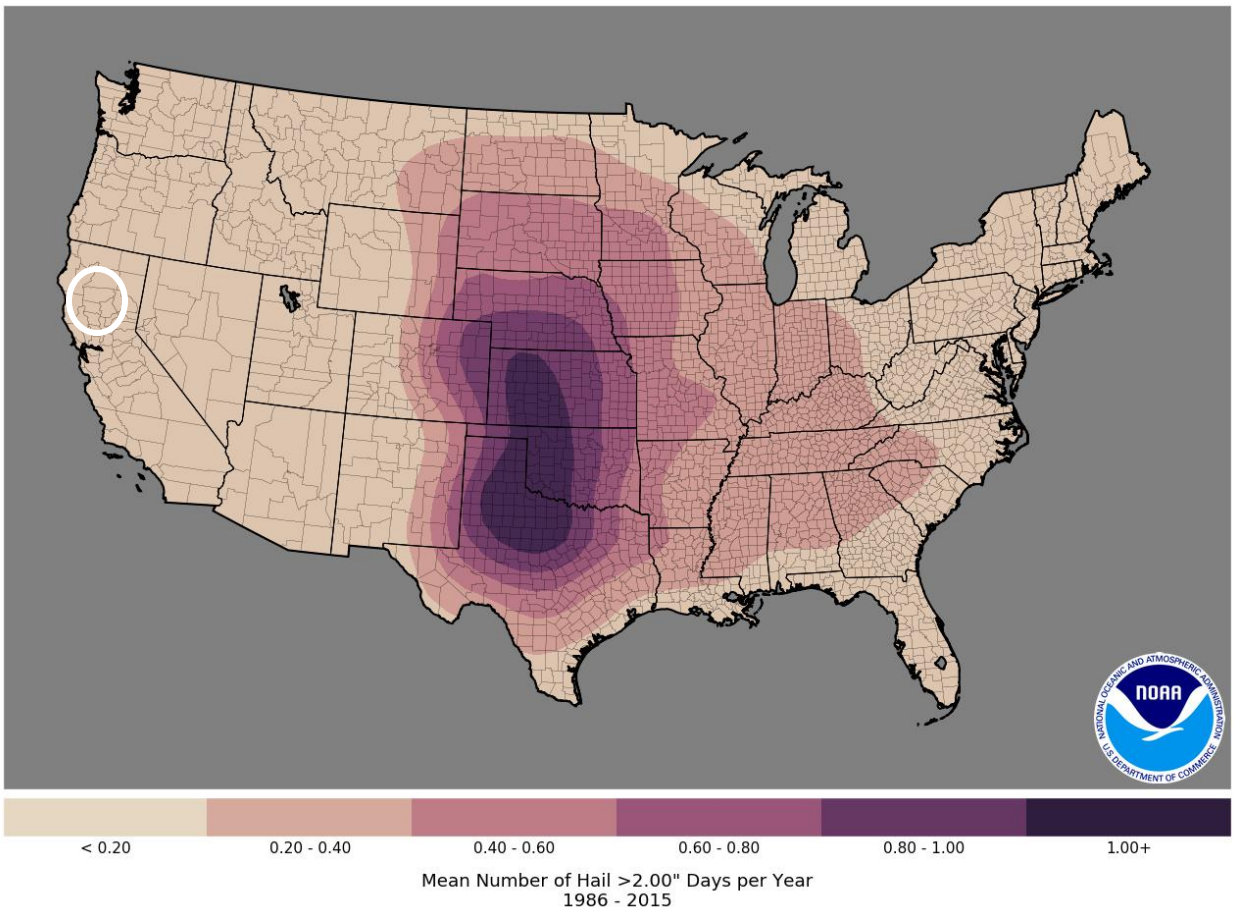
Average Diameter	Corresponding Household Object
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

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. Hail tends to be rare in California. 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 4-38 shows the average days each year where hail of greater than 1" in diameter occurred during a 20-year period from 1986 to 2015 (the most recent data available).

Figure 4-38 Colusa County – Average Hail Days per Year (1986 to 2015)



Source: National Weather Service

Lightning

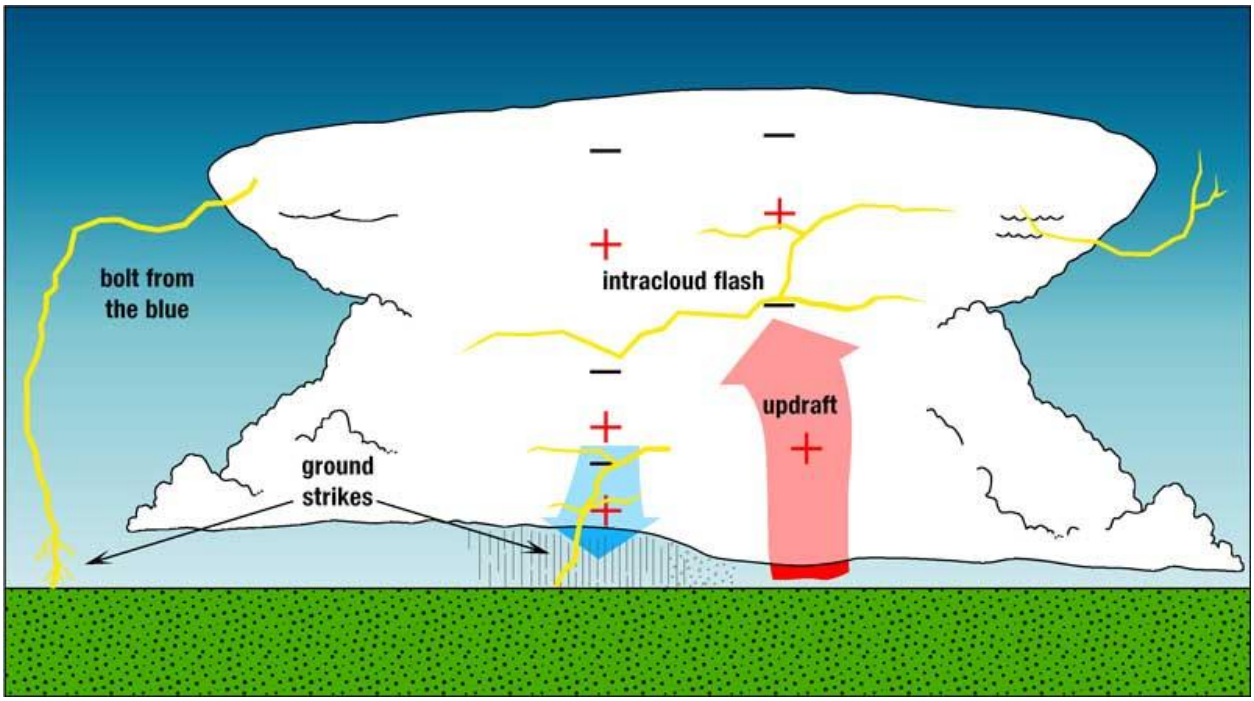
Lightning can occur throughout the County during storm events. Lightning is defined by the NWS as any and all of the various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill 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 4-39). 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 4-39 Cloud to Ground Lightning



Source: National Weather Service

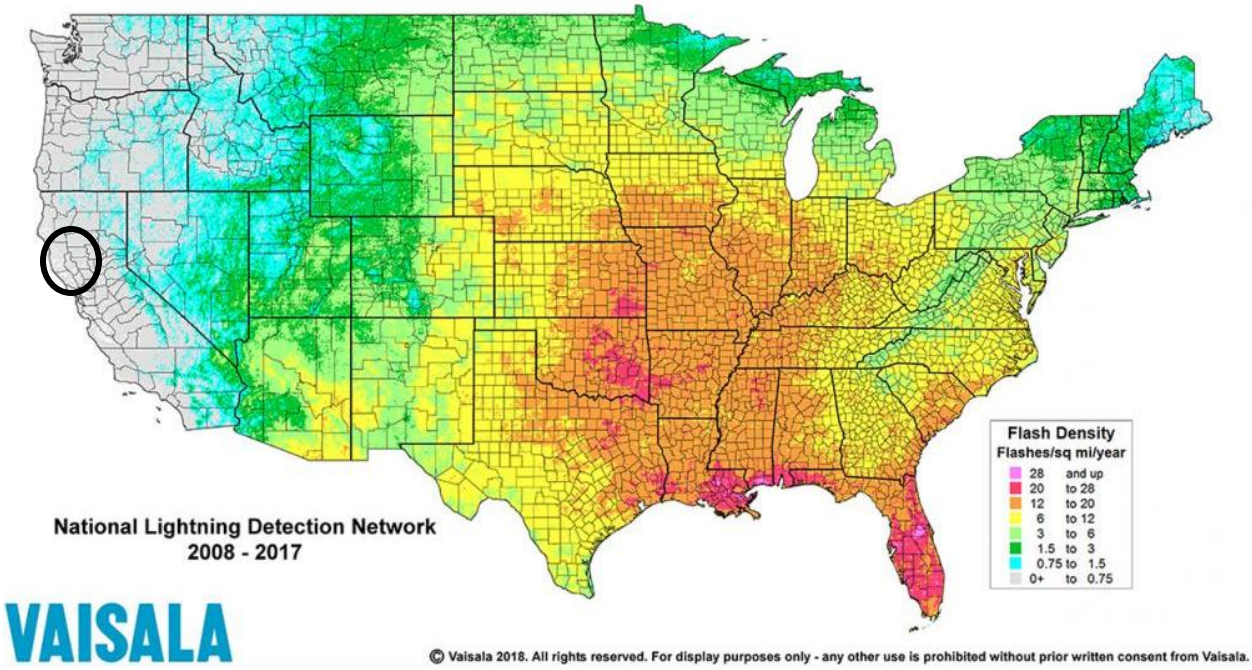
Lightning in the County is also a concern due to the number of fires that are started by lightning strikes. Wildfire is discussed in more detail in Section 4.3.17.

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.

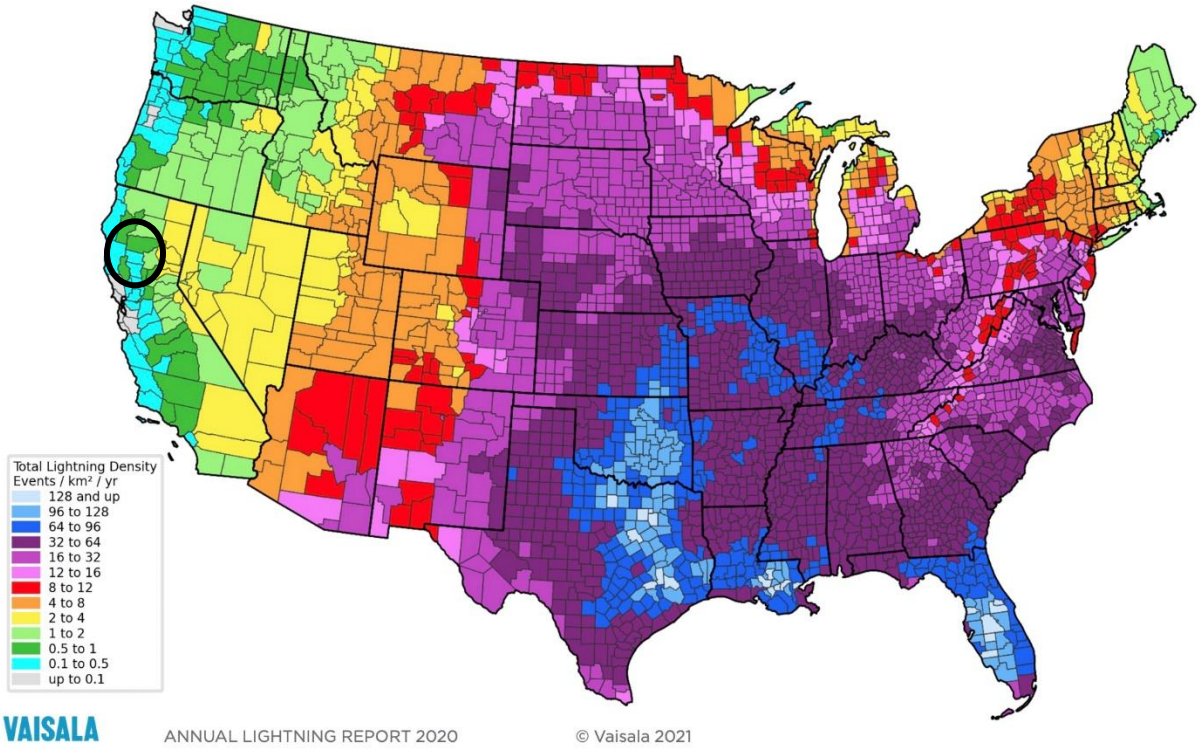
Lightning in the County can occur during thunderstorms. The speed of onset of thunderstorms that can cause lightning can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms in California is often short, ranging from minutes to hours. Thunderstorms and lightning are rare in the County. Lightning can also occur in the County outside of a thunderstorm event. Vaisala maintains the National Lightning Detection Network. It tracks cloud to ground lightning incidences in the United States. Figure 4-40 shows lightning incidences in the County and the rest of the United States from 2008 to 2017 (the most recent long term tracking map available). Figure 4-41 shows a more recent lightning density by county map.

Figure 4-40 Colusa County – Lightning Incidence Map 2008 to 2017



Source: Vaisala National Lightning Detection Network. Retrieved 3/5/2024.

Figure 4-41 Colusa County – Average US Total Lightning Density per County 2015-2019



Source: Vaisala National Lightning Detection Network. Retrieved 3/5/2024.

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 and heavy rains and storms resulted in a state or federal disaster declaration are shown in Table 4-33. More information on USDA disaster declarations from heavy rain and storms (twice in 2016) can be found in Table 4-42 in the Past Occurrences in Section 4.3.6.

Table 4-33 Colusa County – Disaster Declarations from Heavy Rain and Storms 1950-2024

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rain and storms)	17	1955, 1958, 1963 (twice), 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2017, 2019 (twice), 2023 (twice)	19	1950, 1955, 1958 (twice), 1963 (twice), 1973, 1978, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017, 2019 (twice)

Source: FEMA, Cal OES

NCDC Events

The NCDC data recorded 30 hail, heavy rain, and winter storm and weather incidents for Colusa County since 1950. Winter weather events tend to be rain in the lower elevations of the County, while relatively rare, snow can fall in the upper elevations. No incidents of lightning were found in the NCDC database for the County. A summary of these events is shown in Table 4-34

*Table 4-34 NCDC Severe Weather Events in Colusa County 1950-8/31/2023**

	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Hail	1	0	0	0	0	$0	$0
Heavy Rain	5	0	0	0	0	$0	$0
Winter Storm	21	0	0	0	0	$0	$0
Winter Weather	3	0	0	0	0	$0	$0
Total	**30**	**0**	**0**	**0**	**0**	**$ 0**	**$0**

Source: NCDC

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

Hazard Mitigation Planning Committee Events

The County maintains a list of EOC activations by hazard. EOC activations from 2008 to 2024 are shown in Table 4-35.

Table 4-35 Colusa County – EOC Activations for Heavy Rains 2008-2024

Disaster Type	EOC Activations	
	Count	Date
Flood and Storms	6	1/2008; 1/2010, 3/2011; 11/2012; 2/2017, 1/2019

Source: Colusa County OES

The HMPC also noted the following events:

- **January 17th to 21st, 2010**. Periods of heavy rain (up to 8 inches in some areas of the valley) and high winds (logged as high as 56 mph) pounded the county fairly steadily during this time period. Power outages in various locations began on 1/20/10 from about 10:00 AM, with Sutton Road in Maxwell being the last area to have power restored at 11:00 PM on the 21st. Several road closures were made in typical low lying areas. Highway 20 closed, first with one-way controlled traffic, then east and westbound lanes closed around 3:00PM on the 21st.

The County noted many of these past events are discussed in the Section 4.3.11 Flood: 1%/0.2% Annual Chance and Section 4.3.12 Flood: Localized Stormwater Flooding.

Likelihood of Future Occurrence

Highly Likely – Based on NCDC data and HMPC input, 30 heavy rain and storm incidents over a 73-year period (1950-2023) equates to a severe storm event every 2.4 years. As noted, this database likely doesn't capture all heavy rain, hail, lightning, and winter weather events. Severe weather is a well-documented seasonal occurrence that will continue to occur often in the Colusa County Planning Area.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and heavy rains and storms can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

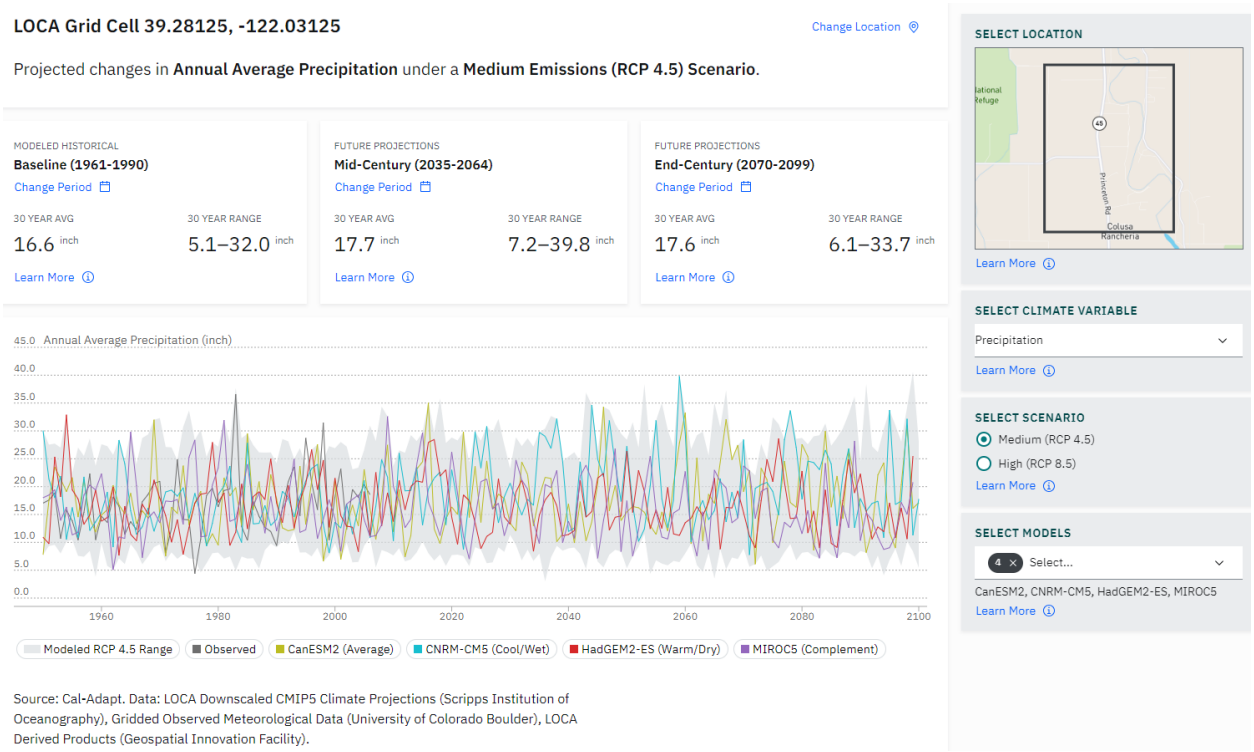
Climate Change and Heavy Rains and Storms

According to the 2021 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.

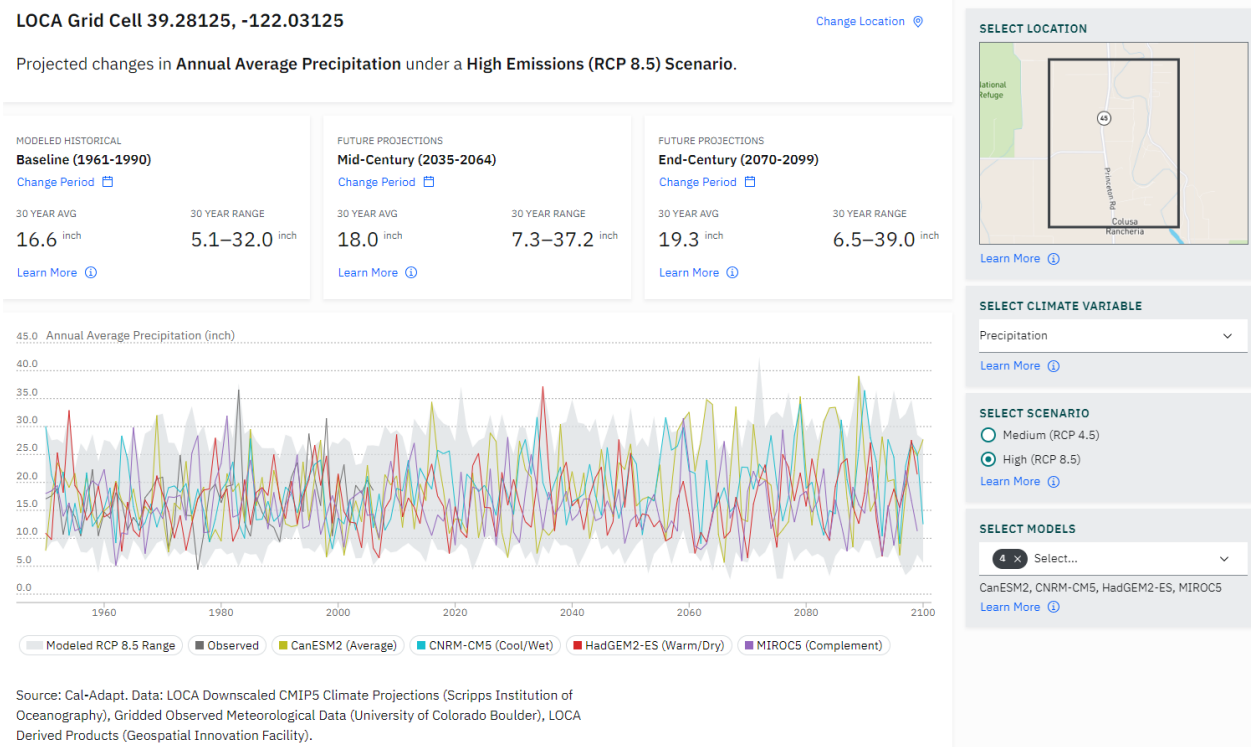
Cal-Adapt noted that, on average, the projections show little change in total annual precipitation in California. Furthermore, among several models, precipitation projections do not show a consistent trend during the next century. The Mediterranean seasonal precipitation pattern is expected to continue, 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. Future precipitation estimates for the County are shown in Figure 4-42.

- The upper chart shows annual averages of observed and projected Precipitation values for the selected area on map under the RCP 4.5 scenario. 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 8.5 scenario. 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 4-42 Colusa County– Future Precipitation Estimates: High and Low Emission Scenarios



Source: Cal-Adapt. Data: LOCA Downscaled CMIP5 Climate Projections (Scripps Institution of Oceanography), Gridded Observed Meteorological Data (University of Colorado Boulder), LOCA Derived Products (Geospatial Innovation Facility).



Source: Cal-Adapt. Data: LOCA Downscaled CMIP5 Climate Projections (Scripps Institution of Oceanography), Gridded Observed Meteorological Data (University of Colorado Boulder), LOCA Derived Products (Geospatial Innovation Facility).

Source: Cal-Adapt – Precipitation: Decadal Averages Map. Retrieved 3/5/2024.

Vulnerability Assessment

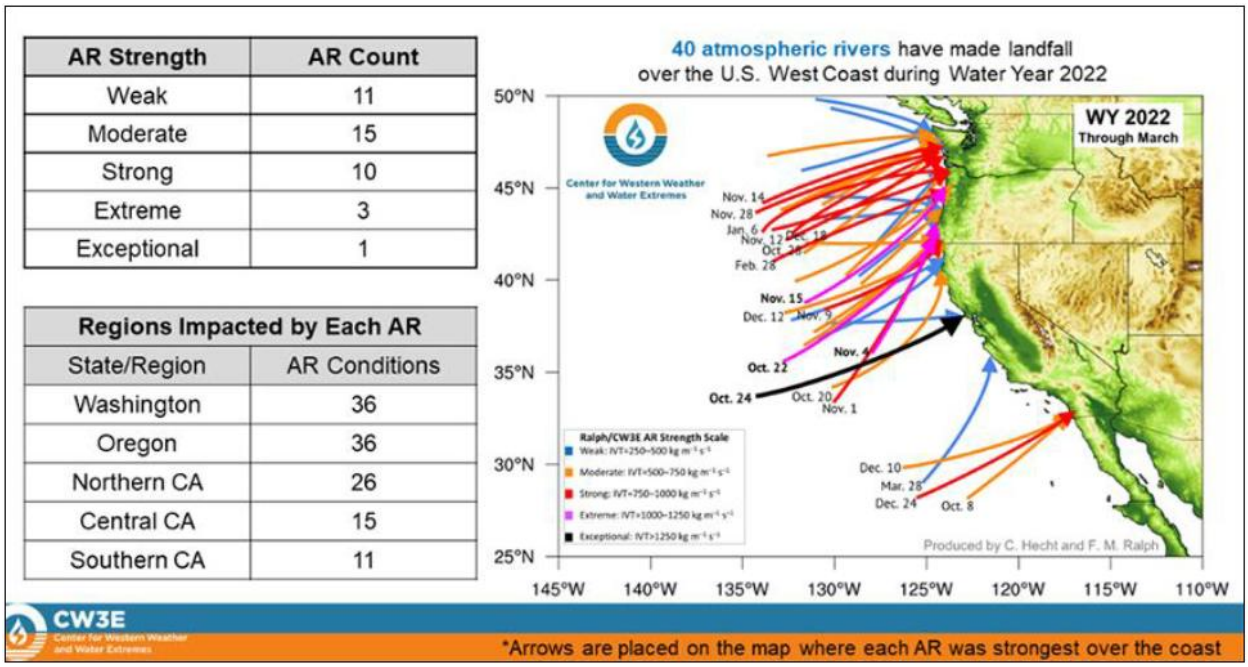
Vulnerability—Medium

According to historical hazard data, heavy rains and storms, including hail and lightning, are an annual occurrence in the Colusa County Planning Area. Heavy rains can cause both localized flooding and flooding in the floodplains. Atmospheric river storms, which have been more frequent in recent years, are of great concern as they can dump large amounts of water in single storms, or in back-to-back storms as seen above in 2022, in the winter storms of 2022/2023, as well as the winter storms of 2023/2024. Impacts can be felt by both the population of the Planning Area as well as the structures that have been built in the Planning Area. An example of this is shown in Figure 4-43. These are from the winter of 2022/2023.

Figure 4-43 2022 Atmospheric Rivers by Strength and Count

AR Strength	AR Count
Weak	11
Moderate	15
Strong	10
Extreme	3
Exceptional	1

Regions Impacted by Each AR	
State/Region	AR Conditions
Washington	36
Oregon	36
Northern CA	26
Central CA	15
Southern CA	11



Source: CW3E

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

One of the primary concerns of the County to heavy rains and storms is the resulting flooding that occurs during extreme storm events. These include large flood events as detailed in the Flood: 1%/0.2% annual chance flood hazard section and the localized flooding that occurs following these storms. Localized flood problem areas in the unincorporated County are shown in Table 4-94

The County noted that a large concern is the recent changes in the mapped FEMA floodplain. Many properties that were once outside the 1% annual chance floodplain have now been mapped into the 1% annual chance floodplain. This has caused citizens to worry about floodplain insurance. Climate instability has led to increased extreme precipitation events. Due to the prevalence of extreme precipitation events, Colusa County is looking for ways to adapt natural lands to be more resilient to flooding and waterway erosion. During heavy or long duration rain events, standing and ponding water are experienced in residential areas within the town of Princeton.

Assets at Risk

Assets at risk from heavy rain and storms include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

All populations in the Colusa County Planning Area have some measure of risk to heavy rains and storms. Those populations that work or recreate outside and unhoused individuals are more vulnerable to impacts from heavy storm events. Heavy rains and storms occur every year and do not generally cause significant adverse impacts to individuals; it is the secondary hazard, flooding, that poses the biggest impact to people. Populations at risk to flooding resulting from heavy rains and storm events include those who live in floodplains (discussed in further detail in the Flood: 1%/0.2% Annual Chance in Section 4.3.11) and those who live in and near localized flooding areas floodplains (discussed in further detail in the Flood: Localized Stormwater Flooding in Section 4.3.12).

Structures

Structures in the Colusa County Planning Area have some risk to heavy rains and storms. Structures built to modern building codes are built to withstand heavy rains and storms (including thunderstorm winds and lightning). During a heavy storm, localized flooding may cause water intrusion into buildings from the outside. Trees can be downed causing impacts to structures. Older homes and buildings may be at increased risk to heavy rains and storms. Power outages during severe storm events can occur, impacting the use of structures until the power is back online.

Critical Facilities and Infrastructure

Heavy rain and storms can affect critical facilities and infrastructure, and community lifelines during large events. Power outages may occur taking facilities offline. High winds can down power lines and trees impacting facilities. Water intrusion into facilities and infrastructure can impact operations. Local roads, streets, and bridges can be impacted resulting in closures restricting traffic flow in the Planning Area. In

certain areas, large storms can cause erosion and localized landslides which can impact affected facilities. Many critical facilities are built to modern design standards that take heavy rains and storms into account when siting and building these structures, and others may need to be retrofitted to better withstand these events.

Community Lifelines

Community lifelines likely to have some vulnerability to heavy rains and storms include:

- **Safety and Security** – Search and rescue and swiftwater teams may be called on to perform riskier duties during times of heavy rains and flooding. Police, Fire, EMS, and Public Works personnel are often called on to respond during flood emergencies taxing these resources.
- **Food, Hydration and Shelter** – Those displaced by heavy rains and flooding and the unsheltered may have needs for food and water.
- **Health and Medical** – Injuries can occur during storm events. Patient movement from accident scenes by EMS may have to be rerouted around inundated and closed streets. Public health can be at risk from contaminated floodwaters caused by heavy rains.
- **Energy** –Significant storms can cause power outages throughout the Planning Area. Downed trees can fall on electric lines in the Planning Area, causing power outages. High winds and other lightning strikes can cause transformers and other infrastructure to be damaged. Fuel supplies can be temporarily cut off, until flooding subsides.
- **Communications** – Communication systems may be damaged during severe storm events. An influx of service calls to dispatch centers for reporting of flooding, power outages, downed trees, or other issues can occur. Messaging systems need to be deployed during these times to let the public know about road and closures, washouts, and debris or flooding on roads.
- **Transportation** – Highways, local roads, and bridges may be impacted by heavy rains and flooding causing road closures. These closures can affect response personnel (EMS, Fire, Police) as well as cause additional traffic issues for residents.
- **Hazardous Material** – Hazardous material facilities can be affected by heavy rains and flooding. Releases during these times can contaminate the environment, affecting drinking water and natural systems.
- **Water Systems** – Water, drainage, and wastewater systems can experience storm related impacts, including excessive water intrusion which can affect the operations of these systems.

Short-term, heavy rains and storms can cause both widespread flooding as well as extensive localized drainage issues throughout the Colusa County Planning Area. As storms continue to increase in intensity, existing drainage and stormwater systems may be overwhelmed at least temporarily contributing to an increase in flooding related impacts. While components of these lifelines may be damaged or otherwise impacted, it is unlikely that large storm events would overwhelm and take out any of these lifelines in the Colusa County Planning Area as a whole.

Natural, Historic, and Cultural Resources

Large storm events and associated flooding can affect natural, historic, and cultural resources. Silt and sediment can damage natural areas. Trees can be uprooted and downed by high winds. Extended periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. While some natural systems can be adversely impacted during these large storms, heavy rain events can also

provide benefits. Groundwater and wetland areas can be recharged and water supplies replenished. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to structures affected by large storm events, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged, and lost during extreme storm and flood events.

Economic Assets and Community Activities of Value

Heavy rain and storm events can cause direct damage to economic assets such as businesses and commercial centers. One of the larger economic drivers in Colusa County is the agricultural sector. During periods of heavy rains and storms, crops may be damaged by both hail and heavy rains. This is discussed in more detail in Section 4.3.6. During extreme events, the economy may slow as people stay home or inside. Business revenue may be reduced during extended storm events. Community activities of value may see a reduction in attendance, impacting revenues associated with these events, especially those that occur outdoors. Events may be cancelled or rescheduled. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Impacts from Heavy Rains and Storms

Impacts from heavy rains and storms include damage to property, critical facilities and infrastructure, and the natural landscape. This includes: erosion, downed trees, damaged utility structures and infrastructure; power outages; road damage and blockages; and lightning strikes to critical infrastructure and people. Lightning can also cause wildfires and urban fires to occur. Landslides occur when the soil on slopes becomes oversaturated and fails. Climate change may cause these impacts to worsen.

Actual damage associated with the primary effects of severe storms and heavy rains has been somewhat limited. It is the secondary hazards caused by these severe weather events, such as floods, landslides, and erosion that have had the greatest impact on the Planning Area. The risk and vulnerability associated with these secondary hazards are discussed in other sections of this Plan (Section 4.3.11 Flood: 100/500-year, Section 4.3.12 Flood: Localized Stormwater – specifically in the localized flood areas shown on Table 4-94, Section 4.3.8 Dam Failure, Section 4.3.13 Landslide, and Section 4.3.14 Levee Failure).

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future heavy rain and storm conditions and associated impacts and vulnerability of the County to flooding.
- Future population growth should be considered as having more or less people in a community affects the overall hazard vulnerability to the County. Population is expected to decrease for Colusa County;

however, the vulnerability may change depending on changes to the makeup of more vulnerable populations. Certain vulnerable populations, such as the unhoused, could experience disproportional effects from this hazard. and should be addressed as the County continues to grow. Thus, changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.

- Land use planning should be proactive to address future hazard conditions. Changes in land use may also amplify the impacts of heavy rains and storms, as additional impervious surfaces can cause additional runoff and localized flooding throughout the County. Building codes in the County ensure that new development is built to current building standards, which should reduce the risk to future development in the County from heavy rains and storms. New critical facilities such as communications towers and others should be built to withstand hail damage, lightning, and thunderstorm winds. With adherence to development standards, changes in land use and development will not likely increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help make for a more resilient community.

4.3.5. Severe Weather: High Winds and Tornadoes

Hazard Profile

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

Hazard/Problem Description

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 snow storms. The winds may also exacerbate fire conditions by drying out the ground cover, propelling fuel 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.

Location and Extent

The entire 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 4-44 shows the Beaufort wind scale.

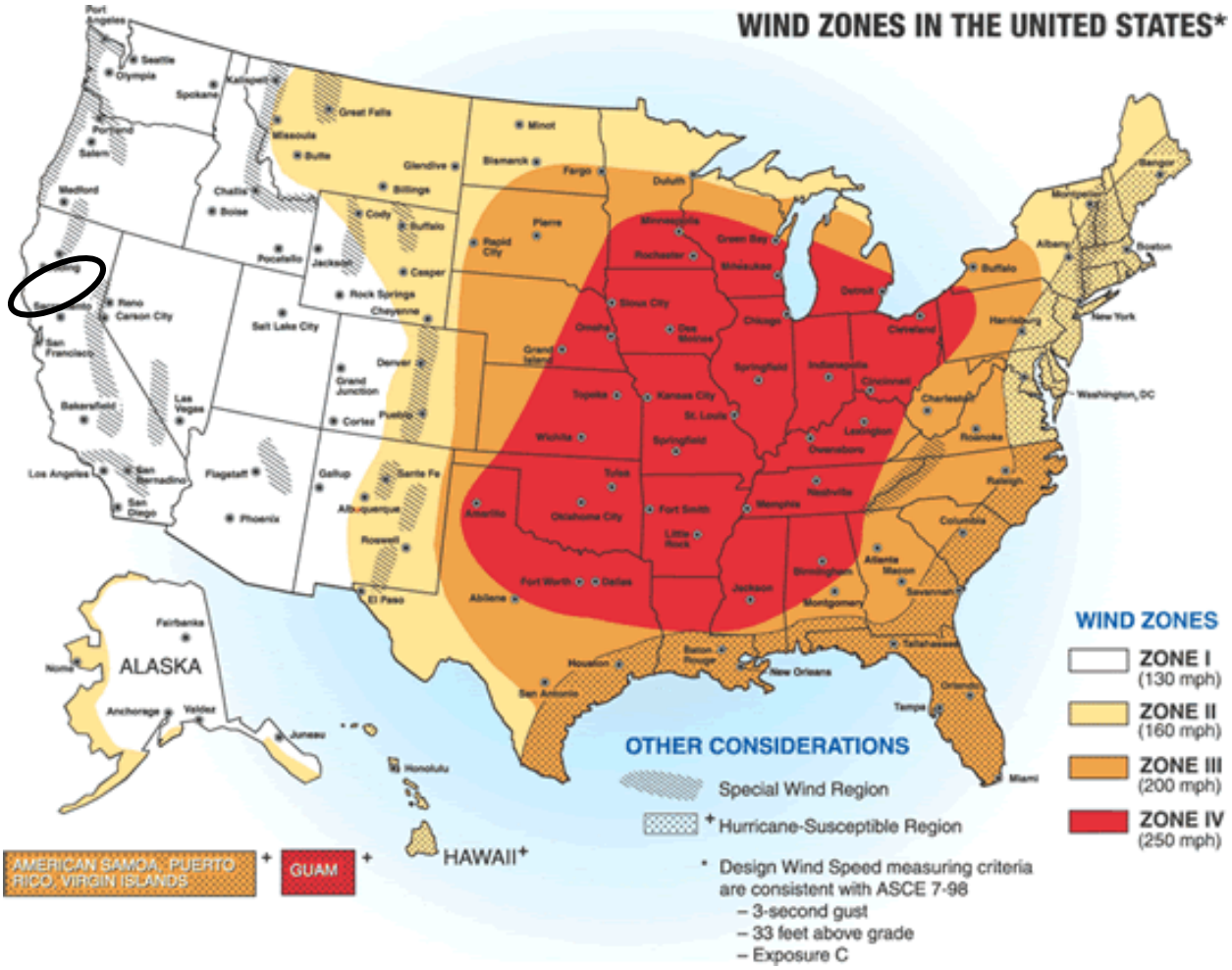
Figure 4-44 Beaufort Wind Scale

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 4-45 depicts wind zones for the United States. The map denotes that Colusa County falls into Zone I, which is characterized by high winds of up to 130 mph.

Figure 4-45 Wind Zones in the United States

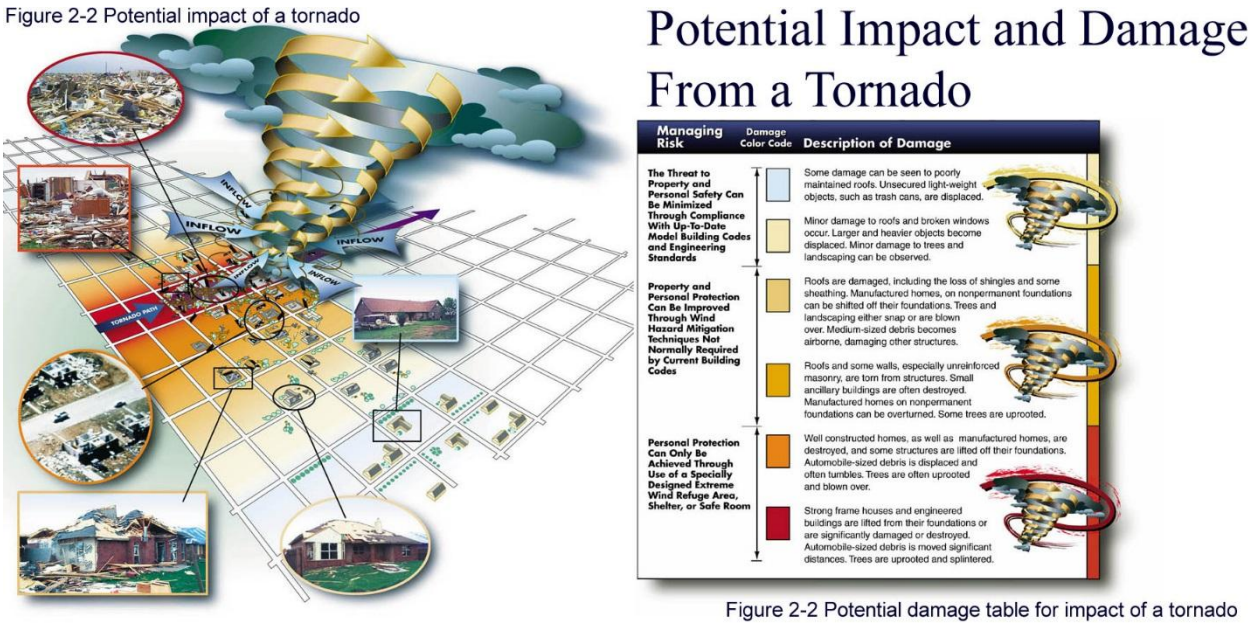


Source: FEMA

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 Colusa 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 4-46 illustrates the potential impact and damage from a tornado.

Figure 4-46 Potential Impact and Damage from a Tornado



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

Location and Extent

Tornadoes, while rare, can occur at any location in the County. All areas of the County are at risk to tornadoes.

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 4-36 shows the wind speeds associated with the original Fujita scale ratings and the damage that could result at different levels of intensity. Table 4-37 shows the wind speeds associated with the Enhanced Fujita Scale ratings.

Table 4-36 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.
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.

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
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 4-37 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 31 high wind and 4 tornado incidents for Colusa County since 1950. A summary of these events is shown in Table 4-38. It should be noted that all tornado events were EF0 intensities.

Table 4-38 NCDC High Wind and Tornado Events in Colusa County 1950-8/31/2023

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
High Wind	22	0	0	0	0	$35,000	$0
Strong Wind	7	0	0	0	0	$50,000	$0
Thunderstorm Wind	2	0	0	0	0	$0	$0

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Tornado	4	0	0	0	0	$70,000	$0
Total	**35**	**0**	**0**	**0**	**0**	**$155,000**	**$0**

Source: NCDC

Hazard Mitigation Planning Committee Events

The HMPC noted that during high wind events, the County experiences down trees, fences blown over, power outages and down powerlines. The agricultural industry is also affected by high winds. Almond trees can be extremely susceptible to high wind events. High winds are an annual occurrence, and specific events are not always tracked by the County.

The HMPC also noted the following tornado events:

- **Tuesday, March 22, 2011** – At approximately 3:23 PM a funnel cloud developed into a tornado and touched down in a field in the area of Maxwell Sites Road and McDermott Road in Maxwell, as reported by a witness to the news media. No damage was done. No emergency response was required.
- **Wednesday, March 23, 2011** – At approximately 3:00 PM a tornado reportedly touched down on Nicolaus Drive, E Street and Davis Roads in Williams with some damage, and one vehicle with damage. It was reported that approximately 3 residences sustained damage to the Spanish tile roofs, and 2 vacant mobile homes were damaged.

The HMPC noted that no other damaging tornadoes could be recalled, including tornadoes since 2018.

Likelihood of Future Occurrence

Highly Likely/Occasional – Based on NCDC data and HMPC input, 35 wind and tornado incidents over a 69-year period (1955-2023) equates to a severe wind/tornado event every 1.9 years. However, as noted, this database likely doesn't capture all wind events. High winds are a well-documented seasonal occurrence that will continue to occur annually in the Colusa County Planning Area. Tornadoes tend to be rare in the County and warrant a likelihood of future occurrence rating of occasional.

Climate change may increase the chance of future occurrence as well as future impacts. More information on climate change and high winds and tornadoes can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and High Winds

According to the 2021 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

The Colusa County Planning Area is subject to potentially destructive high 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. High winds and tornadoes can be a significant public safety and economic concern.

The whole of the Planning Area has some measure of vulnerability to high winds and tornadoes. An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The County noted that while there has been some scattered record keeping describing the impacts of windstorms, there is little information to indicate that straight-line winds are little more than a nuisance. For example, while winds can blow weeds that can create an additional expense for farmers, they often cause little long-term damage and there is little justification for allocating resources to combat them. Trees may be downed in the County. As detailed in the wildfire discussion, one of the most significant concerns in the County is the effect of high winds in fueling wildfires. Even before a wildfire starts, high winds can cause PG&E to put PSPS events into effect.

Assets at Risk

Assets at risk from winds and tornadoes include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

All populations are at some vulnerability to high winds and tornadoes. Certain vulnerable populations are at the greatest risk to the effects of high winds and tornadoes. These include:

- The unsheltered.
- Citizens who reside in mobile homes.
- Citizens in buildings with no tornado shelter or below ground floors.
- Those working or caught outdoors during a wind or tornado event.

Structures

All structures in the Colusa County Planning Area have some measure of risk from high wind and tornadoes. Though most structures are built to withstand winds, high wind speeds can still cause damages in the Planning Area. Though rare, a tornado could cause damage to virtually all facilities in the tornado touchdown path. This would affect homes, businesses, commercial property, as well as government and critical facilities. During a wind or tornado event, power lines in the Planning Area can be damaged by falling trees caused by wind. A tornado could also damage power lines. High winds are a cause for PSPS events to be declared, causing power outages to occur. High winds and tornadoes could cause sparks from electric wires and other sources, which could lead to wildfire ignition. Once ignited, high winds can also cause wildfires to rapidly spread and become out of control. High wind conditions can cause wildfires to move into more urban areas destroying structures and whole subdivisions, as seen in recent wildfire events in the West.

Critical Facilities and Infrastructure

Though most critical facilities are built to withstand winds, high wind speeds can still cause damage in the Colusa County Planning Area. Though rare, a tornado could cause damage to virtually all facilities in the tornado touchdown path. Winds can cause PSPS events and lead to out of control wildfires, which can damage critical facilities and impact their abilities to perform their critical roles in the community.

Community Lifelines

Community lifelines likely to have some vulnerability from wind and tornado include:

- **Safety and Security** – Winds and tornadoes can increase fire spread and also lead to down trees and blocked roads, which causes issues for firefighters, police, dispatch, and EMS in the Planning Area.
- **Food, Hydration, Shelter** – Significant damage caused by tornadoes can increase the need for those who need shelter. This is true for the unsheltered populations as well as for those whose homes may be damaged or rendered unusable.
- **Health and Medical** – Winds and tornadoes can cause injuries or deaths to residents. Trees may be downed during these times, causing EMS to need to reroute ambulance or emergency services around areas where roads may be closed while tree materials are removed.
- **Energy** – Downed trees and other wind impacts may cause power grid issues. If a tornado were to strike a power station or large transmission lines, power outages may occur in the Planning Area.
- **Communications** – 911, dispatch, and emergency responder communications see marked increase during times of high winds and tornadoes.
- **Transportation** – Transportation routes may be blocked by downed trees, downed power wires, or downed poles and signs.
- **Hazardous Materials** – Hazardous materials facilities may be compromised during periods of high winds and tornadoes. Trucks carrying hazardous materials may be overturned on roads in the Planning Area during high wind and tornado events.
- **Water Systems** – Above ground water infrastructure may be damaged by high winds and tornadoes.

Backup power sources to these critical facilities that comprise the community lifelines should be in place to reduce possible impacts from these lifelines going offline. During periods of high wind and tornadoes, the electric system could be overwhelmed, causing brownouts and power outages to occur. Power outages

and PSPS events can also occur during times of high winds, causing the electric grid to temporarily go offline. It is unlikely that whole community lifelines would be overwhelmed by this hazard.

Natural, Historic, and Cultural Resources

Natural resources, such as trees, are vulnerable to winds. Increased levee and streambank erosion can occur during periods of high water and high winds. High wave action during significant wind events can cause levee erosion and impact marsh lands and habitat areas. Soil erosion can also occur during high winds. Most all natural, historic, or cultural resources are at risk to tornadoes. Tornadoes can tear apart habitats, causing fragmentation across ecosystems and can damage and destroy historic structures and cultural resources.

Economic Assets and Community Activities of Value

One of the larger economic drivers in Colusa County is the agricultural sector. During periods of high winds or tornadoes, crops may be damaged. This is discussed in more detail in Section 4.3.6. During periods of high winds and tornadoes, the economy may slow temporarily as people stay home or inside. High winds and tornadoes can damage economic assets in the Planning Area. Should high winds or tornadoes damage businesses and commercial centers, long term economic issues may occur.

All community activities of value have some measure of vulnerability to high wind and tornado. High winds and tornadoes can cause life safety issues. Activities may be cancelled, postponed, or rescheduled due to high wind and tornado events. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Impacts from Severe Weather: High Wind and Tornado

Wind and 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. Local industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying necessary emergency response. Winds can push automobiles off roads, damage roofs and structures, cause power outages, and cause secondary damage due to flying debris and hazardous trees. High winds can also contribute to the spread and intensity of wildfires.

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.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future wind conditions and associated impacts and vulnerability of the County. Climate change is not likely to affect future tornado conditions.
- Future population growth should be considered as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. Vulnerable populations could experience disproportional effects from this hazard and should be planned for as development of the County continues. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. Building codes in the County ensure that new development is built to current building standards to withstand high winds, which should reduce the risk to future development in the County from high winds and tornadoes. With adherence to development standards, future losses to new development should be minimal. Changes in land use and increased development may amplify the impacts of high winds and tornadoes, as additional structures in the County increase the number of buildings at risk to high winds and tornadoes.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help make for a more resilient community.

4.3.6. Agricultural Hazards: Severe Weather/Invasive Species (Pests and Weeds)

Hazard Profile

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

Hazard/Problem Description

Farming and related agricultural industries are not only the backbone of Colusa County's economy, they also play a central role in the way of life of County residents and help define the character of the County. Agriculture has always been an integral part of Colusa County and has continually grown and changed along with the County. Today, the soils and climate of Colusa County make it an ideal area to sustain many agricultural endeavors. Agriculture in Colusa County is a mosaic of farmland intermingled with other uses in the rural setting which typifies the County. This land provides marketable products, open space, wildlife habitat, watershed and an aesthetic environment. According to the California Department of Conservation's Farmland Mapping and Monitoring Program (FMPP), in 2020 the County has 197,122 acres of prime farmland, 2,762 acres of farmland of statewide importance, 115,022 acres of unique farmland, 227,939

acres of farmland of local importance, and 15,965 acres of grazing land. These numbers have been reduced since 1998 due in part to increased development in the County. (see Table 4-39).

Table 4-39 Colusa County Farmland Inventory, 1998, 2020

Soil Category	1998 Acres	2020 Acres	1998-2020 NET ACREAGE CHANGED
Prime Farmland	201,910	197,122	-4,788
Farmland of Statewide Importance	1,746	2,762	1,016
Unique Farmland	125,083	115,022	-10,061
Farmland of Local Importance	239,966	227,939	-12,027
Grazing Land	7,684	15,965	8,281
Urban and Built-Up Land	4,293	5,537	1,244
Other Land	157,872	172,668	14,796
Water area	1,838	3,366	1,528
Total Area Inventoried	**740,392**	**740,381**	**-11**

Source: State of California Department of Conservation Farmland Mapping and Monitoring Program, www.conservation.ca.gov/

According to the 2023 Colusa County Crop Report, many commodities are grown in Colusa County. This includes vegetable crops; nursery and flower products; timber products; fruit and nut crops; livestock and poultry; apiary, eggs, and wool products; and pasture and rangeland. The top three commodities for the County in 2022 were almonds, rice, and walnuts.

According to the 2023 Crop Report, the gross value of Colusa County's agricultural production in 2022 was $433,189,000. This is a decrease of 47.7% in comparison to the estimated value in 2021. Colusa County's agriculture industry faced devastatingly low crop production for multiple commodities in 2022. Crop production hit unprecedented lows. The drought conditions throughout California led to some of the lowest water allocations ever seen in Colusa County. The allotments of water were so low that many growers were forced to fallow fields while others pulled orchards. The crop values presented in this report are a reflection of a year that will always be remembered as a year of tribulations.

The 2023 Crop Report also noted that the County was hit with disastrous drought, freeze and heat, all three of Colusa's historical top crops felt the brunt of these weather conditions. The water allocations took rice down by 80%, the freeze reduced harvested almonds by 62% while the late season heat affected walnut quality dropping their value by 49%.

A summation of crop production values, sourced from the Colusa County Agricultural Commissioner's Annual Crop Reports, from 2018-2022 for Colusa County is shown in Table 4-40.

Table 4-40 Colusa County – Value of Agricultural Production 2018-2022

Crop	2019	2020	2021	2022
Apiary	32,035,000	20,101,000	$27,262,000	$26,099,000

Crop	2019	2020	2021	2022
Fruit and Vegetable	$69,276,000	$74,078,000	$76,925,000	$94,004,000
Fruit & Nut	$435,388,000	$423,511,000	$335,605,000	$160,198,000
Field Crops	$312,217,000	313,511,000	$301,116,000	$83,665,000
Livestock Productions	$20,445,000	$23,595,000	$25,572,000	$24,486,000
Livestock & Poultry Products	$50,000	$50,000	$0	$0
Timber	$0	$0	$0	$0
Certified Seed Crops	$28,560,000	$31,223,000	$29,935,000	$16,920,000
Non-certified Seed Crops	$27,502,000	$23,743,000	$22,713,000	$20,087,000
Organic Crops	$7,490,000	$7,000,000	$8,800,0000	$7,730,000
Total	**$932,963,000**	**$920,110,930**	**$827,928,00**	**$433,189,00**

Source: Colusa County Agricultural Commissioner

According to the HMPC, agricultural losses occur on an annual basis and are usually associated with severe weather events, including heavy rains, floods, heat, and drought. The 2023 State of California Multi-Hazard Mitigation Plan attributes most of the agricultural disasters statewide to drought, freeze, and insect infestations. Other agricultural hazards include fires, crop and livestock disease, insects, and noxious weeds.

Natural Disasters and Severe Weather

According to the US Department of Agriculture (USDA), every year natural disasters, such as droughts, earthquakes, extreme heat and cold, floods, fires, earthquakes, hail, landslides, and tornadoes, challenge agricultural production. Because agriculture relies on the weather, climate, and water availability to thrive, it is easily impacted by natural events and disasters. Agricultural impacts from natural events and disasters most commonly include: contamination of water bodies, loss of harvest or livestock, increased susceptibility to disease, and destruction of irrigation systems and other agricultural infrastructure. These impacts can have long lasting effects on agricultural production including crops, forest growth, and arable lands, which require time to mature.

Invasive Species (Animal Pests)

The HMPC noted that invasive species in the animal groups like wild pigs are causing extensive damage to both residential areas and also agricultural areas.

Invasive Species (Insect Pests)

Colusa County is threatened by a number of insects that, under the right circumstances, can cause severe economic and environmental harm to the agricultural industry. Insects of concern to plants and crops include the gypsy moth, Japanese beetle, light brown apple moth, Mediterranean fruit flies, Oriental fruit flies, melon flies, khapra beetle, and glassy-winged sharpshooter. Pest detection is a proactive program that seeks to identify exotic, invasive insects. These pests have wide host ranges and are difficult and costly

to manage once established. Early detection is essential for quick and efficient eradication. Public participation is critical to the success of this program, since staff relies on the goodwill of property owners who allow traps to be placed on their properties. The Colusa County Department of Agriculture traps and monitors all of these agricultural pests.

Weeds (both invasive and native)

Noxious weeds, defined as any plant that is or is liable to be troublesome, aggressive, intrusive, detrimental, or destructive to agriculture, silviculture, or important native species, and difficult to control or eradicate, are also of concern. Noxious weeds within the Planning Area include those listed on Table 4-41.

Table 4-41 Colusa County Weeds of Concern

Species of Concern					
Barb Goatgrass	Giant Reed	Downybrome	Yellow Starthistle	Jubatagrass	Pampasgrass
Scotch Broom	Brazilian Egeria	Fennel	Perrenial pepperweed	Urugray and creeping water primrose	Purple loosestrife
Parrotfeather	Eurasian watermilfoil	Himalayan blackberry	Red sesbania	Spanish broom	Medusahead
Italian Thistle	Smallflower tamarisk	Saltcedar	Tamarix	Yellow Starthistle	

Source: California Invasive Plant Council

The Colusa County Department of Agriculture uses mechanical and chemical control measures to contain all of these agricultural pests.

Location and Extent

Agricultural hazards occur throughout the County where lands are used for farming and grazing. The County has large swaths of agricultural lands. These are shown in the Land Use Map for the County on Figure 4-21 above. Areas not as greatly affected by severe weather, insects, and pests are the cities of Williams and Colusa, as well as the forest lands in the northwestern portion of the County which all contain fewer agricultural acres. However, while the cities may not be directly affected, they are indirectly affected economically when agricultural losses occur.

There is no scale that measures agricultural hazards. Agriculture in the County is at risk to many hazards: insects, weeds, severe weather, as well as downturns in commodity prices. Each of these has a different duration and speed of onset. Some, such as freeze, can have a short onset and a short duration. Drought can have a long onset and long duration. Insects and weeds can have short or long onset, and short or long durations. All agricultural losses can have a significant impact on affected communities.

Past Occurrences

Disaster Declaration History

The agricultural lands of Colusa County have historically been affected by weather related events such as freeze, heavy rain, and drought. The severe weather events can have devastating effects leading to losses in yield and affecting quality. The US Farm Services Agency provided information on disaster declarations from 2012 through 2023. These are shown in Table 4-42.

*Table 4-42 Colusa County – USDA Disaster Declarations 2012 to 2023**

Year	Declaration Number	Primary or Contiguous County	Disaster Type
2012	S3246	Contiguous	Freezing temperatures
2012	S3268	Contiguous	Drought-FAST TRACK
2012	S3379	Contiguous	Drought
2012	S3452	Contiguous	Drought
2013	S3569	Primary	Drought-FAST TRACK
2014	S3637	Primary	Drought-FAST TRACK
2014	S3743	Primary	Drought
2014	S3797	Primary	Drought
2015	S3784	Primary	Drought-FAST TRACK
2016	S3952	Primary	Drought-FAST TRACK
2016	S4163	Contiguous	Drought-FAST TRACK
2016	S4164	Contiguous	Severe weather including excessive rainfall and high winds
2016	S4170	Contiguous	Excessive rain, high winds, cold temperatures, and hail
2020	S4691	Primary	Drought-FAST TRACK
2020	S4697	Contiguous	Drought-FAST TRACK
2021	S5146	Primary	Drought-FAST TRACK
2022	S5299	Contiguous	Freeze
2022	S5332	Contiguous	Freeze
2023	S5371	Primary	Drought-FAST TRACK

Source: Colusa County Agricultural Commissioner, US Farm Service Agency

NCDC Events

The NCDC does not track agriculture events.

Hazard Mitigation Planning Committee Events

2022 - The HMPC noted that agriculture events occur yearly, though with varying levels of damages to a variety of crops. The 2022 Colusa County Crop Report noted that 2022 saw multiple issues that affected the agricultural industry in the County. Drought had large impacts in the County.

> ***Due to little to no water allocation Colusa County experienced one of the worst environmental and economical disasters the Sacramento Valley has ever endured. Colusa saw nearly half of their 456,000 farmable acres sit fallow. This hurt farmers, processors, farmworkers, wildlife and the entire community.***
>
> ***Colusa fell victim to an environmental war. A war that began with environmental good intentions has led to conflicting regulations that has caused this environmental crisis. This example of single species management resulted in the suffering of all species during this unprecedented drought situation.***
>
> ***Throughout the farming season, there was a clear distinction between the California water project consisting of the Feather River watershed and the Federal water project along the Sacramento River watershed. With the Sacramento River Water Contractors reduced to only 18% of their contracted water allotments farming became an impossible task in 2022.***

The following statistics show how the County was affected:

- Rice production value dropped 80%
- Overall crop values fell by $394,739,000
- Over 350,000 acres of farmland fallowed in the Sacramento Valley
- Water allocations cut to 18% of contracted amounts

February 2022 - In addition to drought, there were issues with freeze. Colusa experienced record low temperatures in February of 2022. These lows were especially devastating due to the length of time the temperatures stayed below freezing. Multiple monitors throughout the county registered 23.8° F for 9 hours. For 5 days, the icy weather persisted during the peak of the non-peril bloom. The Agricultural Commissioner's Office conducted a county wide survey of all growers and found the damages were estimated at 65% of crop loss. Some farmers reported their entire crop was lost. Other farmers left what little crop the trees produced unharvested due to the cost of harvesting exceeding the value of crop. A USDA disaster declaration was requested and granted from the Secretary of the United States Department of Agriculture.

Fall 2022 - Finally, in the Fall of 2022 a late season heat wave hit during a critical time of the growing cycle for Walnuts. These extreme temperatures caused darkening of the walnut meats, resulting in an unmarketable product, with low quality directly affecting prices. Walnut producers were operating below cost of production and some orchards in Colusa County were left unharvested.

Likelihood of Future Occurrence

Highly Likely—As long as severe weather events, insects, pests, and weeds continue to be an ongoing concern to the Colusa County Planning Area, the potential for agricultural losses remains.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and agricultural hazards can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Agricultural Hazards

According to the 2021 CAS, addressing climate change in agriculture will encompass reducing vulnerability through adapting to the ongoing and predicted impacts of climate. Agriculture in California is vulnerable to predicted impacts of climate change, including less reliable water supplies, increased temperatures, and increased pests.

The 2023 California State Hazard Mitigation Plan noted that California farmers contend with a wide range of crop-damaging invasive pests and pathogens. Continued climate change is likely to alter the abundance and types of many pests, lengthen pests' breeding season, and increase pathogen growth rates. It also noted that change in climate can directly impact crop growth through new temperature patterns and northward shifts of pests and disease. Additionally, longer growing seasons may enable pest species to complete more reproductive cycles, which can increase severity of infestations.

Finally, the 2023 State Plan noted that temperature is not the only climatic influence on pests. For example, some insects are unable to cope in extreme drought, while others cannot survive in extremely wet conditions. Furthermore, while warming speeds up the life cycles of many insects, suggesting that pest problems could increase, some insects may grow more slowly as elevated carbon dioxide levels decrease the protein content of the leaves on which they feed.

Vulnerability Assessment

Vulnerability—Extremely High

According to historical hazard data, severe weather affecting agriculture and agricultural pests are an annual occurrence in the Colusa County Planning Area. If left unchecked, invasive species can threaten native species, biodiversity, ecosystem services, recreation, water resources, agricultural and forest production, cultural resources, economies and property values, public safety, and infrastructure.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has certain specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The HMPC noted a recent report from the Intergovernmental Panel on Climate Change shows that the climate crisis has already affected or resulted in the loss of ecosystems, and global warming will likely reach or exceed 1.5°C in the near-term. Agricultural experts warn that these changes are already threatening crop productivity worldwide. Extreme heat has a significant impact on crops, particularly affecting grain crops like wheat, rice, and maize. Unusually hot temperatures cause smaller harvests and rising food prices, a phenomenon known as "heatflation". This is also true with almonds and other high value Colusa County crops.

Assets at Risk

Assets at risk from agricultural hazards include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

Agricultural hazards (both severe weather and invasive species) have a minimal effect on people and populations in Colusa County, including vulnerable populations. However, damage to crops from invasive and nuisance species can cause significant increases in food prices and food insecurity among low-income communities.

Structures

Structures in Colusa County may be indirectly affected by agricultural hazards. The effects of severe weather on structures are included in the discussions on severe weather above. This section focuses then on invasive species and pests. Some species can impact vegetation and can result in stream bank instability, erosion, and increased sedimentation, impacting ground stabilization and possibly causing foundation issues for nearby structures. If species cause trees and other vegetation to die, there is an increased risk of damage to roadways, powerlines, and buildings, and increased risk to wildfire. Some invasive plants have been shown to destabilize soil due to high densities and shallow root systems, negatively impacting nearby buildings and septic systems. Other invasive plant species have been known to clog culverts and streams, increasing flooding risk.

Critical Facilities and Infrastructure

Critical facilities and infrastructure in Colusa County may be affected by agricultural hazards, though these effects are expected to be limited. The effects of severe weather on critical facilities are included in the discussions on severe weather above. This section focuses then on invasive species and pests. The 2023 State of California Hazard Mitigation Plan noted that water treatment plants could be impacted by invasive

and nuisance species. Water that becomes polluted due to increased sedimentation and erosion will require additional treatment. If the system becomes clogged with these pollutants or with invasive aquatic species, the ability of water treatment plants to operate may become impaired. Additionally, soil that becomes unstable due to decaying vegetation can impact critical facilities that are built on or around these soils.

Community Lifelines

The effects of severe weather on community lifelines are included in the discussions on severe weather above. This section focuses then on invasive species and pests. While individually critical facilities and infrastructure can be impacted as discussed above, community lifelines should be minimally affected by agricultural hazards of invasive species and pests.

Natural, Historic, and Cultural Resources

Natural resources can be affected by agricultural hazards. The effects of severe weather on these resources are included in the discussions on severe weather above. This section focuses then on invasive species and pests. Negative impacts of weeds to natural resources include the following:

- Loss of wildlife habitat and reduced wildlife numbers;
- Loss of native plant species;
- Reduced livestock grazing capacity;
- Increased soil erosion and topsoil loss;
- Diminished water quality and fish habitat.

Historic and cultural resources have a more limited risk from agricultural hazards.

Economic Assets and Community Activities of Value

The effects of severe weather on economic assets and community activities of value are included in the discussions on severe weather above. This section focuses then on invasive species and pests. Invasive species and noxious weeds have been introduced in the Planning Area by a variety of means. An absence of natural controls, combined with the aggressive growth characteristics and unpalatability of many of these weeds, allows these weeds to dominate and replace more desirable native vegetation. Negative impacts of weeds and invasive species include the following:

- Reduced livestock grazing capacity;
- Increased wildfire risk;
- Reduced cropland and farmland production; and
- Reduced land value and sale potential.

Severe weather and agricultural pests can cause direct damage to economic assets. The largest economic driver in Colusa County is the agricultural sector. During periods of severe weather, crops may be damaged by dam failure, drought, hail, high winds, floods, levee failures, tornadoes, and wildfires. Should there be significant revenue drop (as was seen in 2022), there will be significant decline in money in the County's economy. Community activities of value will be minimally affected by agricultural hazards.

Impacts from Agricultural Hazards

According to the HMPC, the consequences of agricultural disasters to the Planning Area include ruined plant crops, dead livestock, ruined feed and agricultural equipment, monetary loss, job loss, and possible multi-year effects (i.e., trees might not produce if damaged, loss of markets, food shortages, increased prices, possible spread of disease to people, and loss or contamination of animal products). When these hazards cause a mass die-off of livestock, other issues occur that include the disposal of animals, depopulation of affected herds, decontamination, and resource problems. Those disasters related to severe weather may also require the evacuation and sheltering of animal populations. Overall, any type of severe agricultural disaster can have significant economic impacts on both the agricultural community and the entire Colusa County Planning Area.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future conditions that may impact the agricultural industry in Colusa County.
- Future population growth should be considered as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. Population changes are unlikely to affect the vulnerability of the County to this hazard unless the population growth significantly increases, displacing agricultural uses. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. Limited growth is occurring in the County, which should result in limited changes to land uses that would affect the agricultural industry. As the County continues to add new development, land uses may change resulting in a reduction in agricultural uses. However, for the next five years covered by this LHMP Update, changes in land use and development will likely not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development in the County is not likely to have an impact on agricultural hazards in Colusa County, except to the extent that agricultural lands are taken out of production as new development occurs reducing available land for agricultural uses, including those related to farming, timber production and grazing. In addition, the HMPC did note that with additional development in the County, there may be additional competition for water resources thus possibly impacting the agricultural industry.

4.3.7. Climate Change

Hazard Profile

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

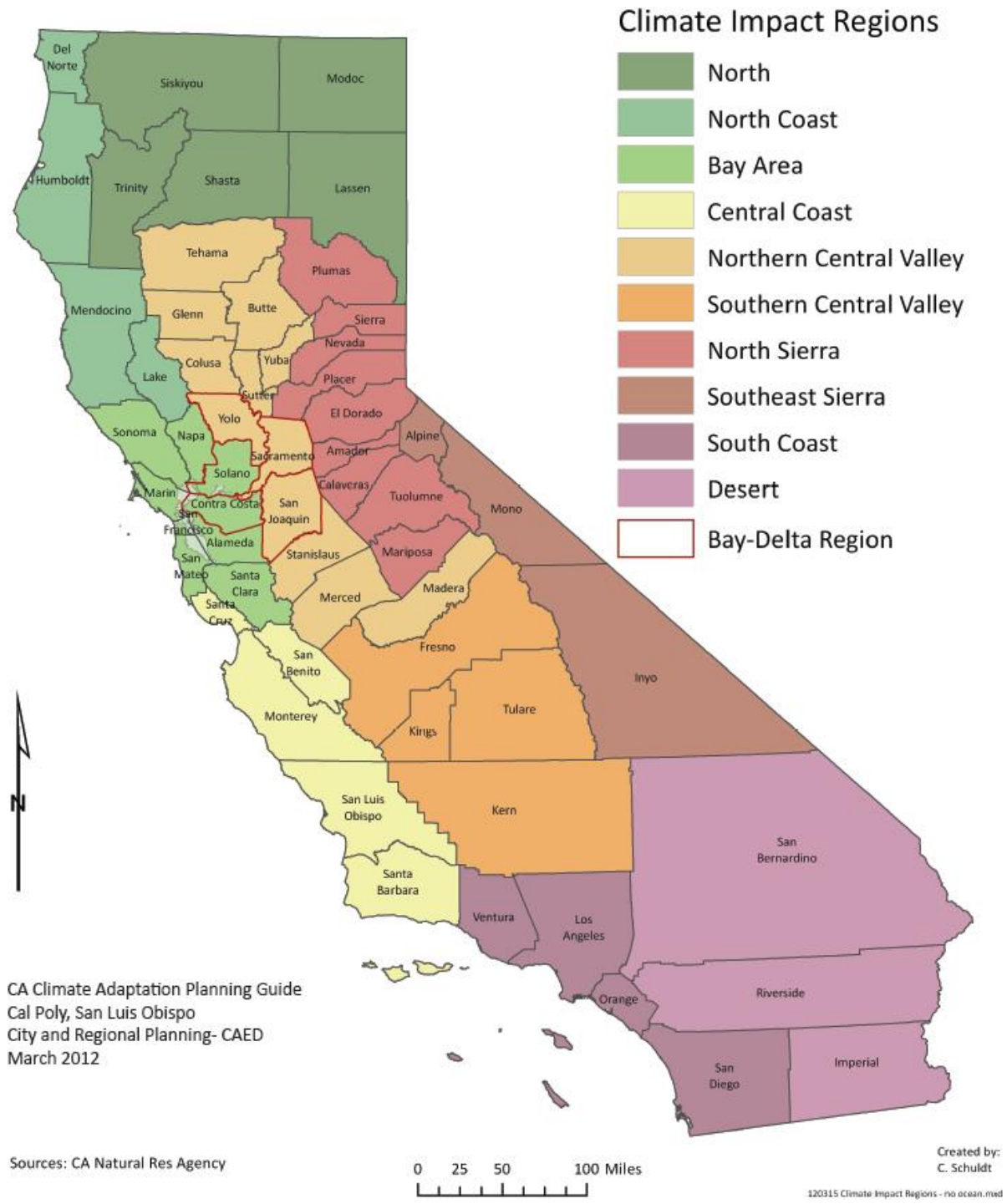
Hazard/Problem Description

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.

In Colusa County, the HMPC noted that each year it seems to get a bit warmer. It was also noted that 2022 and 2023 were some one of the wettest years ever. 2023 was one of the hottest on record. California's Adaptation Planning Guide: 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 (as shown in Figure 4-47). Colusa County falls within the Northern Central Valley Region characterized as an agricultural, inland region with over 3.7 million people, with substantial cities, the largest being the state capitol, Sacramento. Agriculture is the predominant economic activity. The agricultural operations in this region include rice, dairy, and nut trees (almond and walnut). The region's agricultural activity is one of the most productive in the nation. Table 4-43 provides a summary of Cal-Adapt Climate Projections for the North Central Valley Region.

Figure 4-47 Colusa County – Climate Impact Regions



Source: Cal-Adapt 2017/2023

Table 4-43 Colusa County – North Central Valley Region Cal Adapt Climate Projections

Effect	Ranges
Temperature Change, 1990-2100	January increase in average temperature of 4°F to 6°F and between 8°F and 12°F by 2100. July increase in average temperature of 6°F to 7°F in 2050 and 12°F to 15°F by 2100. (Modeled average temperatures; high emissions scenario)
Precipitation	Annual precipitation is projected to decline by approximately one to two inches by 2050 and three to six inches by 2100. (Community Climate System Model Version 3 (CCSM3) climate model; high carbon emissions scenario)
Heat wave	Heat wave is defined as five days over 102°F to 105°F, except in the mountainous areas to the east. Two to three more heat waves per year are expected by 2050 with five to eight more by 2100.
Wildfire	By 2085, the north and eastern portions of the region will experience an increase in wildfire risk, more than 4 times current levels in some areas. (Geophysical Fluid Dynamics Laboratory (GFDL) climate model; high carbon emissions scenario)

Source: Cal-Adapt 2017/2023.

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 climate change incidents could be recalled. HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter.

Likelihood of Future Occurrence

Highly Likely – Climate change is virtually certain to continue without immediate and effective global action. According to NASA, 2021 was one of the hottest years on record as was 2023. Without significant global action to reduce greenhouse gas emissions, the Intergovernmental Panel on Climate Change (IPCC) concludes in its Sixth Assessment Synthesis Report (2022) 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 greenhouse gas (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.

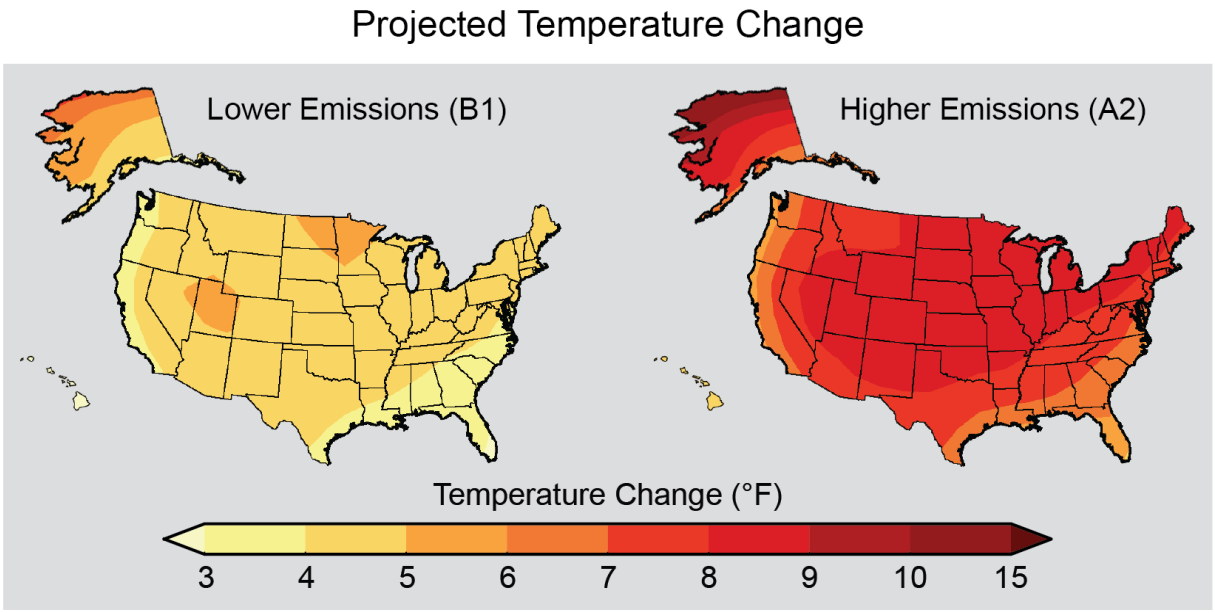
Key Uncertainties Associated with Climate Projections

- 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 4-48.

Figure 4-48 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 2021 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 Colusa 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 to Climate Change

Vulnerability—High

Climate change adaptation is a key priority of the State of California. The 2023 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.

The whole of the County is at some measure of vulnerability to climate change. An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

Anthropogenic and other greenhouse gasses will continue to cause more extreme climate change conditions unless steps taken to minimize greenhouse gases and carbon footprints. The County's roadways, infrastructure in flood zones, disadvantaged communities, agriculture sector and sensitives species habitat are among the most vulnerable to climate change impacts.

Climate change threatens the food security and economic viability of agriculture in Colusa County. Drought, flood, and severe weather are all poised to intensify as climate change continues to impact California. Agricultural practices need updating to become resilient and can be part of the solution to climate change in our region.

Assets at Risk

Assets at risk from climate change include people and populations; structures; critical infrastructure and vulnerable uses (with community lifelines); natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

Climate change affects people and populations within a community, especially those climate change issues related to increases in temperature over time. While all populations can be affected by temperature extremes, populations particularly vulnerable include the very old and very young, medically fragile people, people without means of shelter (and air conditioning) or transportation, people who are socially isolated and other socially vulnerable or underserved populations (as shown in Special Populations discussion in Section 4.2.1). Acclimatization to heat may help reduce risks from heat waves in the healthy general population but may not be sufficient to protect those with underlying issues and lack of resources.

Structures

Climate change, on its own, does not generally impact structures. However, structures in areas of increased wildfire, drought, extreme heat, or flood areas exacerbated by the effects of climate change would be at increased risk, as described throughout this LHMP. Due to the slow onset of climate change, many structures in the County are expected to undergo improvements and adapt over time to a new climate normal.

Critical Infrastructure and Vulnerable Uses

As with structures, critical and vulnerable facilities in areas of increased wildfire, flood areas, or in other hazard areas exacerbated by climate change, would be at increased risk. Climate change is expected to increase the general vulnerability of critical and vulnerable facilities to natural hazards. Due to the slow onset of climate change, critical and vulnerable facilities and community lifelines in the County are expected to undergo improvements and adapt over time to a new climate normal.

Community Lifelines

Due to its slow onset, community lifelines in the County should not be overwhelmed by climate change. During the slow onset of climate change, community lifelines in the County are expected to undergo improvements and adapt over time to a new climate normal.

Natural, Historic, and Cultural Resources

The rivers, streams, and open space areas of the County supports rich biodiversity, including many special-status species. These are all at risk from the effects of climate change. In addition, if heat changes wildfire patterns, all areas (on land) of the County are at increased risk from fire – including natural, historic, and cultural resources. Furthermore, if climate change exacerbates the drought hazard, areas of wetlands in the

County may dry up temporarily, which could damage habitat areas for waterfowl and other species that depend on these areas.

Economic Assets and Community Activities of Value

All economic assets and community activities of value in the County are at some measure of risk to hazards exacerbated by climate change. The 2023 State of California Hazard Mitigation Plan document noted that the frequency of large storm sequences (i.e., atmospheric rivers) over short timeframes is projected to increase, causing flooding events that could affect portions of the County. Should storms or other climate-related hazard events occur, certain economic assets and activities could be adversely affected.

Impacts from Climate Change

The 2017 California Adaptation Planning Guide (APG) North Central Valley Region identifies area specific impacts and vulnerabilities to the Colusa County Planning Area. These impacts include:

- Increased temperatures
- Reduced precipitation
- Public health – heat and air pollution
- Reduced agricultural productivity
- Inland flooding
- Reduced tourism

Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the 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. The 2023 State of California Hazard Mitigation Plan noted that there are direct and secondary impacts:

- Direct Impacts
  - ✓ Increase in average temperature
  - ✓ Changes in annual precipitation
- Secondary Impacts
  - ✓ Increased frequency, intensity, and duration of extreme heat days and heat waves/events
  - ✓ Increased flooding
  - ✓ Increased wildfire
  - ✓ Loss of snowpack and decreased water supplies

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.

In addition to these sources, the 2023 State of California Hazard Mitigation Plan noted that according to California's Fourth Climate Change Assessment, the state will experience the following climate impacts:

- Annual average daily high temperatures are expected to rise by 2.7 °F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. These changes are statewide averages.
- Heat waves are projected to become longer, more intense, and more frequent.
- Warming temperatures are expected to increase soil moisture loss and lead to drier conditions. Summer dryness may become prolonged, with soil drying beginning earlier in the spring and lasting longer into the fall and winter.
- Droughts are likely to become more frequent and persistent through 2100.
- The strength of the most intense precipitation and storm events affecting California is expected to increase.
- Snowpack levels are projected to decline significantly by 2100 due to reduced snowfall and faster snowmelt.
- Marine layer clouds are projected to decrease.
- Extreme wildfires (i.e., fires larger than 24,710 acres) would occur 50 percent more frequently. The maximum area burned statewide may increase 178 percent by the end of the century.
- Sea level rise is expected to continue to increase beach, cliff, and bluff erosion.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- As climate change continues to accelerate over time, climate related impacts to the County will continue to increase.
- Climate change can influence population growth in the County over time. The County could see population fluctuations as a result of climate impacts relative to those experienced in other regions, and these fluctuations are expected to impact demand for housing and other development. While there are currently no formal studies of specific migration patterns expected to impact the 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. So while changes in population and population patterns are not expected to increase the impacts associated with this hazard, climate change may instead influence future population growth in the County.
- Land use planning should be proactive to address future hazard conditions. The increasing severity and frequency of storms and other weather events due to the changing climate should be taken into account while considering land use planning for the County. Ensuring that regulatory requirements, such as building codes, are updated and followed will help reduce future impacts to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more disaster resilient community.

4.3.8. Dam Failure

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect the Colusa County Planning Area. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect or influence 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
- Failure of upstream dams on the same waterway

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. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

The 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 DSOD assigns hazard ratings to large "jurisdictional sized" 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 Colusa County, CA DWR DSOD, and Cal OES, there are six dams in Colusa County that were constructed for flood control, storage, treatment impoundments, electrical generation, and recreational purposes. Of the six dams in the County, three are rated as High Hazard, one is rated as Significant Hazard, and two are rated as Low Hazard. Additionally, according to the HMPC and the General Plan Background Report, eight dams outside of the County retain water from tributaries of the Sacramento or Feather River and could cause damage in Colusa County if their dams were to fail: Black Butte Lake, Davis Creek Reservoir, Indian Valley, Lake Almanor, Lake Oroville, Lake Shasta, Thermalito, and Whiskeytown Lake. Figure 4-49 identifies the dams that have inundation areas located in the Colusa County Planning Area. Table 4-44 gives information on each of the dams in the County, and the dams outside the County that could affect areas in Colusa County.

Figure 4-49 Colusa County Dam Inventory

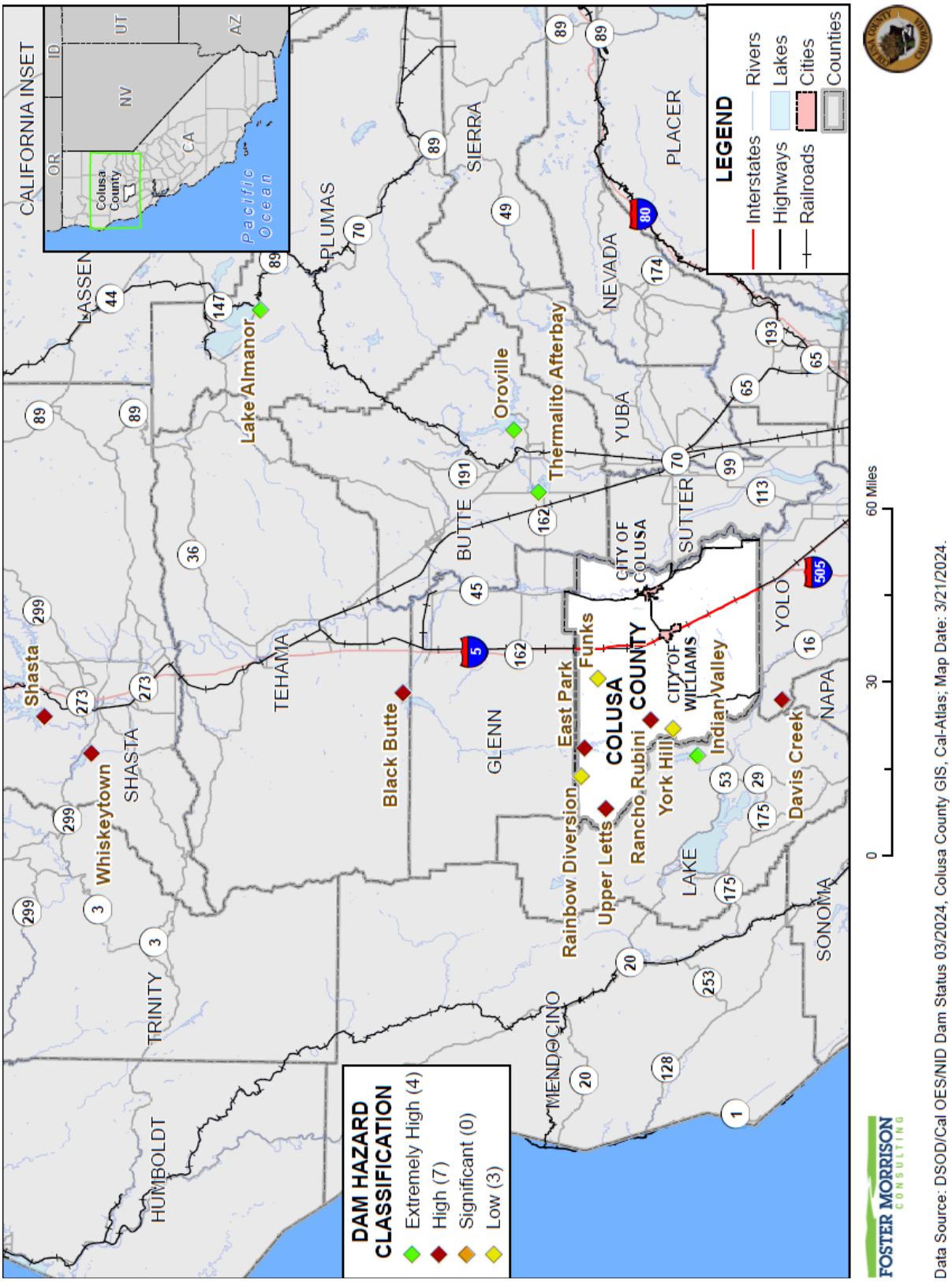


Table 4-44 Colusa County – Dam Inventory

Name	Hazard Classification	Dam Type	River/Stream	Structural Height (ft)	Maximum Storage (acre-ft)	Emergency Action Plan
Dams Inside Colusa County						
East Park	High	Concrete Arch	Little Stony Creek	141	505,992	Y
Funks	Low	Earth	Funks Creek	81	20,820	N
Rainbow Diversion	Low	Unknown	Stony Creek	55	1,000	N
Rancho Rubini	High	Rockfill	Tributary of Bear Creek	31	1,060	Y
Upper Letts	High	Concrete Arch	Letts Creek	21	3,190	N
York Hill	Significant	Unknown	Tributary of Bear Creek	39	2,450	N
Dams Outside Colusa County with Inundation Areas in Colusa County						
Black Butte	High	Earth	Stoney Creek	142	143,700	Y
Davis Creek	High	Earth	Davis Creek	105	6,079	Y
Indian Valley	High	Earth	North Fork Cache Creek	210	261,000	Y
Lake Almanor	Extremely High	Hydraulic Fill	North Fork Feather River	130	1,308,000	Y
Oroville	High	Rockfill	Feather River	782	3,540,000	Y
Shasta	High	Concrete	Sacramento River	612	4,552,090	Y
Thermalito	High	Earth	Feather River	40	57,000	Y
Whiskeytown	High	Earth	Clear Creek	286	241,096	Y

Source: DSOD/Cal OES/NID Dam Status 03/24, National Performance of Dams Program
*One Acre Foot=326,000 gallons

Though not yet built, the proposed Sites Reservoir would be located in Colusa County, 10 miles from the area of Maxwell. The proposed Sites Reservoir would be a large offstream reservoir in the Sacramento Valley in Northern California, a project of Cal DWR. Its primary purpose is to collect winter flood flows from the Sacramento River, diverting the water upstream of the Sacramento–San Joaquin River Delta and pumping it into an artificial lake located west of Colusa. The estimated water yield would be between 470,000 to 640,000 acre feet per year, depending on yearly rainfall and environmental regulations.

The County noted they are most vulnerable to the following dams:

- Black Butte Lake
- Davis Creek
- East Park Reservoir
- Indian Valley
- Lake Almanor

- Lake Oroville
- Lake Shasta
- Thermalito Afterbay
- Whiskeytown Lake

All of these dams are located outside of the County, with the exception of East Park Reservoir.

Once a list of dams was established, dam inundation layers were obtained from DSOD and Cal OES in GIS. Dams with an inundation area in the Colusa County Planning Area are shown on Figure 4-50 for extremely high hazard dams, and Figure 4-51 for high hazard dams. Geographic flood extents as shown on the dam inundation maps are detailed by dam in Table 4-45 for high hazard dams. Only extremely high and high hazard dams were analyzed for this LHMP due to the potential for these dams to cause loss of life in the Colusa County Planning Area should a dam failure occur.

There is no scale with which to measure dam failure, only a scale to measure dam failure vulnerability based on size of dam and proximity to development. Dam failure may range from a small breach to a total 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.

For dam overtopping, the speed of onset is somewhat slower than that of a dam break, and the duration is longer (as evidenced in the 2017 Oroville Dam event). The Colusa County Planning Area would be affected for as long as the flood waters from the dam failure takes to drain downstream.

Figure 4-50 Colusa County Planning Area – Extremely High Hazard Dam Inundation Areas

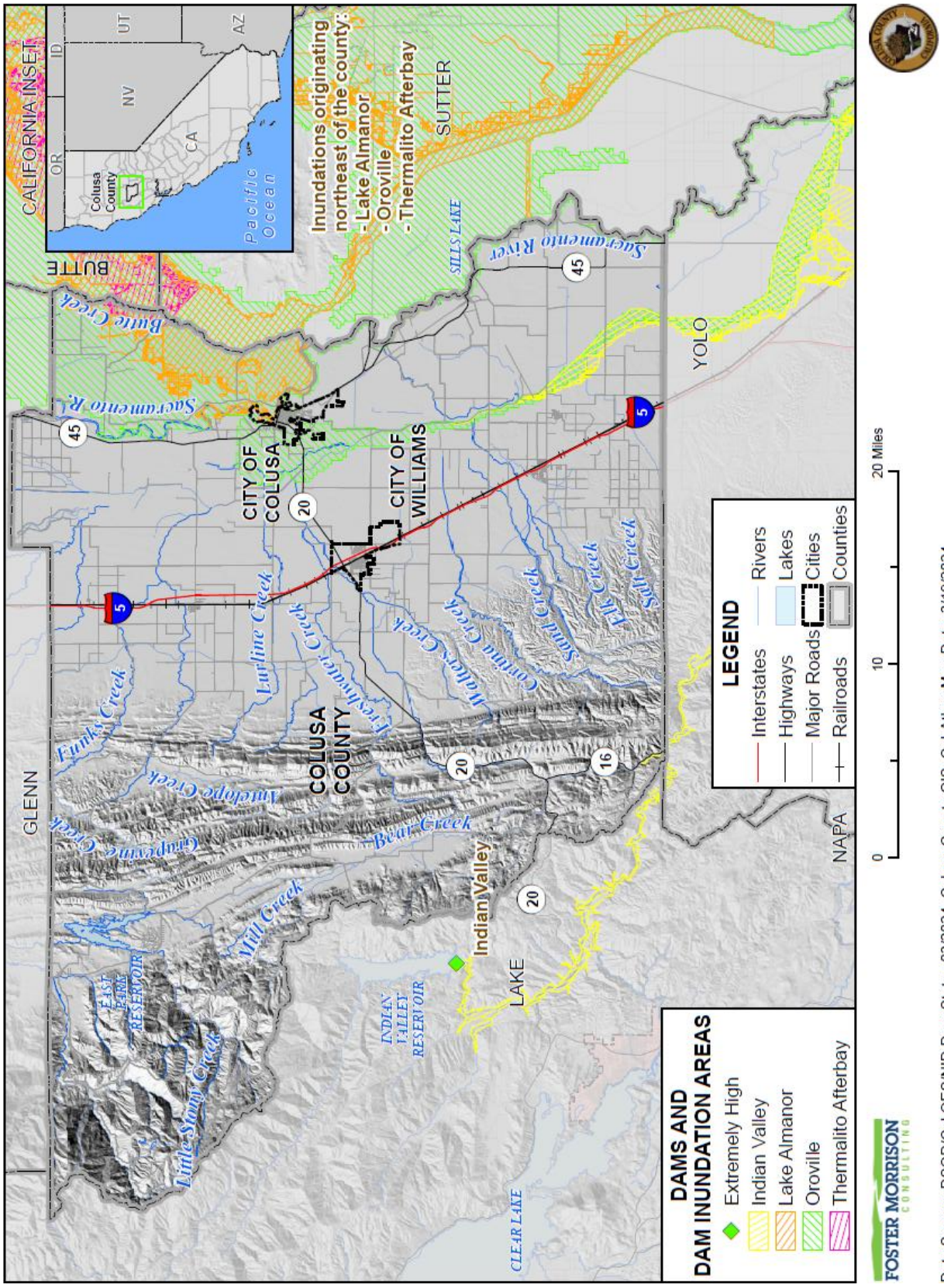


Figure 4-51 Colusa Planning Area – High Hazard Dam Inundation Areas

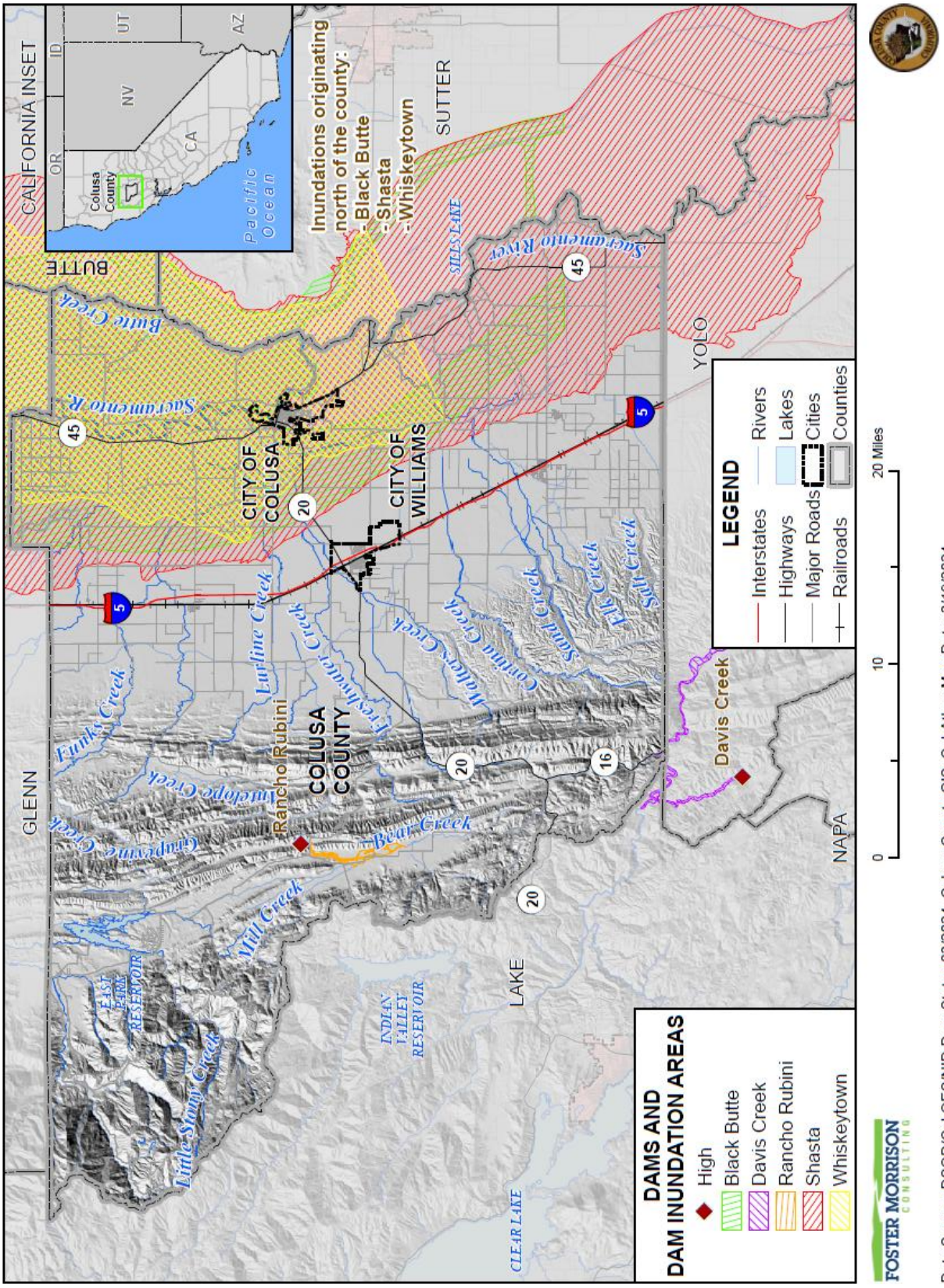


Table 4-45 Colusa County Planning Area –Geographical Dam Inundation Extents by Jurisdiction

Jurisdiction / Dam Inundation Area	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
City of Colusa						
Lake Almanor	81	3.349%	0	0.005%	81	7.887%
Oroville	1,283	53.180%	811	58.430%	471	46.057%
Shasta	2,412	100.000%	1,388	100.000%	1,023	100.000%
Thermalito Afterbay	0	0.000%	0	0.000%	0	0.000%
Unincorporated Colusa County						
Lake Almanor	16,348	2.257%	8,087	3.276%	8,261	1.730%
Oroville	58,892	8.129%	29,389	11.905%	29,504	6.177%
Shasta	203,392	28.074%	91,173	36.932%	112,219	23.495%
Thermalito Afterbay	1,096	0.151%	741	0.300%	356	0.074%

Source: DSOD/Cal OES/NID Dam Status 03/24

Past Occurrences

Disaster Declaration History

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

NCDC Events

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

Hazard Mitigation Planning Committee Events

February 2017 - In February 2017, Oroville Dam's main and emergency spillways were damaged, prompting the evacuation of more than 180,000 people living downstream along the Feather River and the relocation of a fish hatchery. Heavy rainfall during the 2017 California floods damaged the main spillway on February 7, so Cal DWR stopped the spillway flow to assess the damage and contemplate its next steps. The rain eventually raised the lake level until it flowed over the emergency spillway, even after the damaged main spillway was reopened. As water flowed over the emergency spillway, headward erosion threatened to undermine and collapse the concrete weir, which could have sent a 30-foot wall of water into the Feather River below and flooded communities downstream. No collapse occurred, but the water further damaged

the main spillway and eroded the bare slope of the emergency spillway. Evacuees fled to the town of Colusa. As they were panicking and either not following or not receiving media information about location of shelters for them, they stopped at a local strip mall and began sheltering in their vehicles, as well as parking on the streets. No shelter or staging area would be opened in Colusa: Colusa Medical Center, the only hospital in the County, was closed for an indefinite period of time. There would be no Red Cross presence in Colusa to staff a shelter as all resources were committed to open shelters. In addition, if the dam or auxiliary dam had failed, the City of Colusa would need to be evacuated within an 8-10 hour inundation time period. People were provided with information on where open shelters were and if they accepted pets.

The Oroville Dam EAP in the Colusa EOC was consulted to determine inundation times. Evacuation planning was made with local government and first responders. Local law enforcement responded to a Law Enforcement Mutual Aid request by Sutter County to patrol evacuated areas.

No other events of dam failure were noted to have occurred in Colusa County.

Likelihood of Future Occurrence

Occasional—The County remains at risk to dam breaches/failures from numerous dams under a variety of ownership and control and of varying ages and conditions. Although, there is no history of past dam failures, given the Oroville spillway event and the number and types of dams of concern to the County and their ages, a potential exists for future dam issues, including failures, in the Colusa County Planning Area. Thus, the HMPC determined the likelihood of future occurrence to be occasional. In addition to the aging dam infrastructure, this ranking was based on the recent issues with the nearby Oroville dam, that was at risk of a spillway failure during the winter storms in 2017. There is concern that many of the State's older dams, including those in Colusa County, could start experiencing similar problems.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and dam failure can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Dam Failure

The 2023 California State Hazard Mitigation Plan noted that modeling described in California's Fourth Climate Change Assessment projects less frequent but more extreme daily precipitation. Year-to-year precipitation will become more volatile, and the number of dry years will increase by mid-century. As the climate continues to warm, atmospheric rivers will carry more moisture, and extreme precipitation may increase. Climate model projections show a tendency for the northern part of the State to become wetter. 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 Colusa County.

Vulnerability Assessment

Vulnerability—Extremely High

Dam failure flooding can occur as the result of a partial or complete collapse of an impoundment. Dam failures often result from prolonged rainfall and flooding. An earthquake event can also contribute to a dam failure. 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 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. Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The 2010 General Plan Background Report noted that Lake Oroville, which is located in Butte County, would represent the most immediate threat to Colusa County in the event of a dam failure, as flood waters could reach the County within eight hours. Lake Shasta, in Shasta County, could cause the most extensive inundation, reaching as far west as Maxwell and College City in a period of 42 hours. Inundation from Whiskeytown Lake, located in Trinity County, would take over three days to reach Colusa County. Failure of the dam of Black Butte Lake, which is on the border of Glenn and Tehama Counties, could result in some inundation within a period of about 35 hours. The inundation from a failure of this dam would be less extensive than if the other above referenced dams were to fail.

Failure of the dam at East Park Reservoir could cause minor inundation at the reservoir's outlet. The flood waters would flow into Glenn County; thus, its failure would not likely impact areas of Colusa County. In Glenn County, the flooding could extend up to one-quarter mile on either side of Stony Creek at its widest point. The water could cause an overflow of Stony Gorge Reservoir, which is located on Stony Creek. Black Butte Reservoir would retain the excess inundation.

Assets at Risk from Dam Failure

Assets at risk from dam failure include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources, economic assets, and community activities of value). These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

Methodology and Results

In order to analyze people and populations, structures, and critical facilities at risk in dam inundation areas, GIS was used to quantify those values. The 2023 Colusa County Parcel/Assessor Data was provided by Colusa County and was used as the basis for the inventory of assessed values for both improved and unimproved parcels within the Colusa County Planning Area. The dam inundation areas, obtained from DSOD and Cal OES, were then overlaid on the parcel layer. For the purposes of this analysis, if the dam inundation layer intersected any portion of a parcel polygon, the entire parcel was considered to be in the dam inundation area. The parcels were segregated and analyzed in this fashion for the entire Planning Area. This analysis was performed on extremely high and high hazard dam inundation areas only. No significant hazard dam analysis was performed, as it was determined no significant hazard dams intersect the County.

People and Populations

All people and populations located in dam inundation areas are vulnerable to dam failure. Certain vulnerable populations may be at increased risk to dam failure, especially during a large event with minimal advance notice. These vulnerable populations may include: the unhoused, those with limited mobility, and those that lack the resources to leave the area.

Colusa County residents that live in these dam inundation areas are often the most vulnerable. Not only are the residents at risk, but their homes and contents are all at risk, compounding the impacts associated with significant hazard events. To further evaluate the impact to the Colusa County Planning Area's residential populations located in these hazard areas, a separate analysis was performed to determine residential populations in the dam inundation areas. The DSOD and Cal OES dam inundation areas were overlayed on the parcel layer and linked to the Assessor Data. Those residential parcel centroids that intersect the dam inundation areas were counted and multiplied by the Census Bureau average household factors for each jurisdiction. This is shown in Table 4-46.

Table 4-46 Colusa County Planning Area – Improved Residential Parcels and Population by Dam Inundation Area (Extremely High and High Hazard) and Jurisdiction

Dam Classification/Dams	City of Colusa		City of Williams		Unincorporated Colusa County	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Extremely High Hazard Dams						
Indian Valley	0	0	0	0	0	0
Lake Almanor	0	0	0	0	0	0
Oroville	982	2,848	0	0	330	1,181
Thermalito Afterbay	0	0	0	0	0	0
High Hazard Dams						
Black Butte	76		0	0	343	1,228
Rancho Rubini	0	0	0	0	1	4

Dam Classification/Dams	City of Colusa		City of Williams		Unincorporated Colusa County	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Shasta	1,778	5,156	0	0	558	1,998
Whiskeytown	1,778	5,156	0	0	449	1,607

Source: Cal OES, DSOD, 2023 Colusa County Parcel/Assessor Data, 2020 US Census Bureau Average Household Size– City of Colusa (2.90); City of Williams (2.55); Unincorporated Colusa County (3.58).

These numbers may reflect low end estimates as the property use categories based on the Assessor data utilized for this LHMP Update assumes all residential properties are single family residences. However, many of the residential parcels actually include multi-family units, including apartments, condominiums, as well as duplexes and triplexes. These variations in residential property use were not accounted for in the analysis, which skews populations results to be lower.

Structures

Many structures in the Colusa County Planning Area have some measure of risk to dam failure. Dam failure flooding can affect the built environment of many locations in the Colusa County Planning Area. Structures in dam inundation areas are at risk and depending on flood depths, can range from slight damage to total inundation. Analysis by extremely high hazard dam and high hazard dam follows.

Extremely High Hazard Dam Analysis

Parcel counts, land, and improved values (i.e., those with a structure improvement on the parcel), estimated content replacement values, other values and total values that fall within each extremely high hazard dam inundation areas in the Planning Area are presented below by hazard class and by dam. The results are presented in tables below by:

- Table 4-47 shows the count and value of parcels in the Indian Valley dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-48 breaks down Table 4-47 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.
- Table 4-49 shows the count and value of parcels in the Lake Almanor dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-50 breaks down Table 4-49 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.
- Table 4-51 shows the count and value of parcels in the Lake Oroville dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-52 breaks down Table 4-51 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.
- Table 4-53 shows the count and value of parcels in the Thermalito Dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-54 breaks down Table 4-53 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.

Breakdowns of parcel counts by property use in each inundation area for the incorporated jurisdictions in the County are shown in their respective annexes to this LHMP Update.

Table 4-47 Colusa County Planning Area – Count and Value of Parcels in Indian Valley Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	0	0	$0	$0	$0	$0	$0
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	42	17	$10,800,745	$1,207,213	$7,360	$1,207,213	$13,222,531
Grand Total	**42**	**17**	**$10,800,745**	**$1,207,213**	**$7,360**	**$1,207,213**	**$13,222,531**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-48 Unincorporated Colusa County – Count and Value of Parcels in Indian Valley Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	32	13	$8,900,090	$1,172,864	$7,360	$1,172,864	$11,253,178
Commercial	0	0	$0	$0	$0	$0	$0
Government	2	0	$74,922	$0	$0	$0	$74,922
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	8	4	$1,825,733	$34,349	$0	$34,349	$1,894,431
Residential	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County Total	**42**	**17**	**$10,800,745**	**$1,207,213**	**$7,360**	**$1,207,213**	**$13,222,531**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-49 Colusa County Planning Area – Count and Value of Parcels in Lake Almanor Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	2	0	$930	$0	$0	$0	$930
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	110	41	$37,397,541	$7,230,520	$787,680	$7,230,520	$52,646,261
Grand Total	**112**	**41**	**$37,398,471**	**$7,230,520**	**$787,680**	**$7,230,520**	**$52,647,191**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-50 Unincorporated Colusa County – Count and Value of Parcels in Lake Almanor Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	93	38	$35,928,124	$5,545,567	$774,550	$5,545,567	$47,793,808
Commercial	3	2	$272,977	$1,379,730	$13,130	$1,379,730	$3,045,567
Government	12	1	$708,626	$305,223	$0	$305,223	$1,319,072
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	1	0	$480,440	$0	$0	$0	$480,440
Miscellaneous	0	0	$0	$0	$0	$0	$0
Residential	1	0	$7,374	$0	$0	$0	$7,374
Unincorporated Colusa County Total	**110**	**41**	**$37,397,541**	**$7,230,520**	**$787,680**	**$7,230,520**	**$52,646,261**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-51 Colusa County Planning Area – Count and Value of Parcels in Lake Oroville Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	1,380	1,227	$79,509,222	$223,006,030	$21,416,768	$153,838,006	$477,770,026
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	1,183	684	$213,537,009	$113,589,418	$14,666,038	$88,293,392	$430,085,857
Grand Total	**2,563**	**1,911**	**$293,046,231**	**$336,595,448**	**$36,082,806**	**$242,131,398**	**$907,855,883**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-52 Unincorporated Colusa County – Count and Value of Parcels in Lake Oroville Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	609	285	$172,531,882	$45,525,933	$8,702,741	$45,525,933	$272,286,489
Commercial	69	49	$4,522,086	$10,595,186	$2,762,578	$10,595,186	$28,475,036
Government	70	7	$8,081,883	$848,620	$890	$848,620	$9,780,013
Industrial	12	7	$1,355,403	$2,895,584	$169,198	$4,343,376	$8,763,561
Institutional	5	1	$864,247	$196,057	$345,687	$196,057	$1,602,048
Miscellaneous	23	5	$4,827,703	$40,381	$1,579,253	$40,381	$6,487,718
Residential	395	330	$21,353,805	$53,487,657	$1,105,691	$26,743,839	$102,690,992

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Unincorporated Colusa County Total	**1,183**	**684**	**$213,537,009**	**$113,589,418**	**$14,666,038**	**$88,293,392**	**$430,085,857**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-53 Colusa County Planning Area – Count and Value of Parcels in Thermalito Afterbay Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	0	0	$0	$0	$0	$0	$0
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	5	3	$3,515,286	$1,235,230	$557,400	$1,235,230	$6,543,146
Grand Total	**5**	**3**	**$3,515,286**	**$1,235,230**	**$557,400**	**$1,235,230**	**$6,543,146**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-54 Unincorporated Colusa County – Count and Value of Parcels in Thermalito Afterbay Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	5	3	$3,515,286	$1,235,230	$557,400	$1,235,230	$6,543,146
Commercial	0	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
Residential	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County Total	**5**	**3**	**$3,515,286**	**$1,235,230**	**$557,400**	**$1,235,230**	**$6,543,146**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

High Hazard Dam Analysis

Parcel counts, land, and improved values (i.e., those with a structure improvement on the parcel), estimated content replacement values, and total values that fall within each high hazard dam inundation areas in the Planning Area are presented below by hazard class and by dam. The results are presented in tables below by:

- Table 4-55 shows the count and value of parcels in the Black Butte dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-56 breaks down Table 4-55 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.
- Table 4-57 shows the count and value of parcels in the Rancho Rubini dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-58 breaks down Table 4-57 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.
- Table 4-59 shows the count and value of parcels in the Shasta dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-60 breaks down Table 4-59 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.
- Table 4-61shows the count and value of parcels in the Whiskeytown dam inundation area summarized for each jurisdiction in the Planning Area. Table 4-62 breaks down Table 4-61 to show the parcel counts by property use in the inundation area for unincorporated Colusa County.

Breakdowns of parcel counts by property use in each inundation are for the incorporated jurisdictions in the County are shown in their respective annexes to this LHMP Update.

Table 4-55 Colusa County Planning Area – Count and Value of Parcels in Black Butte Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	132	103	$13,962,858	$14,526,257	$161,962	$10,684,843	$39,335,920
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	1,892	954	$441,769,205	$149,096,279	$22,171,704	$126,743,701	$739,780,889
Grand Total	**2,024**	**1,057**	**$455,732,063**	**$163,622,536**	**$22,333,666**	**$137,428,544**	**$779,116,809**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-56 Unincorporated Colusa County – Count and Value of Parcels in Black Butte Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	1,180	529	$371,320,240	$77,247,487	$14,807,437	$77,247,487	$540,622,651
Commercial	64	48	$4,276,861	$9,622,062	$2,290,634	$9,622,062	$25,811,619
Government	109	12	$19,808,816	$809,514	$3,485	$809,514	$21,431,329
Industrial	14	8	$1,780,800	$7,901,410	$1,330,878	$11,852,115	$22,865,203
Institutional	16	3	$885,398	$293,916	$424,813	$293,916	$1,898,043
Miscellaneous	92	11	$23,345,721	$615,300	$1,669,923	$615,300	$26,246,244
Residential	417	343	$20,351,369	$52,606,590	$1,644,534	$26,303,307	$100,905,800
Unincorporated Colusa County Total	**1,892**	**954**	**$441,769,205**	**$149,096,279**	**$22,171,704**	**$126,743,701**	**$739,780,889**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-57 Colusa County Planning Area – Count and Value of Parcels in Rancho Rubini Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	0	0	$0	$0	$0	$0	$0
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	2	2	$209,011	$176,093	$0	$104,980	$490,084
Grand Total	**2**	**2**	**$209,011**	**$176,093**	**$0**	**$104,980**	**$490,084**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-58 Unincorporated Colusa County – Count and Value of Parcels in Rancho Rubini Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	1	1	$140,744	$33,866	$0	$33,866	$208,476
Commercial	0	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
Residential	1	1	$68,267	$142,227	$0	$71,114	$281,608
Unincorporated Colusa County Total	**2**	**2**	**$209,011**	**$176,093**	**$0**	**$104,980**	**$490,084**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-59 Colusa County Planning Area – Count and Value of Parcels in Shasta Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	2,334	2,077	$144,303,544	$443,767,787	$49,228,543	$309,495,963	$946,795,837
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	3,067	1,490	$711,435,016	$222,619,493	$42,124,385	$187,464,749	$1,163,643,643
Grand Total	**5,401**	**3,567**	**$855,738,560**	**$666,387,280**	**$91,352,928**	**$496,960,712**	**$2,110,439,480**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-60 Unincorporated Colusa County – Count and Value of Parcels in Shasta Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	1,939	810	$620,417,954	$108,865,792	$30,538,004	$108,865,792	$868,687,542
Commercial	97	68	$6,004,719	$16,825,221	$4,029,204	$16,825,221	$43,684,365
Government	149	19	$22,817,179	$1,307,058	$4,375	$1,307,058	$25,435,670
Industrial	26	12	$2,279,116	$11,423,870	$1,856,608	$17,135,805	$32,695,399
Institutional	19	6	$916,273	$1,723,486	$1,885,258	$1,723,486	$6,248,503
Miscellaneous	158	17	$27,154,618	$740,683	$1,669,923	$740,683	$30,305,907
Residential	679	558	$31,845,157	$81,733,383	$2,141,013	$40,866,704	$156,586,257
Unincorporated Colusa County Total	**3,067**	**1,490**	**$711,435,016**	**$222,619,493**	**$42,124,385**	**$187,464,749**	**$1,163,643,643**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-61 Colusa County Planning Area – Count and Value of Parcels in Whiskeytown Dam Inundation Area by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa	2,334	2,077	$144,303,544	$443,767,787	$49,228,543	$309,495,963	$946,795,837
City of Williams	0	0	$0	$0	$0	$0	$0
Unincorporated Colusa County	1,937	1,064	$392,883,131	$173,034,903	$34,043,357	$142,614,065	$742,575,456
Grand Total	**4,271**	**3,141**	**$537,186,675**	**$616,802,690**	**$83,271,900**	**$452,110,028**	**$1,689,371,293**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Table 4-62 Unincorporated Colusa County – Count and Value of Parcels in Whiskeytown Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Agricultural	1,138	528	$334,977,775	$77,682,482	$24,607,844	$77,682,482	$514,950,583
Commercial	73	53	$5,180,898	$10,224,497	$2,882,914	$10,224,497	$28,512,806
Government	100	14	$12,991,666	$1,154,477	$4,375	$1,154,477	$15,304,995
Industrial	20	10	$2,045,713	$10,665,718	$1,493,698	$15,998,577	$30,203,706
Institutional	17	4	$910,879	$1,673,371	$1,829,749	$1,673,371	$6,087,370
Miscellaneous	44	6	$8,473,978	$126,943	$1,579,253	$126,943	$10,307,117
Residential	545	449	$28,302,222	$71,507,415	$1,645,524	$35,753,718	$137,208,879

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Unincorporated Colusa County Total	**1,937**	**1,064**	**$392,883,131**	**$173,034,903**	**$34,043,357**	**$142,614,065**	**$742,575,456**

Source: Cal OES/DSOD, 2023 Colusa County Parcel/Assessor Data

Critical Facilities and Infrastructure

Dam failure presents a threat to critical facilities and infrastructure. For example, transportation routes, including bridges and highways, are vulnerable to dam inundation and have the potential to be wiped out, creating isolation and supply chain issues. Those critical facilities that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. The following GIS analysis identifies critical facilities and infrastructure at risk to dam inundation flooding. It is separated by extremely high hazard and high hazard dams.

Extremely High Hazard Dam Inundation Analysis

A separate analysis was performed on the critical facility inventory in the City to determine critical facilities in the extremely high hazard dam inundation areas. Using GIS, each extremely high hazard dam inundation area was overlayed on the critical facility GIS layer. This is shown on Figure 4-52. Table 4-63 details which critical facilities fall in the extremely high hazard dam inundation area. As seen, only Oroville Dam has critical facilities in its inundation area. Details of critical facility categories, type, name, and address by dam inundation area are listed in Appendix F.

Figure 4-52 Colusa County Planning Area – Critical Facilities in Extremely High Hazard Dam Inundation Zones

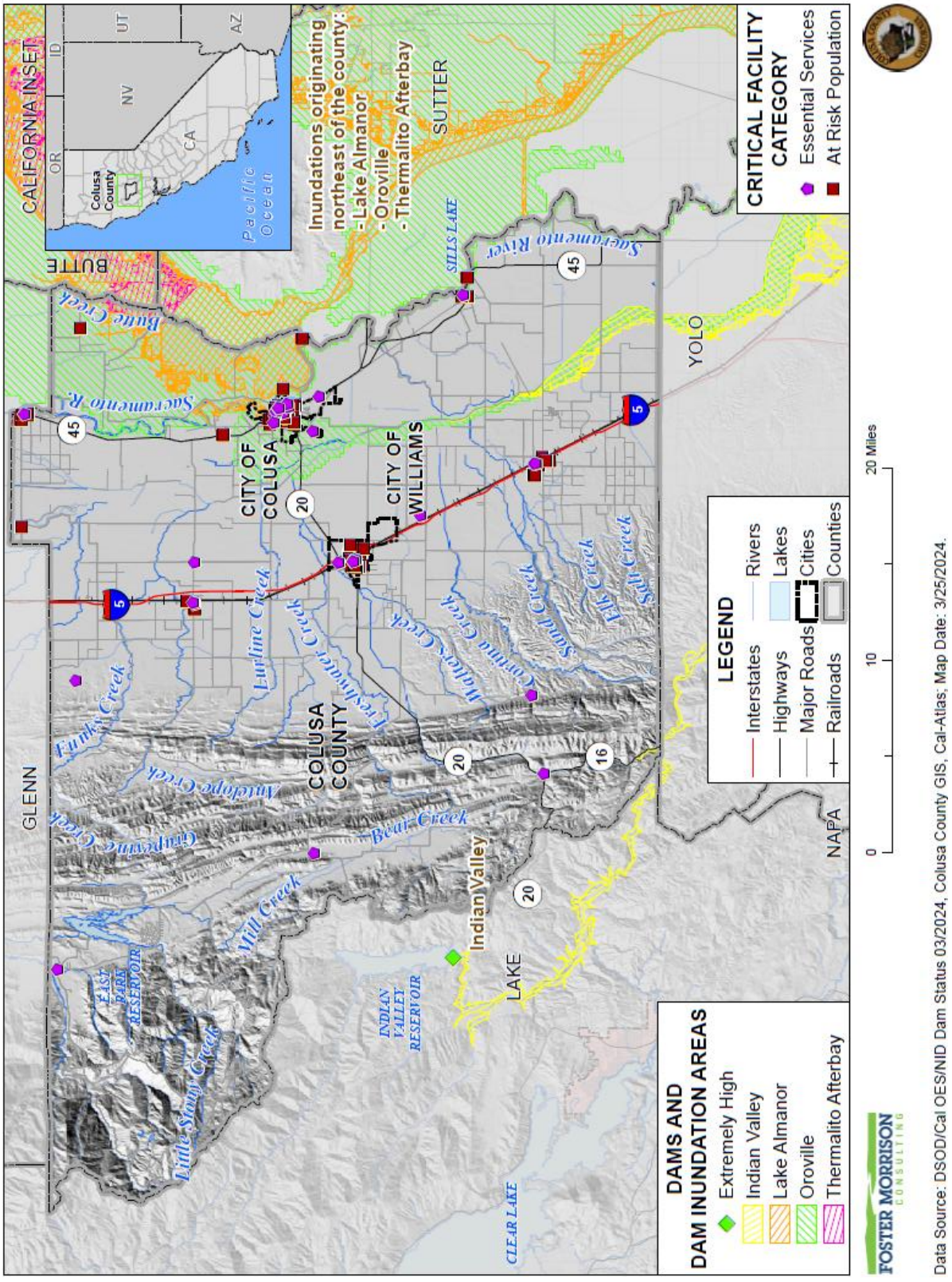


Table 4-63 Colusa County Planning Area – Critical Facilities in Oroville Dam Inundation Zones by Critical Facility Category, Type, and Jurisdiction

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
City of Colusa		
Essential Services Facilities	Emergency Response	1
	Fire Station	2
	Medical	1
	Police Station	1
	Public Services	2
	Utility Facility	2
	Total	**9**
At Risk Population Facilities	Apartment Complex	19
	Assisted-Living	1
	Hotel or Motel	2
	Jail	1
	Mobile Home Park	4
	School	8
	Senior Living Facility	1
	Total	**36**
City of Colusa Total		**45**
Unincorporated Colusa County		
At Risk Population Facilities	Apartment Complex	1
	Mobile Home Park	5
	Total	**6**
Unincorporated Colusa County Total		**6**
Grand Total		**51**

Source: DSOD/Cal OES/NID Dam Status 03/24, Colusa County GIS

High Hazard Dam Inundation Analysis

A separate analysis was performed on the critical facility inventory in the County to determine critical facilities in the high hazard dam inundation areas. Using GIS, each high hazard dam inundation area was overlayed on the critical facility GIS layer. This is shown on Figure 4-53. Three dams have inundation areas that affect critical facilities in the Colusa County Planning Area: Black Butte (see Table 4-64), Shasta (see Table 4-65), and Whiskeytown (see Table 4-66). These tables detail which critical facilities fall in the high hazard dam inundation area. Details of critical facility categories, type, name, and address by dam inundation area are listed in Appendix F.

Figure 4-53 Colusa County Planning Area – Critical Facilities in the High Hazard Dam Inundation Areas

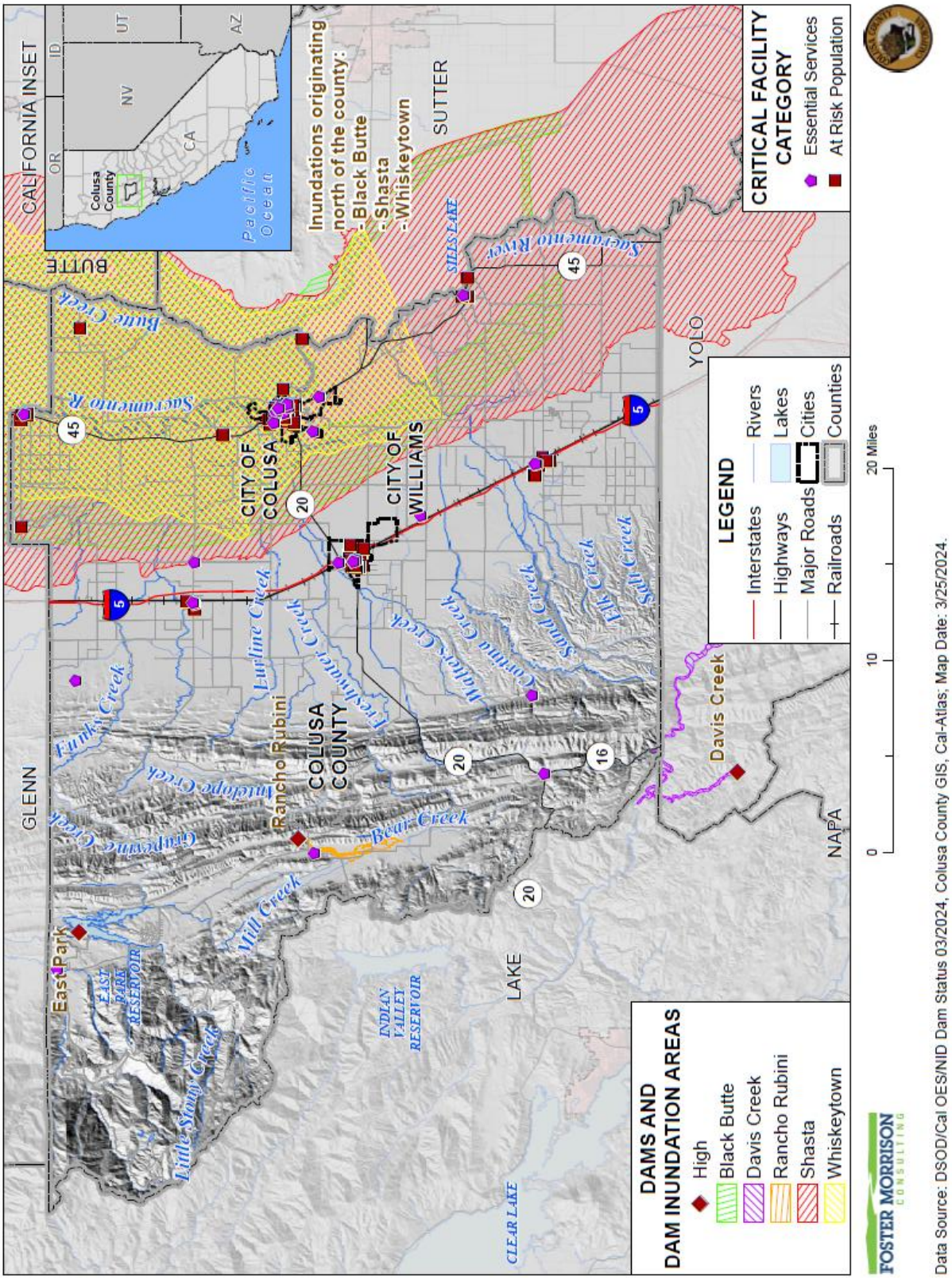


Table 4-64 Colusa County Planning Area – Critical Facilities in Black Butte Dam Inundation Zones by Critical Facility Category, Type, and Jurisdiction

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
City of Colusa		
Essential Services Facilities	Emergency Response	1
	Public Services	1
	Utility Facility	1
	Total	**3**
At Risk Population Facilities	Mobile Home Park	2
	Total	**2**
City of Colusa Total		**5**
Unincorporated Colusa County		
Essential Services Facilities	Fire Station	1
	Total	**1**
At Risk Population Facilities	Apartment Complex	1
	Casino	1
	Hotel or Motel	1
	Mobile Home Park	5
	School	2
	Total	**10**
Unincorporated Colusa County Total		**11**
Grand Total		**16**

Source: DSOD/Cal OES/NID Dam Status 03/24, Colusa County GIS

Table 4-65 Colusa County Planning Area – Critical Facilities in Shasta Dam Inundation Zones by Critical Facility Category, Type, and Jurisdiction

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
City of Colusa		
Essential Services Facilities	Emergency Response	1
	Fire Station	2
	Medical	1
	Police Station	1
	Public Services	3
	Utility Facility	2
	Total	**10**
At Risk Population Facilities	Apartment Complex	22

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
	Assisted-Living	1
	Hotel or Motel	2
	Jail	1
	Mobile Home Park	5
	School	8
	Senior Living Facility	1
	Total	**40**
City of Colusa Total		**50**
Unincorporated Colusa County		
Essential Services Facilities	Fire Station	2
	Total	**2**
At Risk Population Facilities	Apartment Complex	3
	Casino	1
	Hotel or Motel	1
	Mobile Home Park	7
	School	3
	Total	**15**
Unincorporated Colusa County Total		**17**
Grand Total		**67**

Source: DSOD/Cal OES/NID Dam Status 03/24, Colusa County GIS

Table 4-66 Colusa County Planning Area – Critical Facilities in Whiskeytown Dam Inundation Zones by Critical Facility Category, Type, and Jurisdiction

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
City of Colusa		
Essential Services Facilities	Emergency Response	1
	Fire Station	2
	Medical	1
	Police Station	1
	Public Services	3
	Utility Facility	2
	Total	**10**
At Risk Population Facilities	Apartment Complex	22
	Assisted-Living	1
	Hotel or Motel	2

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
	Jail	1
	Mobile Home Park	5
	School	8
	Senior Living Facility	1
	Total	**40**
City of Colusa Total		**50**
Unincorporated Colusa County		
Essential Services Facilities	Fire Station	1
	Total	**1**
At Risk Population Facilities	Apartment Complex	2
	Casino	1
	Hotel or Motel	1
	Mobile Home Park	5
	School	2
	Total	**11**
Unincorporated Colusa County Total		**12**
Grand Total		**62**

Source: DSOD/Cal OES/NID Dam Status 03/24, Colusa County GIS

Community Lifelines

Dam failure flooding presents a threat to life and property, including community lifelines in the Colusa County Planning Area. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Community lifelines that would be at risk to dam failure flooding include:

- **Safety and Security** – Police, Fire, EMS, and Public Works personnel are often called on to respond during flood emergencies. This would be especially true in a dam failure event. Search and rescue and swiftwater teams may be called on to perform riskier duties during times of heavy rains and flooding.
- **Food, Hydration, Shelter** – a dam failure would displace many residents in the Planning Area. Some would need shelter, as well as food and water.
- **Health and Medical** – There is the potential for multiple injuries and deaths from a catastrophic dam failure taxing health and medical facilities. Casualty and patient movement from the inundation areas and unrelated incidents by EMS may be significantly impacted and have to be rerouted. Public health facilities can also be at risk from flooding caused by dam failures.
- **Energy** – Dam failure could impact large areas of above ground electric infrastructure, causing widespread power outages. Dam failure could also affect fueling stations, as well as electric car charging stations.
- **Communications** – An influx of service calls to dispatch centers for reporting of flooding, power outages, and rescues or other issues can occur resulting in communication networks going down for extended periods of time. Messaging systems need to be deployed during these events to let the public

know about road closures, washouts, debris on roads, or lane closures. Calls to and from family and friends during a hazard event can further overwhelm communication systems such as cell towers and other infrastructure. Demand may exceed the capacity of these systems to remain operational during response efforts.

- **Transportation** – Highways and local roads may see extensive flooding. Bridges can be damaged or destroyed. This can cause lane closures or road closures and limit available routes altogether. These closures can affect response personnel (EMS, Fire, Police) as well as cause additional traffic issues for residents. Evacuation efforts may be difficult and further put people at risk of death or injury.
- **Hazardous Material** – Hazardous material facilities can be affected by flooding. Releases during these events can contribute to the dangers of floodwaters and cause contamination of potable water sources, as well as additional exposure to the environment.
- **Water Systems** – Any water (or wastewater) system located in a dam inundation area may be affected by dam failure flooding. The Planning Area's stormwater drainage system and facilities may also be affected.

A large dam failure event could overwhelm many community lifelines in the Colusa County Planning Area. As shown on the maps and tables above, there are multiple dams that would affect large swaths of the Planning Area. A failure of many of these dams could, at least temporarily, overwhelm the community lifelines in place in affected areas of the Planning Area.

Natural, Historic, and Cultural Resources

A major dam failure event and associated flooding could have a devastating impact on the Colusa County Planning Area. Large flood events can affect all natural, historic, and cultural resources that lie in the dam inundation areas. There are a number of ways floodwaters associated with a dam failure event can impact natural resources and the environment: Wildlife habitats can be destroyed by floodwaters. Contaminated floodwater can pollute rivers and habitats. Silt and sediment can destroy natural areas. Riverbanks and natural levées can be eliminated as rivers reach bankfull capacity. Rivers can be widened, and deposition can increase downstream. Trees can be uprooted by high-velocity water flow. Plants that survive the initial flood may die due to being inundated with water. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to these structures within the inundated areas, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged, and lost during extreme flood events.

Economic Assets and Community Activities of Value

As shown on the maps and tables above, there are multiple dams that would affect large swaths of the Colusa County Planning Area should they fail. Many economic assets of the Planning Area would be at least temporarily disrupted. Many of these would come back online relatively quickly after a dam failure flood event, but some would take longer to re-engage in business. Some economic assets may be damaged to the point where the business or area would no longer be economically viable to continue to operate. Depending on the time of year the dam failure occurs, the agricultural sector in the County could see significant damages. This is discussed in more detail in Section 4.3.6. Depending on the dam that failed, most community activities of value would be affected if they occurred during a dam failure event. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Impacts from Dam Failure

Impacts to the Colusa County Planning Area from dam failure flooding could be extensive and widespread and include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant.

Other impacts associated with dam failure are landslides, bank erosion, and destruction of habitat. Dam failures can cause downstream flooding and can transport large volumes of sediment and debris and contaminants from the floodwaters. Other environmental impacts can include contamination from septic system failures and releases of contaminants from hazardous materials facilities, contamination of potable water supplies; changes in configurations of streams; loss of wildlife habitats; and degradation of wetlands. A large dam failure event could have significant and catastrophic impacts.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future rain and storm conditions and associated impacts and vulnerability of the County to dam failure.
- Population growth in Colusa County has recently slowed; however, additional growth within the dam inundation areas of the County would place additional populations at risk to dam failure. Additional population growth would likely bring continued diversity to the County. Vulnerable population groups could face disproportionate effects from a dam failure and should be planned for. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. Locating new development, structures, and critical facilities and infrastructure within or near areas of dam failure risk may put additional development at risk. However, County building codes are in effect to partially reduce this risk and should be updated as necessary to continue to address future dam failure conditions. Thus, depending on the location of new development and adherence to protective building codes, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more resilient community. 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.

GIS Analysis

Colusa County provided 53 future development areas which were used as the basis for the inventory of future development for the unincorporated County. These were mapped in GIS. Where multiple parcels are listed, the parcels are merged to form one polygon, and the hazards assigned are based on the centroid of the polygon. Figure 4-54 and Figure 4-55 show the locations of the future development areas overlayed on the extremely high and high hazard dam inundation areas, respectively. Table 4-67 shows the details of the future development areas that are located in both the extremely high and high hazard dam inundation areas.

Figure 4-54 Unincorporated Colusa County – Future Development Areas in Extremely High Hazard Dam Inundation Areas

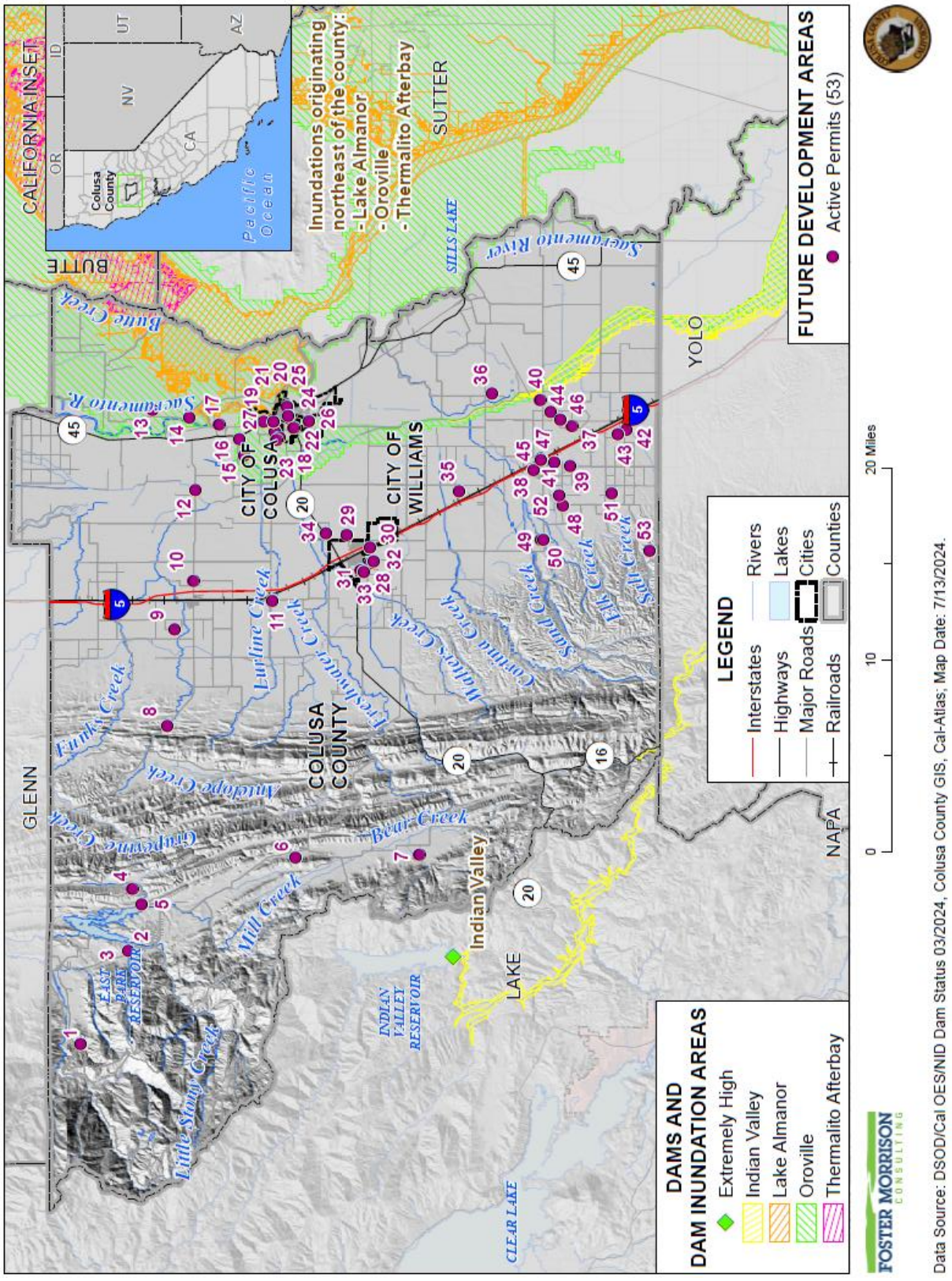


Figure 4-55 Unincorporated Colusa County – Future Development Areas in High Hazard Dam Inundation Areas

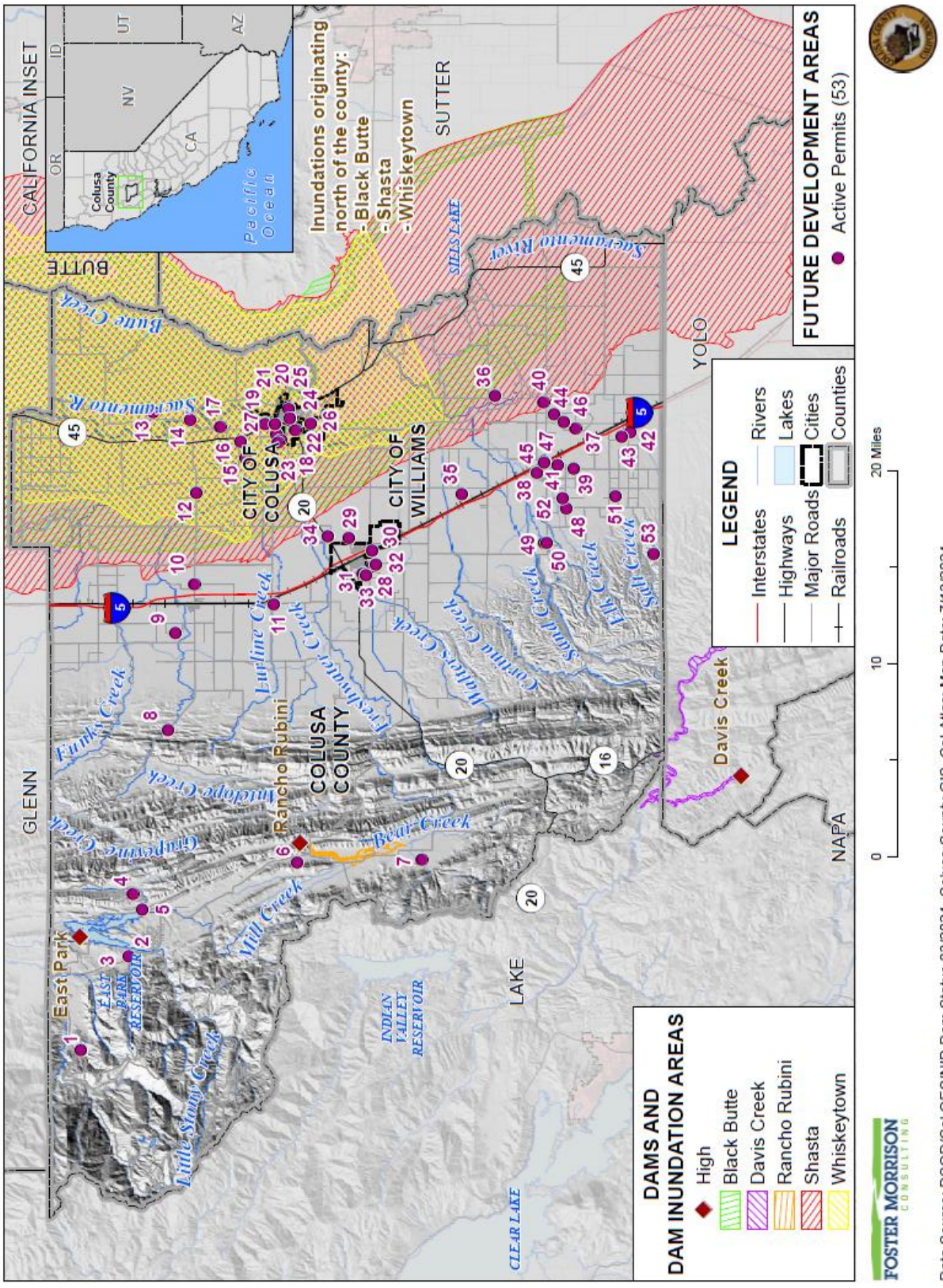


Table 4-67 Unincorporated Colusa County – Future Development Areas in Extremely High and High Hazard Dam Inundation Areas with Parcel Counts and Acreages

Dam Classification/ Dam	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
Extremely High Dam Inundation Area				
	13	4374 RIVER RD	1	402.44
	14	4073 RIVER RD	1	10.32
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	18	3258 MCCOY RD	1	6.01
	19	015-310-050-000	1	11.97
	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	23	3286 RANCH RD	1	1.85
	24	1232 FIFTH ST	1	0.60
	25	002-101-004-000	1	4.48
	27	1773 LURLINE AVE	1	3.40
Oroville Total			13	957.55
High Dam Inundation Area				
Black Butte	12	6458 MAXWELL RD	1	319.89
	13	4374 RIVER RD	1	402.44
	14	4073 RIVER RD	1	10.32
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	17	015-030-094-000	1	17.03
	18	3258 MCCOY RD	1	6.01
	19	015-310-050-000	1	11.97
	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	23	3286 RANCH RD	1	1.85
	27	1773 LURLINE AVE	1	3.40
	Black Butte Total		**13**	**1,289.39**
Shasta	12	6458 MAXWELL RD	1	319.89
	13	4374 RIVER RD	1	402.44
	14	4073 RIVER RD	1	10.32

Dam Classification/ Dam	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	17	015-030-094-000	1	17.03
	18	3258 MCCOY RD	1	6.01
	19	015-310-050-000	1	11.97
	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	23	3286 RANCH RD	1	1.85
	24	1232 FIFTH ST	1	0.60
	25	002-101-004-000	1	4.48
	26	015-380-019-000	1	1.00
	27	1773 LURLINE AVE	1	3.40
	36	019-090-058-000	1	10.00
	40	7251 TULE RD	1	2.64
	Shasta Total		**18**	**1,308.12**
Whiskeytown	12	6458 MAXWELL RD	1	319.89
	13	4374 RIVER RD	1	402.44
	14	4073 RIVER RD	1	10.32
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	17	015-030-094-000	1	17.03
	18	3258 MCCOY RD	1	6.01
	19	015-310-050-000	1	11.97
	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	23	3286 RANCH RD	1	1.85
	24	1232 FIFTH ST	1	0.60
	25	002-101-004-000	1	4.48
	26	015-380-019-000	1	1.00
	27	1773 LURLINE AVE	1	3.40
	Whiskeytown Total		**16**	**1,295.47**

Source: Cal OES/DSOD, Colusa County GIS

4.3.9. Drought and Water Shortage

Hazard Profile

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

Hazard/Problem Description

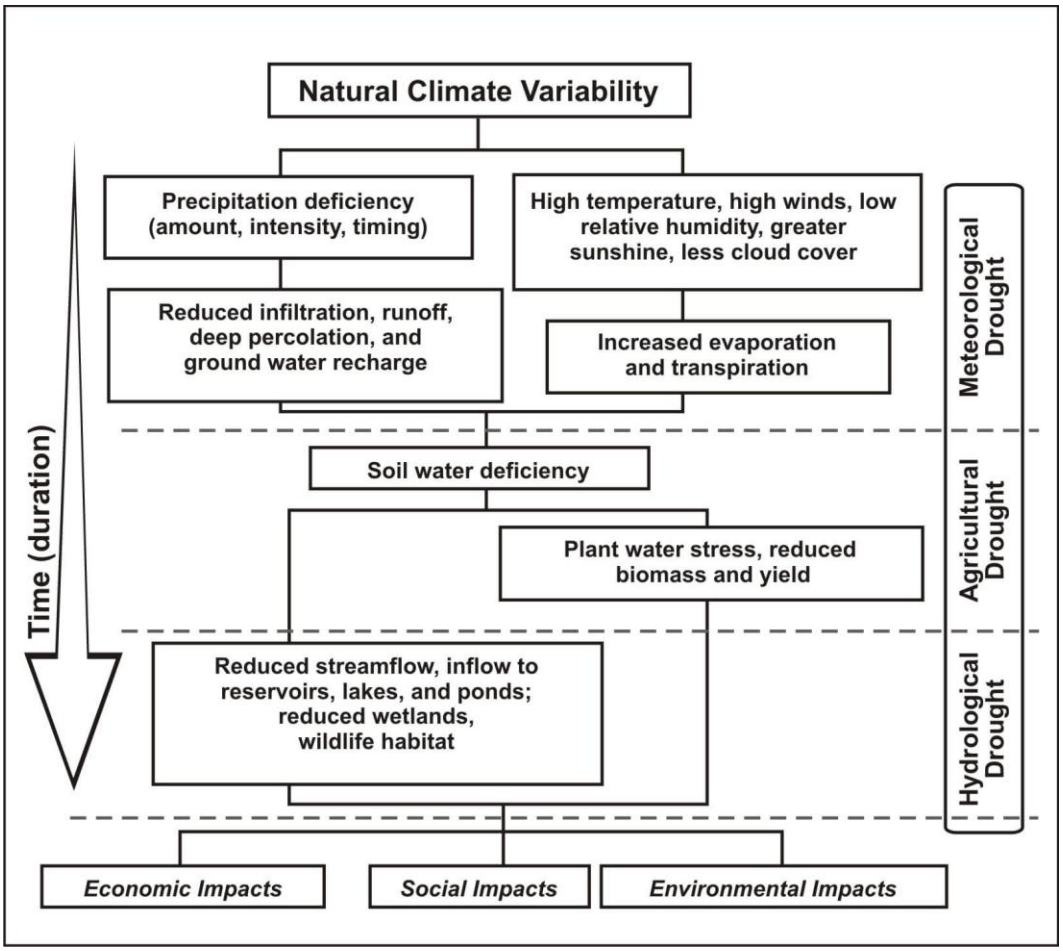
Drought

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.

Drought is a complex issue involving (see Figure 4-56) 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 4-56 Causes and Impacts of Drought

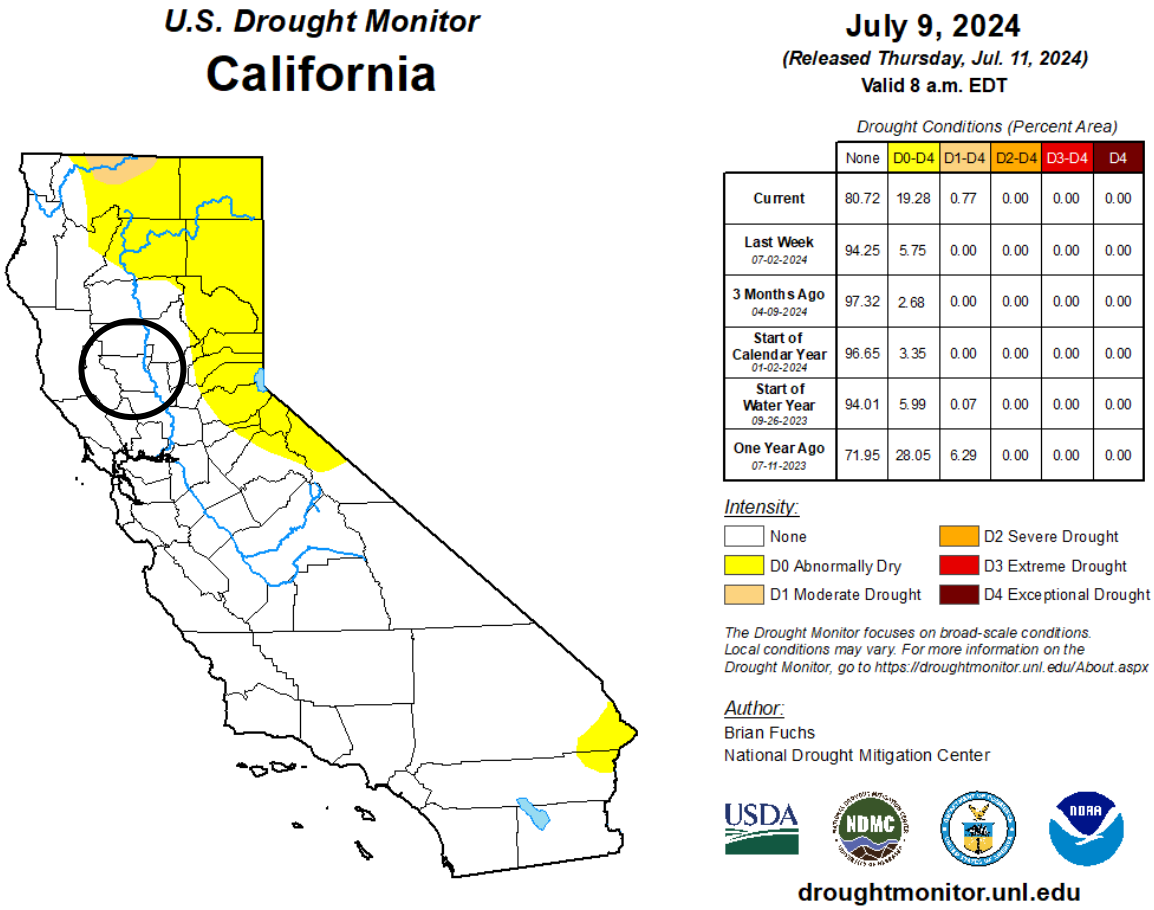


Source: National Drought Mitigation Center (NDMC)

Location and Extent of Drought

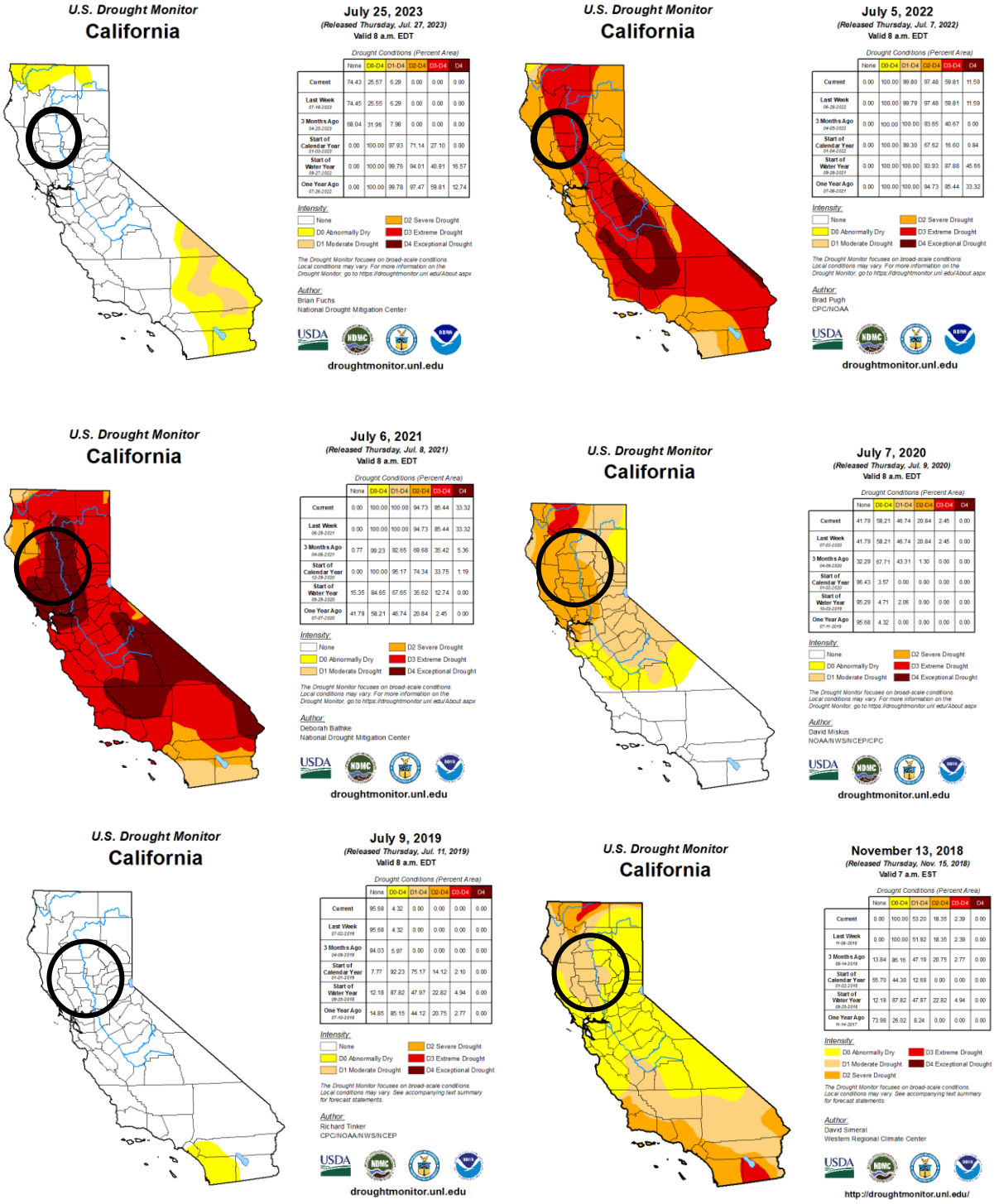
Drought is a regional phenomenon that affects the entire Colusa County Planning Area. Drought in the United States is monitored by the National Integrated Drought Information System (NIDIS). A major component of this portal is the U.S. Drought Monitor. The Drought Monitor concept was developed jointly 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 current 2023 drought conditions in California and the Colusa County Planning Area can be found in Figure 4-57. Snapshots from 2014 to 2023 are shown in Figure 4-58 and Figure 4-59. As seen in these figures and related data, the Planning Area has been in and out of drought over the past ten years since the last drought started in 2014.

Figure 4-57 Colusa County Planning Area – Current Drought Status



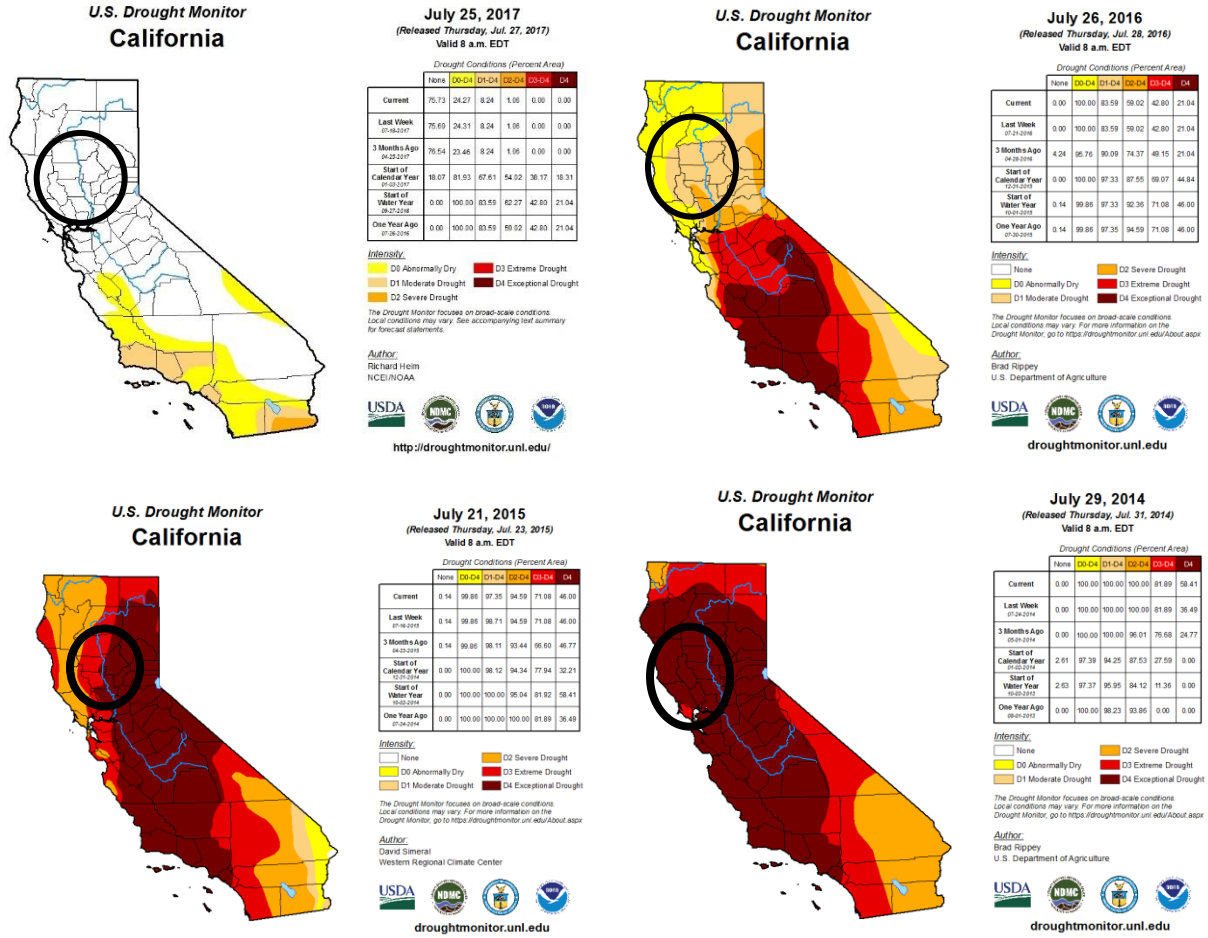
Source: US Drought Monitor

Figure 4-58 Previous Drought Status in Colusa County (2018-2023)



Source: US Drought Monitor

Figure 4-59 Previous Drought Status in Colusa County (2014-2017)



Source: US Drought Monitor

Cal 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 domestic uses, farming and federally protected fish habitats in California further 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)

Drought has a slow onset and long duration. Drought is not initially recognized as a problem because it normally originates in what is considered good weather, which typically includes a dry late spring and summer in Mediterranean climates, such as in California. This is particularly true in Northern California where drought impacts are delayed for most of the population by the wealth of stored surface and ground water. The drought complications normally appear more than a year after a drought begins. The most direct and likely most difficult drought impact to quantify is to local economies, especially agricultural economies. Drought has the potential to affect the entire Colusa County Planning Area.

Water Shortage

Northern California communities, including the Colusa County Planning Area, 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 2010 General Plan Background Report and the 2021 Colusa County Groundwater Sustainability Report noted that water supplied to Colusa County comes from two sources: groundwater and surface water. All domestic water systems in the County are supplied with groundwater, while most irrigation systems are supplied with surface water from the Tehama-Colusa or Glenn-Colusa Canals, the Colusa Drain, or the Sacramento River. The surface water supplies available for use in Colusa County are significant. Surface water is used on 74 to 86 percent of the irrigated land within the Sacramento Valley portion of the County. Whereas, groundwater is used on 10 to 22 percent of that land. Of the land where groundwater is used, 6 to 11 percent is not within the service area of any organized entity. There are community water systems located in Arbuckle, Maxwell, Princeton, Grimes, Stonyford, and the Cities of Colusa and Williams. There are also numerous private groundwater wells located throughout the County that serve individual parcels throughout the unincorporated areas of the County. Colusa County's access to water makes water shortage a less threatening hazard to the Planning Area.

Location and Extent of Water Shortage

Since water shortage generally happens on a regional scale, the entirety of the Colusa County Planning Area 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 and the status of the water sources going into the drought. The extent of the drought considers several factors, including the nature, source, and reliability of water. While drought conditions persist, the Planning Area has sufficient water supply from water supplies, which lessens the extent of water shortage impacts in the Planning Area.

Past Occurrences

Disaster Declaration History

There have been three state and one federal disaster declarations for Colusa County. These are shown on Table 4-68. More information on USDA disaster declarations from drought (fourteen events) can be found in Table 4-42 in the Past Occurrences in Section 4.3.6.

Table 4-68 Colusa County – Federal and State Drought Disaster Declarations 1950-2024

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Drought	1	1977	3	1976, 2014, 2021

Source: Cal OES, FEMA

NCDC Events

There have been 58 NCDC drought events in Colusa County. This is shown on Table 4-69.

*Table 4-69 NCDC Drought Events for Colusa County 1950-8/31/2023**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Drought	58	0	0	0	0	$0	$0

Source: NCDC

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

EOC Activations

The HMPC noted that there have been times where the County EOC has been activated for drought response. This is shown on Table 4-70.

Table 4-70 Colusa County – EOC Activations from Drought 2008-2024

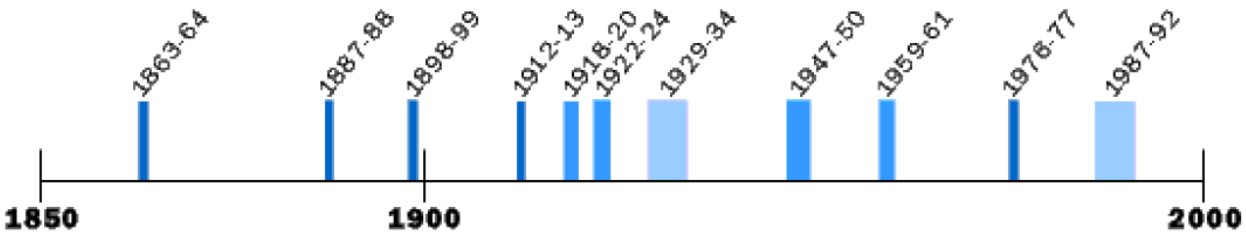
Disaster Type	EOC Activations	
	Count	Date
Drought	3	6/2015; 10/2017, 1/2019

Source: Colusa County

CA DWR Events (with Hazard Mitigation Planning Team Input)

Historically, California has experienced multiple severe droughts. According to the DWR, droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. Figure 4-60 depicts California's Multi-Year Historical Dry Periods, 1850-2000. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large northern California reservoirs. Figure 4-61 compares the 1929-34 drought to the 1976-77, 1987-92, 2007-09, and 2012-2016 droughts.

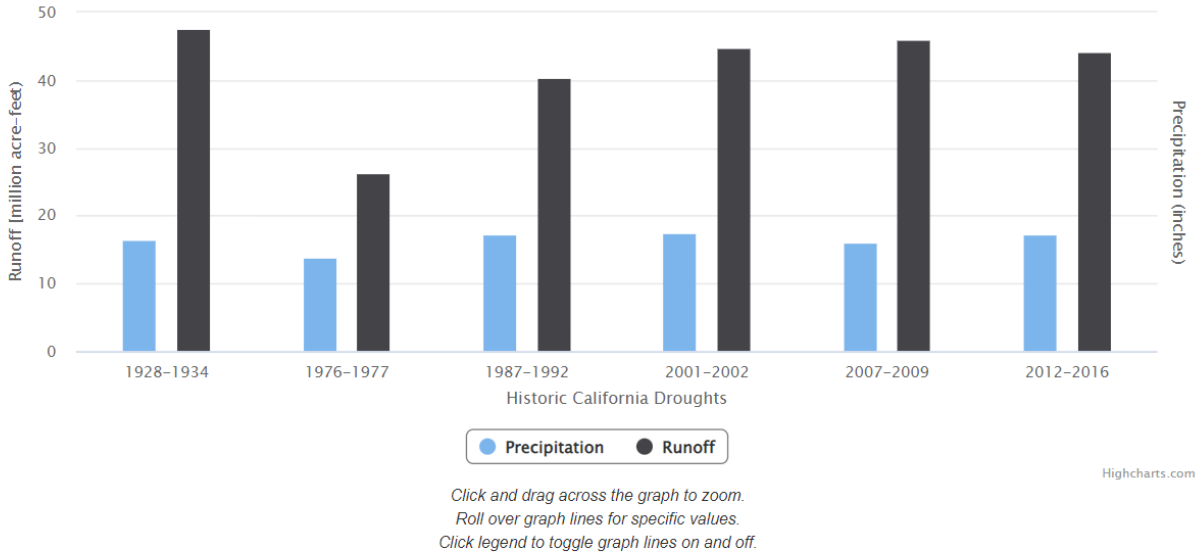
Figure 4-60 California's Multi-Year Historical Dry Periods, 1850-2000



Source: Cal DWR

Notes: Dry periods prior to 1900 estimated from limited data; covers dry periods of statewide or major regional extent

Figure 4-61 Average Annual Runoff and Precipitation for Historic Droughts

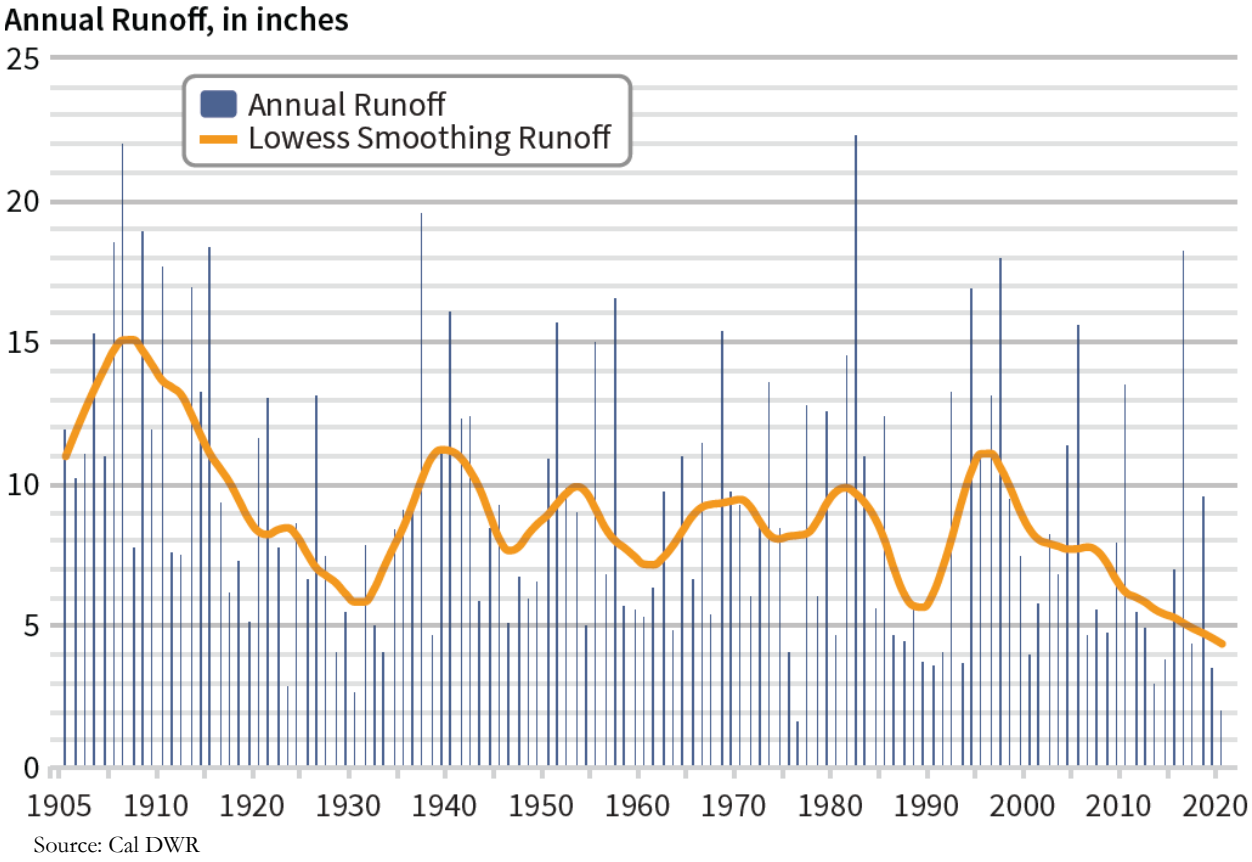


Runoff and precipitation conditions for California's six historical droughts. The most severe drought both in terms of precipitation and runoff was the drought of 1976-77. However, because it was just a two-year drought, the water supply impacts were not as severe as those associated with the longer duration droughts because shorter droughts can be partially mitigated by surface and groundwater storage.

Source: CA DWR – 2012-2016 California Drought: Historical Perspective (https://ca.water.usgs.gov/california-drought/california-drought-comparisons.html)

Figure 4-62 depicts runoff for the State from 1905 to 2021. This gives a historical context for the 2014-2021 drought to compare against past droughts.

Figure 4-62 Annual California Runoff –1905 to 2021



Source: Cal DWR

The 2018 and 2023 California State Hazard Mitigation Plan discussed the major droughts from 1900 to 2022. The 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.

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, 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 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 (which carried forward until 2023 after a pause in 2017)

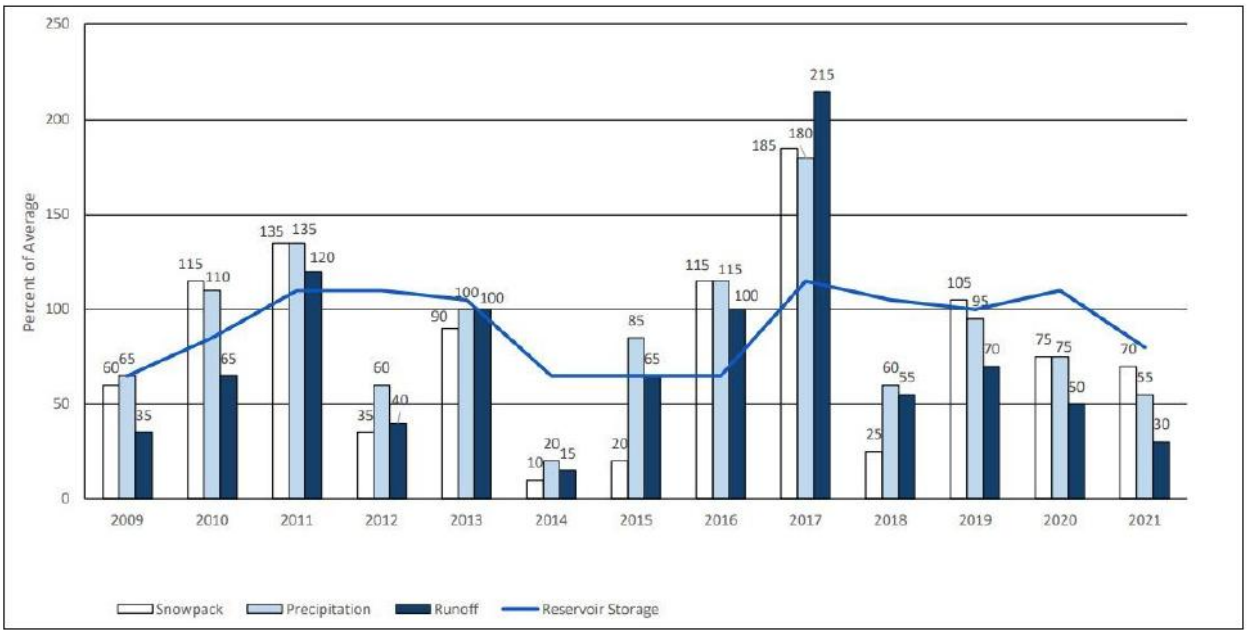
The statewide drought of 2012-2017, which is still ongoing, will be remembered as one of the most severe and costliest droughts of record in California. The drought that spanned water years 2012 through 2017 included the driest four-year statewide precipitation on record (2012-2015) and the smallest 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.

Colusa County issues a local proclamation for drought on March 5, 2021. This coincides with many of the drought declarations from the USDA (discussed in more detail in Section 4.3.6 above).

Water Shortage

Figure 4-63 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 2021. The chart illustrates the cyclical nature of weather patterns in California.

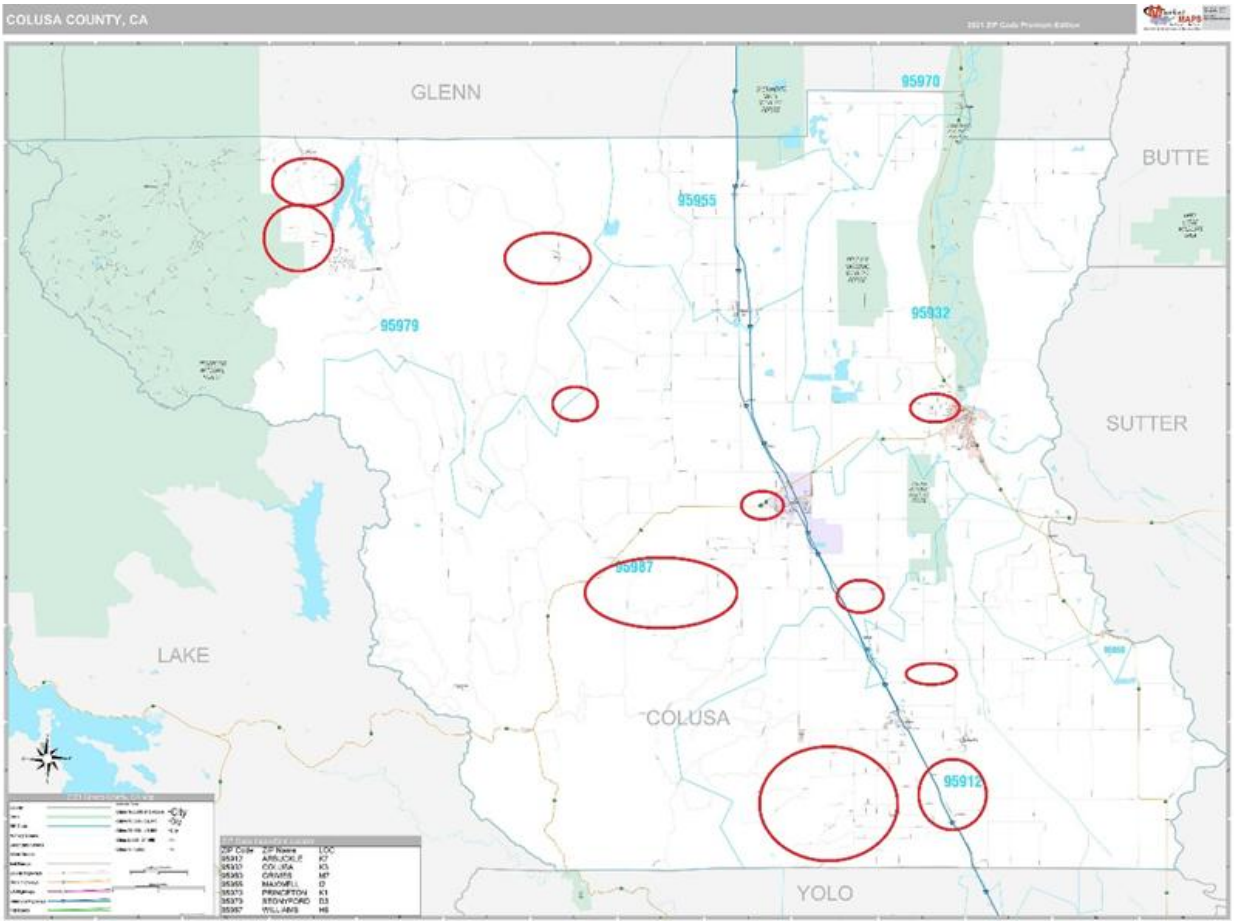
Figure 4-63 Water Supply Conditions, 2009 to 2021



Source: 2023 State of California Hazard Mitigation Plan

The County noted that during drought conditions in 2021 to 2023, wells in areas went dry. These areas can be seen in Figure 4-64. During this time 20 wells were reported as dry in 2021 and 1 was reported as dry in 2022. Many of these dry wells affected individuals who could not afford the additional costs of drilling a deeper well. Additionally, pumping from deeper wells requires larger pumps, which add to the costs of well drilling and deepening.

Figure 4-64 Colusa County – Drought Affected Well Locations from 2021/2022



Source: Colusa County OES

Dry wells caused County residents to have to rely on water deliveries. From June 2021 – November 3, 2021, there were 241,539 gallons of water delivered. From November 2021 – July 2022 533,000 gallons of water delivered. Beginning in August of 2022 the County tracked monthly deliveries:

- 35,500 gallons August 2022
- 41,000 gallons September 2022
- 57,000 gallons October 2022
- 57,600 gallons November 2022
- 42,000 gallons December 2022
- 64,500 gallons January 2023
- 58,500 gallons February 2023
- 41,000 gallons March 2023
- 39,500 gallons April 2023
- 31,000 gallons May 2023
- 36,500 gallons June 2023
- 14,000 gallons July 2023
- 15,000 gallons August 2023
- 2,000 gallons September 2023

- 5,000 gallons October 2023
- 9,500 gallons November 2023
- 2,500 gallons December 2023

Likelihood of Future Occurrence

Drought

Likely—Historical drought data for the Colusa County Planning Area indicate there have been 5 significant droughts in the last 86 years. This equates to a drought every 16.8 years on average or a 6.0 percent chance of a drought in any given year. Based on this data and given the multi-year length of droughts and future climate change affects, the Colusa County Planning Area determined that future drought occurrence continues to be likely.

Water Shortage

Occasional — Recent historical data for water shortage indicates that California and the Colusa County Planning Area 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 Planning Area in the future during extreme drought conditions. New development, landscaping, and road paving put stress on water resources. The supply of water is currently sufficient, but as population grows and land use patterns shift, it will be necessary to consider the added stress that new development will put on water demand and quality.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and drought and water shortage can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

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 2021 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.

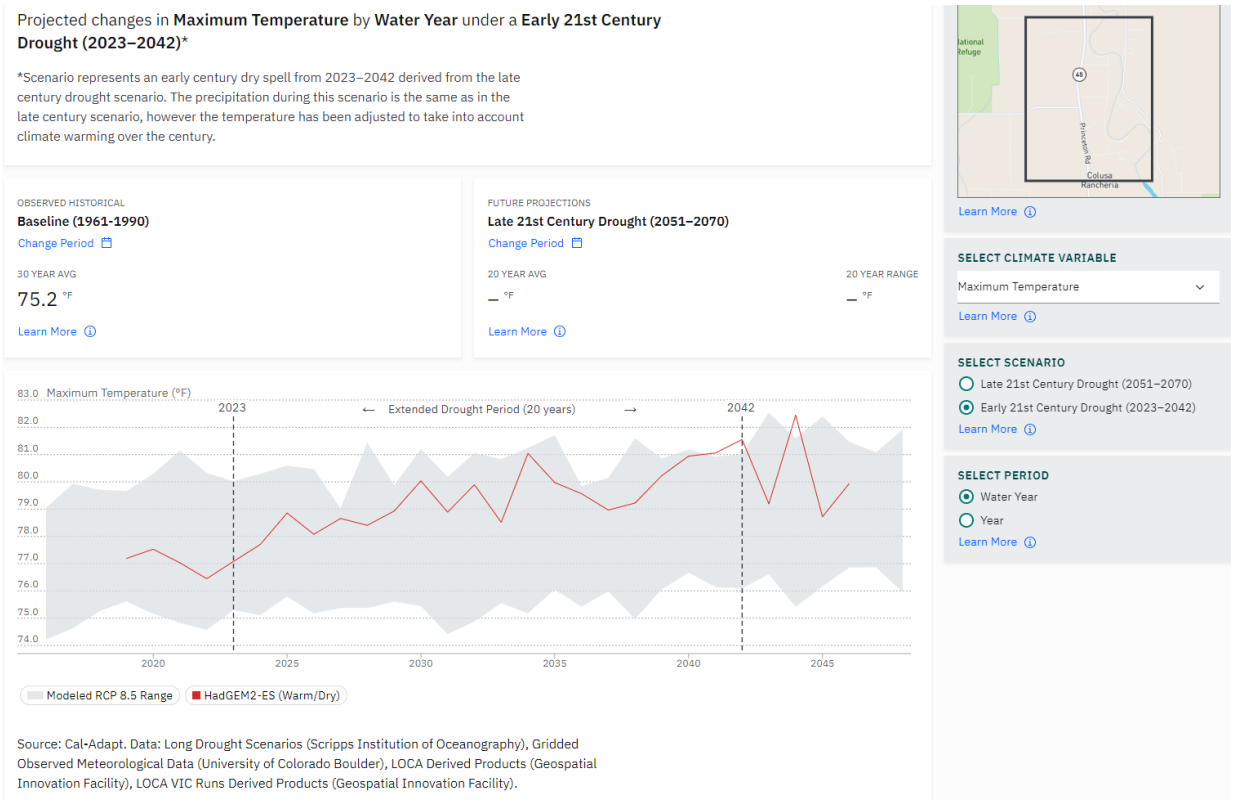
A 2018 report from the Public Policy Institute of California noted that thousands of Californians – mostly in rural, small, disadvantaged communities – already face acute water scarcity, contaminated groundwater, or complete water loss. Climate change would make these effects worse.

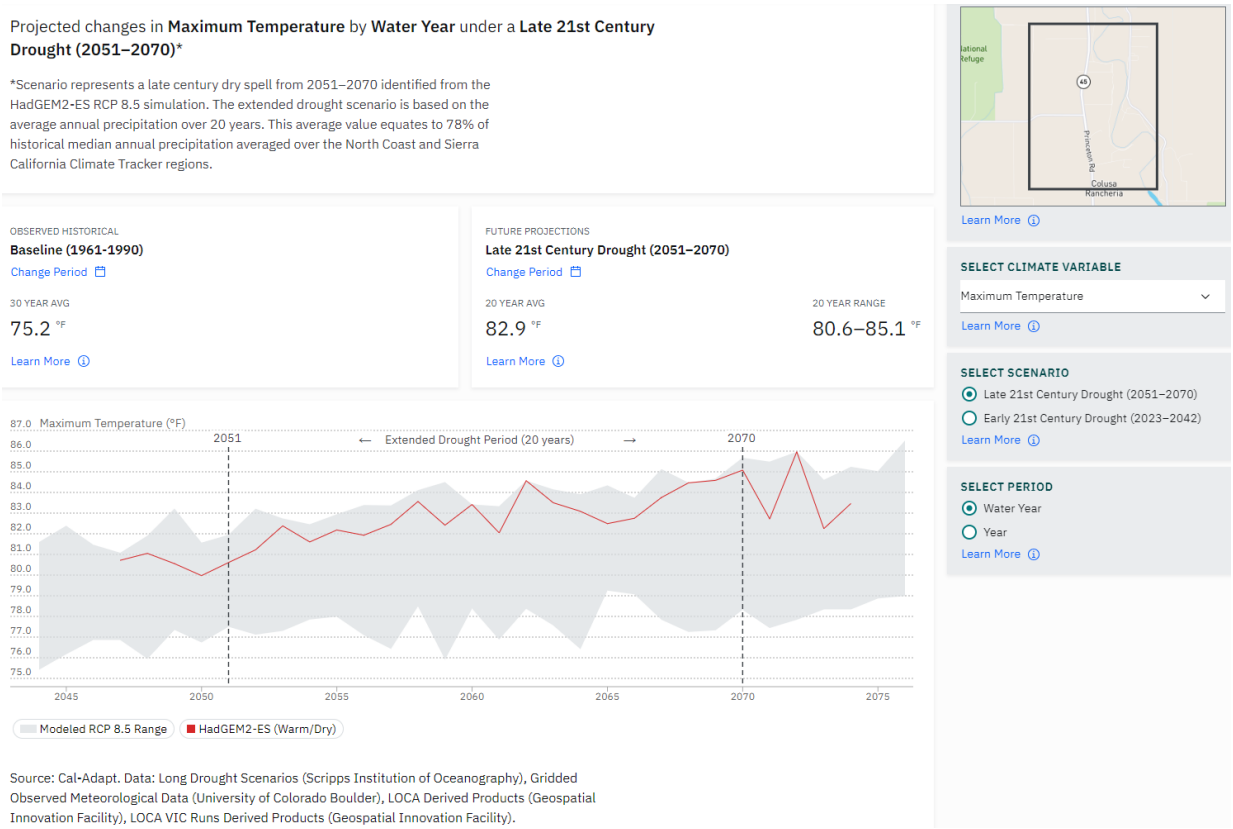
Cal-Adapt has modeled future risk of drought. Recent research suggests that extended drought occurrence ("mega-drought") could become more pervasive in future decades. This tool explores data for two 20-year drought scenarios (using the quad that contains the City of Colusa in Figure 4-65) derived from LOCA

downscaled meteorological and hydrological simulations – 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 4-65 Colusa County Planning Area – Future Extended Drought Scenarios





Source: Cal Adapt – Extended Drought Scenarios (retrieved 3/20/2023)

Vulnerability Assessment

Vulnerability—High

Based on historical information, the occurrence of drought in California, including the Colusa County Planning Area, 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 can be 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 to drought may vary and include reduction in water supply, turf losses, impacts to natural resources, and an increase in dry fuels and tree dieback.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Tree Mortality and Drought

One of the specific impacts of drought in the Colusa County Planning Area is the increased risk to trees from beetle kill and other insects, pathogens and parasites, and other tree mortality and die back issues. Drought weakens trees and makes them more susceptible to insect infestation and other pathogens. Insects, such as bark beetles and others, frequently attack trees weakened by drought, disease, injuries, or other factors that may stress the tree. These insects and other pathogens can contribute to the decline and eventual death of trees throughout the Planning Area, especially in those areas on the west where the elevations increase.

The tree mortality and dieback problem are a high priority because of the issue of hazardous trees and increased wildfire hazard in the wildland areas and the potential for worsening conditions and expansion into other forested sites in future years. Fuel loading and fire potential are greater in stands as compared to healthy stands due to the higher proportion of dead and dying material. Removal of dead and dying trees near structures, powerlines, and roadways is also a high priority because of the immediate falling hazard.

University of California, Berkeley's Department of Environmental Science, Policy, and Management (ESPM) was commissioned in 2021 to investigate the symptoms and possible causes of the dieback. Preliminary results show that the dieback is driven mostly by environmental stressors, including but not limited to drought, predisposing trees to disease caused by opportunistic pathogens. The report includes best management practices to limit the spread of pathogens. It is important to continue investigating the causes of the tree mortality and dieback to help Planning Area jurisdictional staff track changes over time, recognize where other areas may potentially be susceptible to tree mortality, and apply appropriate best management practices.

Under current drought conditions, competition for resources within forested areas will likely continue to intensify with greater stress increasing tree susceptibility to insect damage and disease, and ultimately increase mortality.

In all vegetation types, drought extends the length of the fire season because of its effect on live and dead fuel moisture, with critical low fuel moisture levels occurring early in spring or summer and extending at least through the first significant rains that typically come in late fall.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

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 (which has happened in the recent past). 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 (discussed in Section 4.3.16) can also occur when the groundwater table is depleted.

Assets at Risk

Assets at risk from drought and water shortage include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

The people and populations of the Colusa County Planning Area are not directly affected by general drought conditions; although, their turfed areas, trees, and other water dependent resources can all be affected. In extreme drought conditions, however, residents and other populations within the Planning Area may be vulnerable to drought and water shortage issues. Drought and water shortage can lead to an increase in wildfires threatening Planning Area residents. Water shortages can have an effect on all of the population in the Planning Area, but often have a greater effect on the unhoused and other vulnerable populations that may be unable to access and afford clean drinking water during shortages. During periods of drought as the costs of water usage may increase, those who are economically disadvantaged may be unable to afford the increased costs of potable water.

Structures

Structures have a limited vulnerability to drought and water shortage. It is the secondary hazard of drought (wildfire) which causes risks to structures. Drought can also stress trees, causing die off. These trees may fall on structures adjacent to them.

Critical Facilities and Infrastructure

Most critical facilities and infrastructure have a limited vulnerability to drought and water shortage. Should drought conditions be severe enough to cause water shortage reliability issues, some facilities and infrastructure may be affected. Water and wastewater systems may be impacted during times of reduced water supply and need to employ contingencies to remain functional and fully operational. Other water dependent systems may also be adversely affected. Further, the secondary hazard of drought (increased potential for spread of urban fires and wildfire) can pose a significant risk to critical facilities and infrastructure. Drought can also stress trees, causing die off. These trees may fall on critical infrastructure adjacent to them and impact power lines and other utilities.

Community Lifelines

While limited, community lifelines can have a vulnerability to drought and water shortage. This includes:

- **Safety and Security** – Agencies may need to assist in providing alternative water supplies. Agencies may also need to staff locations where water is distributed.
- **Food, Hydration, Shelter** – Drought can limit agricultural production, including timber and grazing activities. Additional water supplies may need to be procured.
- **Health and Medical –** Additional water supplies may be required for these facilities to remain fully operational during drought and water shortages.
- **Energy –** Sufficient water is required to generate electricity and power. Additional fuels and power may be required to move water to and from locations that need it.
- **Communications** – Most communication systems will not be affected. In extreme instances, additional messaging may be required during drought and water shortages.
- **Water Systems** – During period of drought and water shortage, additional pressure may be put on water companies to secure additional supplies. With reductions in available water, the ability of wastewater systems to effectively treat wastewater may be impacted.

It is unlikely that any of these community lifelines would be overwhelmed by drought and water shortages, especially given the current state of water supply reliability in the Colusa County Planning Area.

Natural, Historic, and Cultural Resources

Drought and water shortage can have a significant impact on natural resources. Water levels in reservoirs and lakes may be reduced and a loss of wetlands and marsh areas may occur. Severe drought conditions can contribute to an increase in erosion of soils and lead to poor soil quality. Further, all of the trees in the Planning Area are at risk to drought impacts and a reduction in water supply. These trees provide a wealth of social and environmental benefits to Planning Area residents and visitors, from shade and beauty to air quality, carbon reduction and stormwater management. Drought can devastate crops and dry out pastures, dry out forests and critical habitat areas, and reduce food and water available for wildlife and livestock. Additionally, drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. It is unlikely that drought and water shortage would have a significant impact on historic and cultural resources in the Planning Area.

Economic Assets and Community Activities of Value

Economic assets and community activities in the Colusa County Planning Area generally have a limited vulnerability to drought and water shortage, with the exception of the agricultural industry. Drought is a problem which predominantly affects rural small business owners such as farmers and agricultural contractors who rely on water for their crops. More information on drought and agriculture can be found in the discussion in Section 4.3.9. Additionally, supply issues can also affect businesses such as cafes and restaurants in more urban areas. Drought impacts to the agricultural industry can affect the supply chain and increase the cost of food and water, and adversely impact businesses tied to these industries. Reduction in or interruption of the water supply could also lead to lower productivity or closure of manufacturing facilities. Other economic sectors with a heavy reliance on water may also be affected. Depending upon how severe the conditions get and how long they last, drought can restrict recreational and community activities, all of which can stress businesses and local economies over time.

Impacts from Drought and Water Shortage

The vulnerability to drought is Countywide, but impacts may vary and include reduction in water supply and an increase in dry fuels. The potential for a reduction in water supply during drought conditions generally leads to both mandated and voluntary conservations measures during extended droughts. During these times, the costs of water can also increase. Also of concern, the increased dry fuels and fuel loads associated with drought conditions can result in an increased fire danger. In areas of extremely dry fuels, the intensity and speed of fires can be significant. Water supply and flows for fire suppression can also be an issue during extended droughts. Drought that occurs during periods of extreme heat and high winds can cause PSPS events to be declared in the Planning Area. More information on PSPS can be found in Section 4.3.1.

Other qualitative impacts associated with drought in the Colusa County Planning Area are those related to water intensive activities such as municipal usage, commerce, tourism, and recreation use. With more precipitation likely falling as rain instead of snow and warmer temperatures causing decreased snowfall to melt faster and earlier, water supply is likely to become more unreliable. In addition, drought and water shortage is predicted to become more common. This means less water available for use over the long run, and additional challenges for water supply reliability, especially during periods of extended drought.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Drought Impact Reporter

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 4-71 show drought impacts for County from 1850 to June 2023. The data represented is skewed, with the majority of these impacts from records within the past ten years.

Table 4-71 Colusa County Drought Impacts 1850-3/1/2024

Category	Colusa County Number of Impacts
Agriculture	58
Business and Industry	9
Energy	6
Fire	17
Plants & Wildlife	47
Relief, Response, and Restrictions	83
Society and Public Health	35
Tourism and Recreation	7
Water Supply and Quality	94
Total	**356**

Source: National Drought Mitigation Center. Retrieved 3/20/2024.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future drought conditions and associated impacts and vulnerability of the County to drought and water shortage.
- Future population growth should be considered as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. According to the HMPC, Colusa County has access to large quantities of water through its groundwater as well as surface water. However, any future population growth in the County will add additional pressure to water companies during periods of drought and water shortage. Water companies will need to continue to plan for and add infrastructure capacity for population growth. As the population grows, the nature and makeup of populations will shift and change along with it. Vulnerable and underserved populations, such as those with low incomes and the unhoused that might not always have access to clean water, will need to be considered as future development continues, since they may experience a disproportionate impact from drought and water shortage. Potential population growth will be a challenge not only with regard to Colusa County's water access for agricultural production, but state- and nation-wide with regard to food production. Should the County see a growth in population, it will increase the vulnerability and impacts to the County from this hazard.
- Land use planning should be proactive to address future hazard conditions. As the County continues to grow, more cropland will be taken out of production to provide housing to accommodate for population growth. As Colusa's agricultural lands are reduced, it seems likely that there would be less of a competing demand for water. However, more development will also require an increase in water supply and associated infrastructure. Changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard depending on where and how this future growth occurs.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more resilient community.

4.3.10. Earthquake

Hazard Profile

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

Ground shaking is motion that occurs as a result of energy released during faulting. The damage or collapse of buildings and other structures caused by ground shaking is among the most serious seismic hazards. Damage to structures from this vibration, or ground shaking, 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. As with most communities in Northern California near active faults, much of Colusa County would be susceptible to violent ground shaking.

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) 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 can cause 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.

The General Plan Background Report noted that the Sacramento River corridor presents the greatest likelihood of loose sediment and saturated soils within Colusa County. In contrast, eastern Colusa County is the least prone to strong seismic ground shaking and associated liquefaction.

Landslide/Debris Flows

Landslides can occur as a result of horizontal seismic inertia induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes totally saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during

a wet winter. This is discussed in the vulnerability section below, and as a stand-alone hazard in Section 4.3.13.

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.

Fire Following Earthquake

Fire ignitions and spread in urban regions following a major earthquake can further compound the potentially catastrophic impacts of a large earthquake event. Fire following earthquake is a major hazard in earthquake-prone areas which are densely developed and have high inventories of wood frame buildings. The capability of fire departments to combat fires following an earthquake is impacted by the regional nature of an earthquake, damage to transportation and water supply systems, and the potential failure of telecommunications. A local fire department may suffer impacts to its personnel, buildings, equipment, and communications systems. Moreover, fewer resources are immediately available as mutual aid – due to the commitment of nearby fire departments responding to the earthquake withing their own jurisdictions. Transportation system damage may adversely impact the mobilization of off-duty personnel and fire and rescue mutual aid resources from unaffected areas. Maneuvering fire crews within the affected areas of the earthquake may be impeded by debris or damage to roads and bridges. Additionally, the municipal water supply system which ordinarily supports firefighting operations is likely to be impacted.

Fire following earthquake is an issue that could impact any California community that experiences an earthquake – both urban and rural. According to the FM Global Insurance company, "Fires after earthquakes commonly initiate from electrical or fuel related sources because their use is widespread. In the US, natural gas is a factor 15 to 50 percent of the time, and electrical ignitions account for 40 percent or more of post-earthquake wildfires. Ignitable liquid spills, chemical reactions, and the contact of combustibles with heat sources have also initiated or contributed to many fires after earthquakes."

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

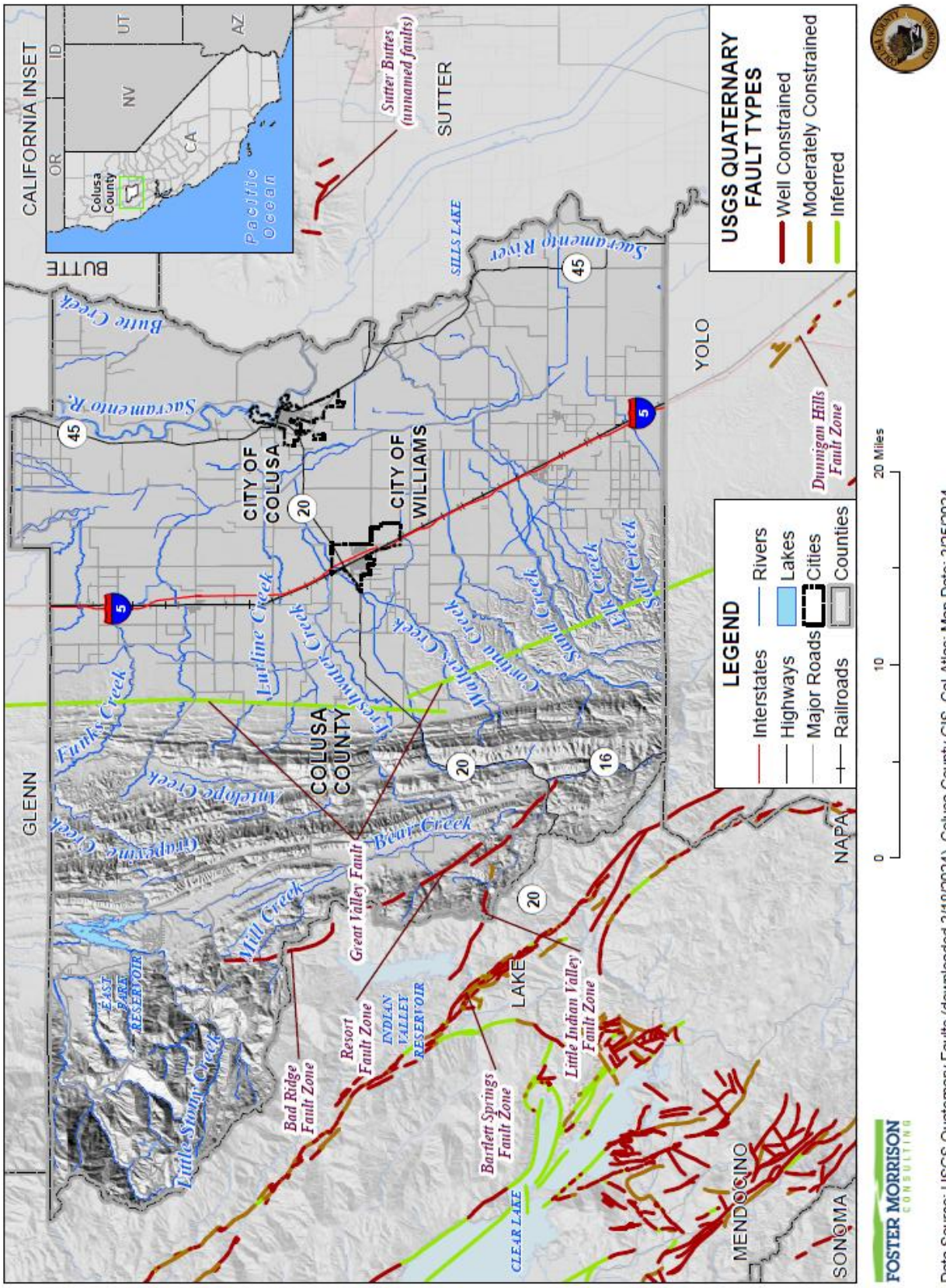
A fault is defined as "a fracture or fracture zone in the earth's crust along which there has been displacement of the sides relative to one another." For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting 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 2010 General Plan Background Report noted that there are no known active faults within the County. However, the Great Valley Fault, an inferred fault, is located within Colusa County and has the potential to produce a magnitude 7.03 earthquake. Further, Colusa County could experience considerable ground shaking generated by faults outside Colusa County. For example, southeastern Colusa County could experience intensities of MM VII to VIII generated by seismic events occurring in Sutter and Lake Counties.

Figure 4-66 shows fault locations in and near Colusa County.

Figure 4-66 Faults in and near Colusa County



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 4-72). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4-72 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 4.3.7 Dam Failure). Earthquakes can also cause levees to fail (see Section 4.3.14)

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 Colusa County area. Table 4-73 shows the approximate distances earthquakes can be felt away from the epicenter. According to the table, 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 Colusa in Colusa County. These results are detailed in Table 4-74.

Table 4-73 Approximate Relationships between Earthquake Magnitude and Intensity

Richter Scale Magnitude	Maximum Expected Intensity (MM)*	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: USGS Earthquake Intensity Zonation and Quaternary Deposits, Miscellaneous Field Studies Map 9093, 1977.

*Table 4-74 Magnitude 5.0 Earthquakes or greater within 90 Miles of Colusa County**

Date	Richter Magnitude	Location
12/14/2016	5.01	5 miles NW of The Geysers, California
8/10/2016	5.09	12 miles NNE of Upper Lake, California
8/24/2014	6.02	South Napa
5/24/2013	5.69	6 miles WNW of Greenville, California
8/10/2001	5.2	Northern California
8/10/2001	6.2	Northern California
9/3/2000	5	Northern California
11/28/1980	5.1	Northern California
11/22/1977	5.2	Northern California
8/2/1975	5.2	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

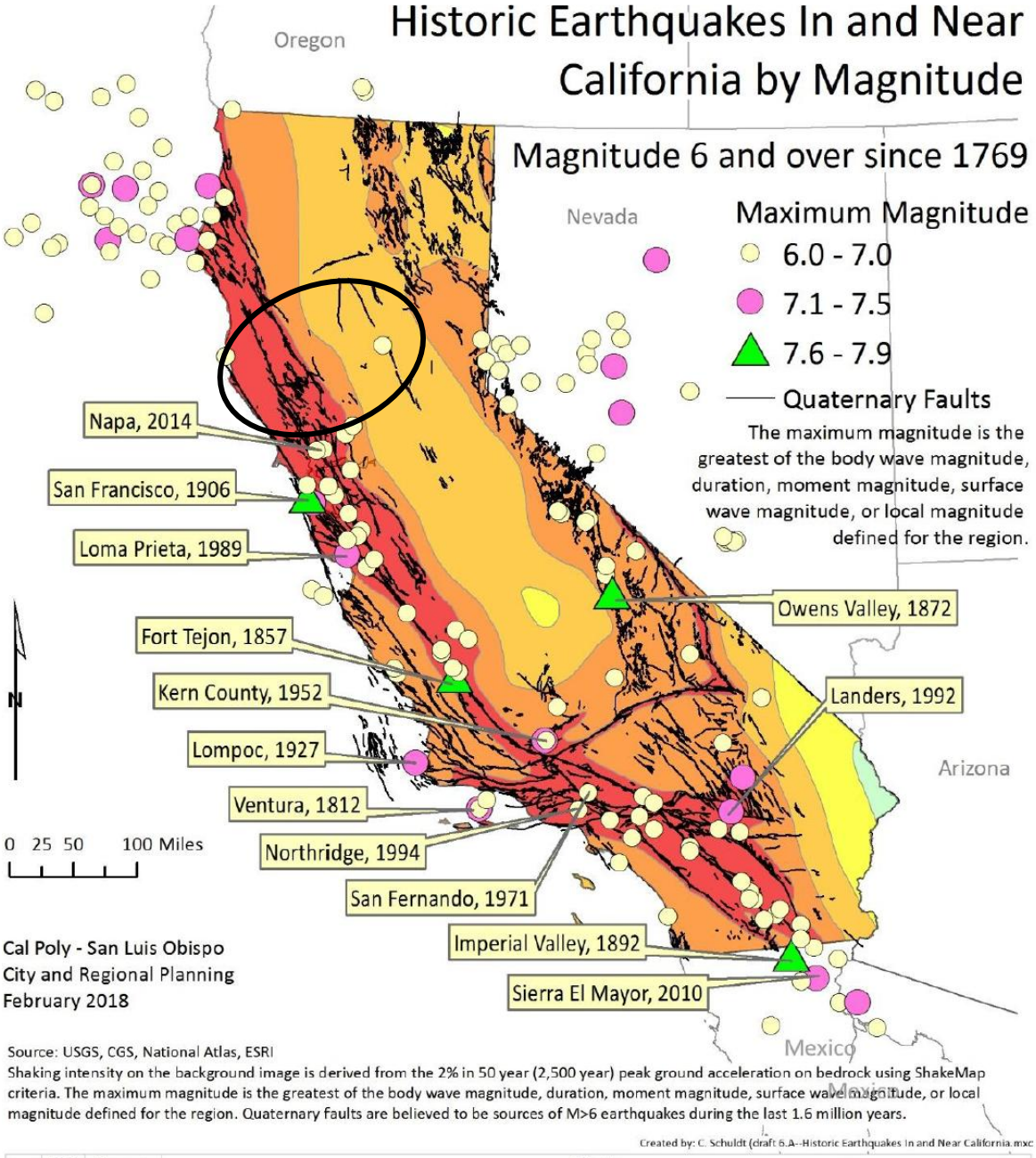
Source: USGS, National Earthquake Information Center
*Search dates 1950 – March 1, 2024

Figure 4-67 shows major historical earthquakes in California from 1769 to 2017. Since 2017, California has experienced four additional 6.0 or greater earthquakes:

- 2022 - 6.4 Ferndal
- 2021 - 6.0 Antelope Valley
- 2019 - 6.4 and 7.1 Ridgecrest

None of these earthquakes (over 6.0) since 2017 have affected the Colusa County Planning Area.

Figure 4-67 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: 2023 State of California Multi-Hazard Mitigation Plan

Hazard Mitigation Planning Committee Events

The HMPC noted that during past regional earthquake events, Colusa County has experienced groundshaking. In addition, in some instances, nearby earthquake events have caused cracking in the plaster on walls and in windowsills.

Likelihood of Future Occurrence

Unlikely (major earthquake); Likely (minor earthquake)—Colusa County seismic activity within the past two hundred years has shown absence of any major or damaging earthquake occurring within Colusa County. However, the possibility of an earthquake is an ever-present phenomenon in California and Colusa 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.

It is likely that climate change will not affect the chance of future occurrence as well as future impacts. More information on climate change and earthquake can be found below the Mapping of Future Occurrences section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Mapping of Future Occurrences

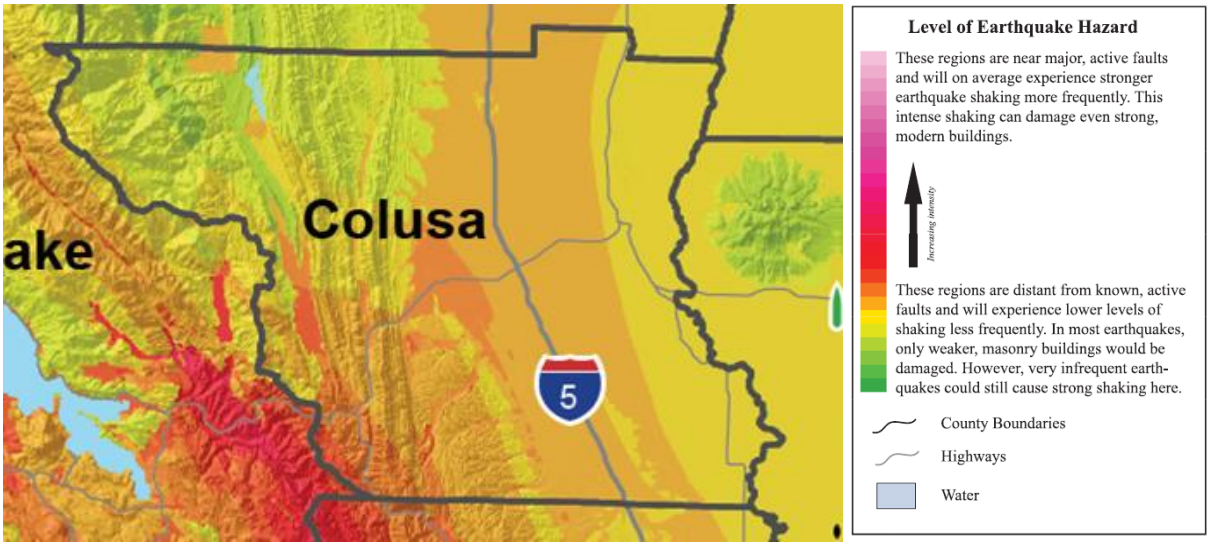
Mapping of future occurrences is presented in the following sections:

- CGS Analysis
- UCERF Analysis

CGS Analysis

Maps indicating the maximum expectable intensity of ground shaking for the County are available through several sources. Figure 4-68, prepared in 2016 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. Although the greatest hazard is in areas of highest intensity as shown on the map, no region is immune from potential earthquake damage.

Figure 4-68 Maximum Expectable Earthquake Intensity – 2% Chance in 50 Years

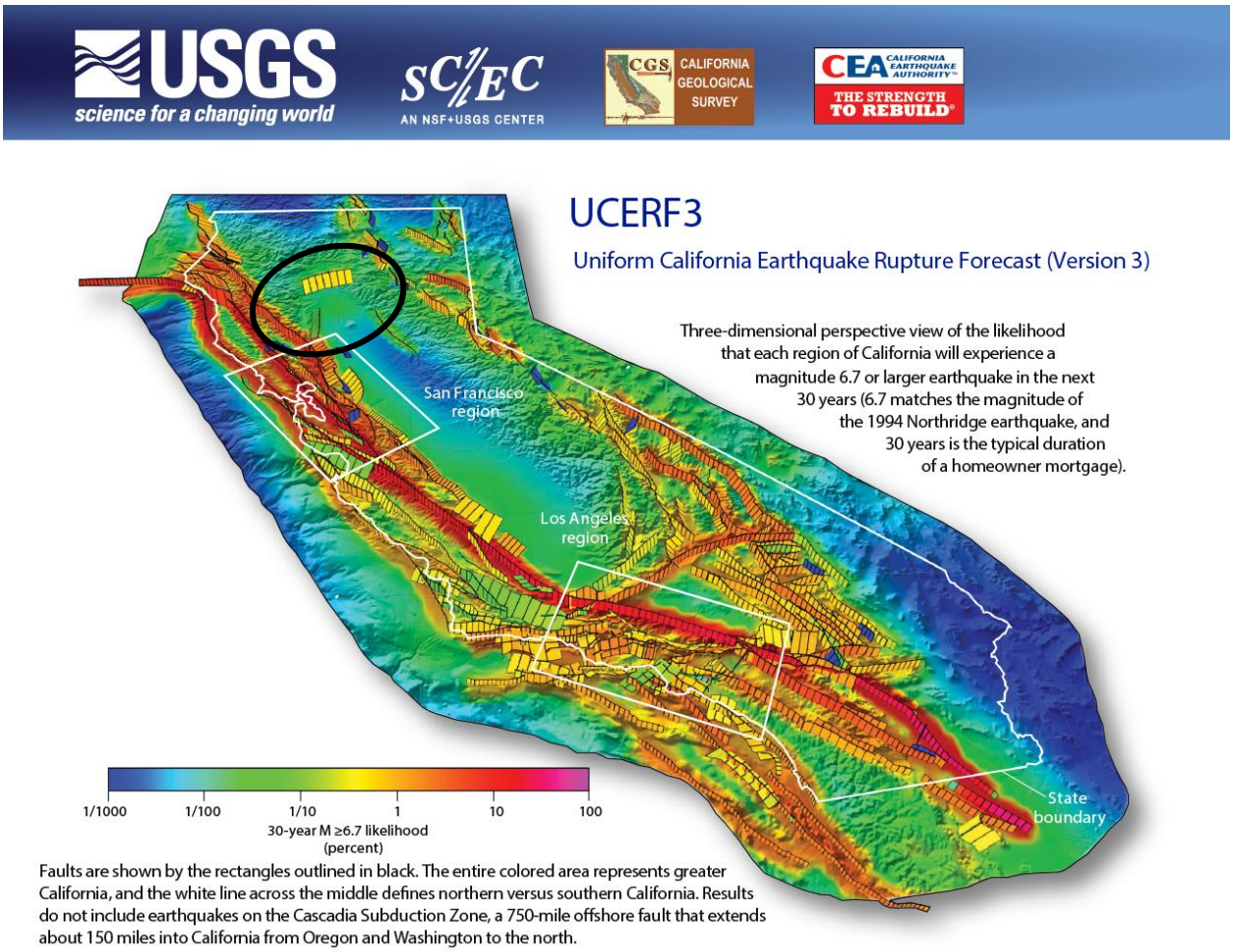


Source: California Division of Mines and Geology (2016)

UCERF Analysis

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 4-69 and indicates that Colusa County has a low to moderate risk of earthquake occurrence.

Figure 4-69 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 change is unlikely to increase earthquake frequency or strength.

Vulnerability Assessment

Vulnerability—Extremely High

Earthquake vulnerability is primarily based on population and the built environment. Urban areas in high seismic hazard zones are the most vulnerable, while more rural areas, such as Colusa are less vulnerable. The primary impacts of concern are life safety and property damage. Several faults are in and near the Colusa County Planning Area, and seismic hazard mapping indicates that the Planning Area has low to moderate seismic hazard potential. Depending on the location and magnitude of an earthquake event, some degree of structural damage due to stronger seismic shaking could be expected.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has certain specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

Seismic events can have particularly negative effects on older buildings constructed of URM, including materials such as brick, concrete, and stone, as well as soft story buildings and tilt-up concrete. 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. The Planning Area is within the less hazardous Zone 3.

A concern identified by Colusa County is the risk of an earthquake event aggravating the artesian up coning of salt water and mercury at some locations in Colusa County. USGS Open-File Report 2013-1056 stated that regarding the source of methylmercury contamination in the Bear Creek watershed near the abandoned Clyde and Elgin mines. It was determined that although the old mines were a likely source of mercury contamination, the more dominant source was from the effluent salt water that came from salt water hot springs about fault lines. It was noted that this area is subject to earthquake risk since this site is west of the public supply system for the City of Williams and it is not clear how the water held in the proposed Sites Reservoir may impact ground water quality generally or how it would impact the presence of artesian salt water in this portion of Colusa County. Irrespective of current conditions an earthquake could change fault lines and future trends of artesian up coning of salt water with potential contaminants such as mercury (which is discussed in greater detail in the Section 4.3.11 Flood: 1%/0.2% Annual Chance).

Assets at Risk

Assets at risk from earthquake include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

All people and populations are at risk from earthquake shaking. Those at heightened risk include:

- The unsheltered
- Infants and children under age five and their caregivers
- Elderly (65 and older)

- Individuals with disabilities
- Individuals dependent on medical equipment
- Individuals with impaired mobility

The greatest risk to people and populations from earthquake is death and injury. More information on people and populations at risk to earthquake shaking events can be seen in the Hazus scenarios developed for this LHMP and described in the Hazus Analysis section below.

Structures

All structures in the Colusa County Planning Area are vulnerable to earthquakes, depending on the severity and location of the shake. Older buildings, unreinforced masonry and soft story buildings are at a much greater risk to earthquakes. More information on structures at risk can be seen in the Hazus scenarios below.

Critical Facilities and Infrastructure

Earthquakes present a tremendous threat to critical facilities and infrastructure. More information on structures at risk can be seen in the Hazus scenarios below.

Community Lifelines

Community lifelines at risk to earthquake include:

- **Safety and Security** – Many personnel from the Planning Area would be involved in response and recovery efforts. This includes police, fire, EMS, public works, and other personnel. Due to the potential for widespread and major damages citywide, these resources can be stretched and quickly overwhelmed.
- **Food, Hydration, and Shelter** – As homes are damaged, shelter needs would significantly increase. Temporary housing would be to be established. Water supplies could be offline for an extended period. Residents, visitors and others caught in a large event would need to find sources of food and water until the Planning Area recovers.
- **Health and Medical** – Substantial numbers of injuries and deaths can occur. This causes EMS calls and ER visits to spike. Portable morgues and refrigeration units may need to be brought in. Transporting patients to medical facilities may be difficult. Depending on the extent of injuries and deaths the capacity of medical facilities could be strained and eventually overwhelmed.
- **Energy** – The power grid may be damaged from earthquake. Damages to natural gas pipelines that feed homes and businesses in the Planning Area may also be disrupted. Restoring these systems may take longer during a widespread event.
- **Communications** – Communications systems may be damaged during shaking events. Once the shaking ceases, responder communications need to be back online quickly to coordinate response efforts in the Planning Area. Messaging boards and alerts need to be then put into place to ensure public safety and order. Calls to and from family and friends during a hazard event can further overwhelm communication systems such as cell towers and other infrastructure. Demand may exceed the capacity of these systems to remain operational during response efforts.
- **Transportation** – Major damage can occur to roads and bridges in the Planning Area. Damage can also occur to rail lines and airports in and near the Planning Area. Roads may be closed due to damage,

or to debris on the roads from earthquake events. These closures could be place for an extended period while debris clearing efforts are undertaken to allow repairs to be made.

- **Hazardous Material** – Hazardous materials facilities can be compromised during times of earthquake events causing releases of contaminants into the environment. Natural gas pipelines can be affected by earthquakes. This can affect not only residents, but those who are charged with responding to or resolving the spill/rupture.
- **Water Systems** – Damages to underground pipes may occur. These take time to locate and fix in normal circumstances. During periods of earthquake, this becomes even more difficult. Water and wastewater systems and their respective piping can be damaged and systems may become inoperable for extended periods of time.

All community lifelines in the Colusa County Planning Area are vulnerable to earthquakes, depending on the severity and location of the shake. A major earthquake event could cause these lifelines to be overwhelmed. Some of these would be able to be restored to service quickly, while others would take more time having a prolonged impact on the people and structures within the Planning Area. More information on community lifelines at risk can be seen in the Hazus scenarios below.

Natural, Historic, and Cultural Resources

The 2023 State Hazard Mitigation Plan noted that environmental problems from earthquakes can be numerous. Earthquakes can significantly damage surrounding habitats. It is also possible for earthquakes to reroute streams, which can change the water quality, possibly damaging habitat and feeding areas. Streams fed by groundwater and/or springs may dry up because of changes in underlying geology. Another threat to the environment from earthquakes is the potential release of hazardous materials. Historical and cultural resources are at risk, often due to their age and construction types. The Hazus scenarios below are relatively silent on the vulnerability to natural, historic, and cultural resources, but impacts to these resources could be long lasting.

Economic Assets and Community Activities of Value

All economic assets in the County are vulnerable to earthquakes, depending on the severity and location of the shake and associated cascading hazards and impacts. More information on economic assets at risk can be seen in the Hazus scenarios below. All community activities of value would be affected by an earthquake if they were underway during an earthquake event and may be postponed or cancelled until the County has sufficiently recovered. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Hazus Analysis

Earthquake losses will vary across the Colusa 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 scenarios were run for this 2024 LHMP Update:

- A deterministic Great Valley Fault 7.03 earthquake event
- A probabilistic 7.0 earthquake event

These events were chosen from data gathered from the General Plan Safety Element and the USGS' seismic scenarios catalog. For deterministic Hazus scenarios, a single scenario event is selected based on a specific fault, the epicenter location, and the potential magnitude of the event. A probabilistic approach is not scenario based, but considers all possible and relevant deterministic earthquake scenarios as well as all possible ground motion probability levels.

Great Valley Fault 7.03 Hazus Scenario

Hazus-MH 6.1 was utilized to model earthquake losses for the County. 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 Great Valley Fault deterministic scenario was developed based on a seismic scenario obtained from the USGS seismic scenario catalog.

The results of the deterministic scenario are captured in Table 4-75 and shown on Figure 4-70. Key losses included the following:

- Total economic loss estimated for the earthquake was $624,160,000, which includes building losses and lifeline losses based on the Hazus-MH inventory.
- The total building-related losses were $257,320,000; 18% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 38 % of the total loss.
- 942 buildings in the County were at least moderately damaged. 23 buildings were completely destroyed.
- Before the earthquake, the region had 48 hospital beds available for use. On the day of the earthquake, the model estimates that only 27 hospital beds (58.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 88.00% of the beds will be back in service. By 30 days, 99.00% will be operational.
- The mid-day earthquake had the highest number of casualties at 1.
- 411 households experienced a loss of potable water the first day after the earthquake.
- 1,427 households experienced a loss of electricity the first day after the earthquake.

Table 4-75 Colusa County Planning Area – Great Valley Fault 7.03 Magnitude Deterministic Scenario Results

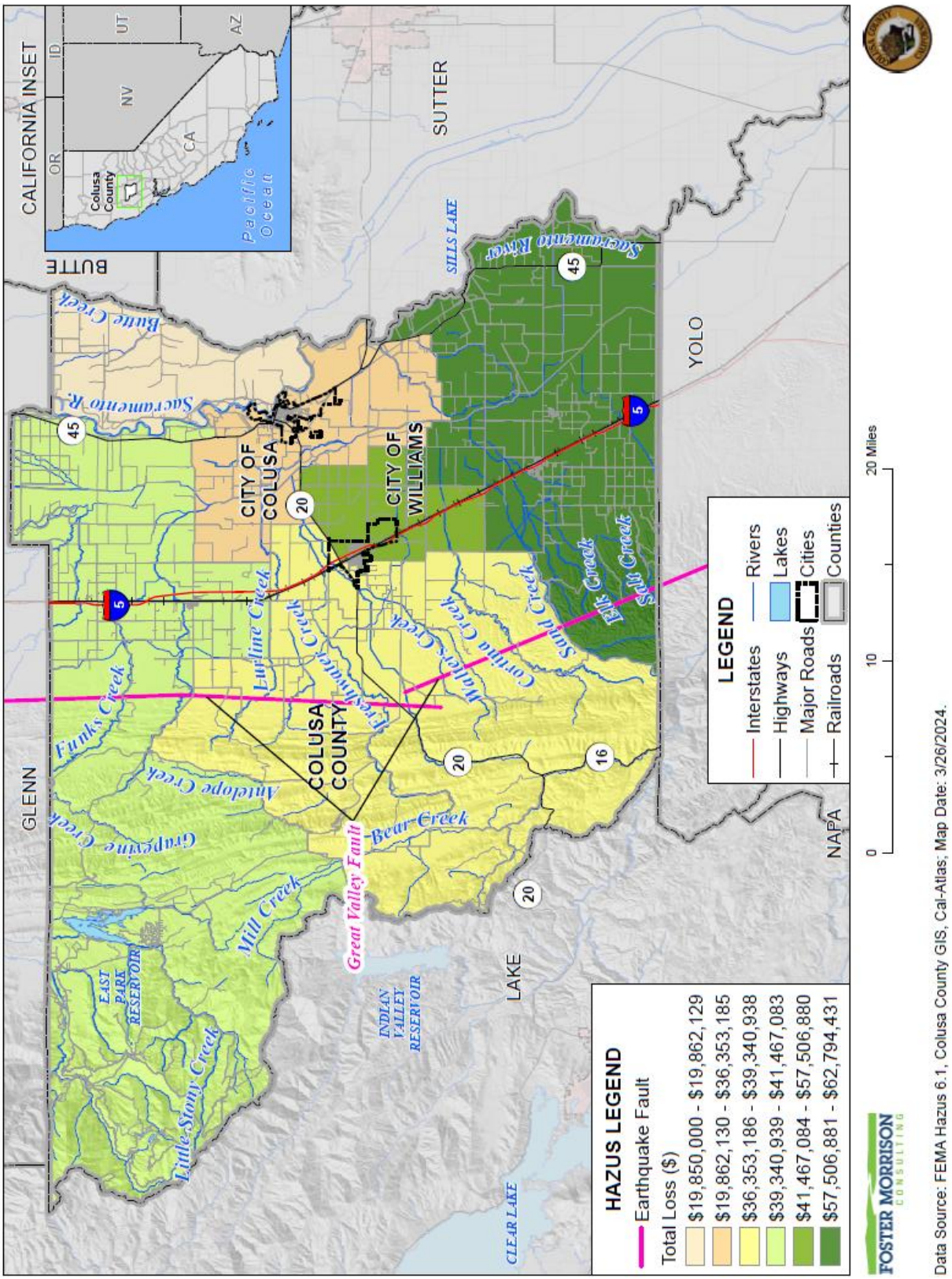
Type of Impact	Great Valley 7.03 Deterministic Scenario
Total Buildings Damaged (based on 8,000 buildings)	Slight: 2,125 Moderate: 799 Extensive: 120 Complete: 23
Building and Income Related Losses	$257,320,000
Total Economic Losses (Includes building, income and lifeline losses)	$624,160,000
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 15 Requiring hospitalization: 2 Life threatening: 0

Type of Impact	Great Valley 7.03 Deterministic Scenario	
	Fatalities: 0	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 27 Requiring hospitalization: 5 Life threatening: 1 Fatalities: 1	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 19 Requiring hospitalization: 4 Life threatening: 1 Fatalities: 1	
Damage to Transportation Systems	None with at least moderate damage	
Damage to Essential Facilities	None with at least moderate damage	
Damage to Utility Systems	1 electrical power facility with at least moderate damage. 101 potable water line breaks, 51 wastewater line breaks, and 3 natural gas line breaks.	
Households without Power/Water Service (Based on 7,227 total households)	Power loss, Day 1: 1,427 Power loss, Day 3: 802 Power loss, Day 7: 272 Power loss, Day 30: 16 Power loss, Day 90: 2	Water loss, Day 1: 411 Water loss, Day 3: 16 Water loss, Day 7: 0 Water loss, Day 30: 0 Water loss, Day 90: 0
Displaced Households	55 displaced households	
Shelter Requirements	35 persons	
Debris Generation	38,000 tons	

Source: Hazus 6.1

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.). The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Figure 4-70 Colusa County Planning Area – Great Valley 7.03 Magnitude Hazus Total Loss



7.0 Probabilistic Hazus Scenario

Hazus-MH 6.1 was utilized to model earthquake losses for the County. 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 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 4-76 and shown on Figure 4-71. Key losses included the following:

- Total economic loss estimated for the earthquake was $2,151,030,000, which includes building losses and lifeline losses based on the Hazus-MH inventory.
- The total building-related losses were $1,174,080,000; 19% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 35 % of the total loss.
- 3,500 buildings in the County were at least moderately damaged. 310 buildings were completely destroyed.
- Before the earthquake, the region had 48 hospital beds available for use. On the day of the earthquake, the model estimates that only 1 hospital beds (3.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 16.00% of the beds will be back in service. By 30 days, 61.00% will be operational.
- The mid-day earthquake had the highest number of casualties at 17.
- 4,522 households experienced a loss of potable water the first day after the earthquake.
- 6,098 households experienced a loss of electricity the first day after the earthquake.

Table 4-76 Colusa County Planning Area – 7.0 Probabilistic Scenario Results

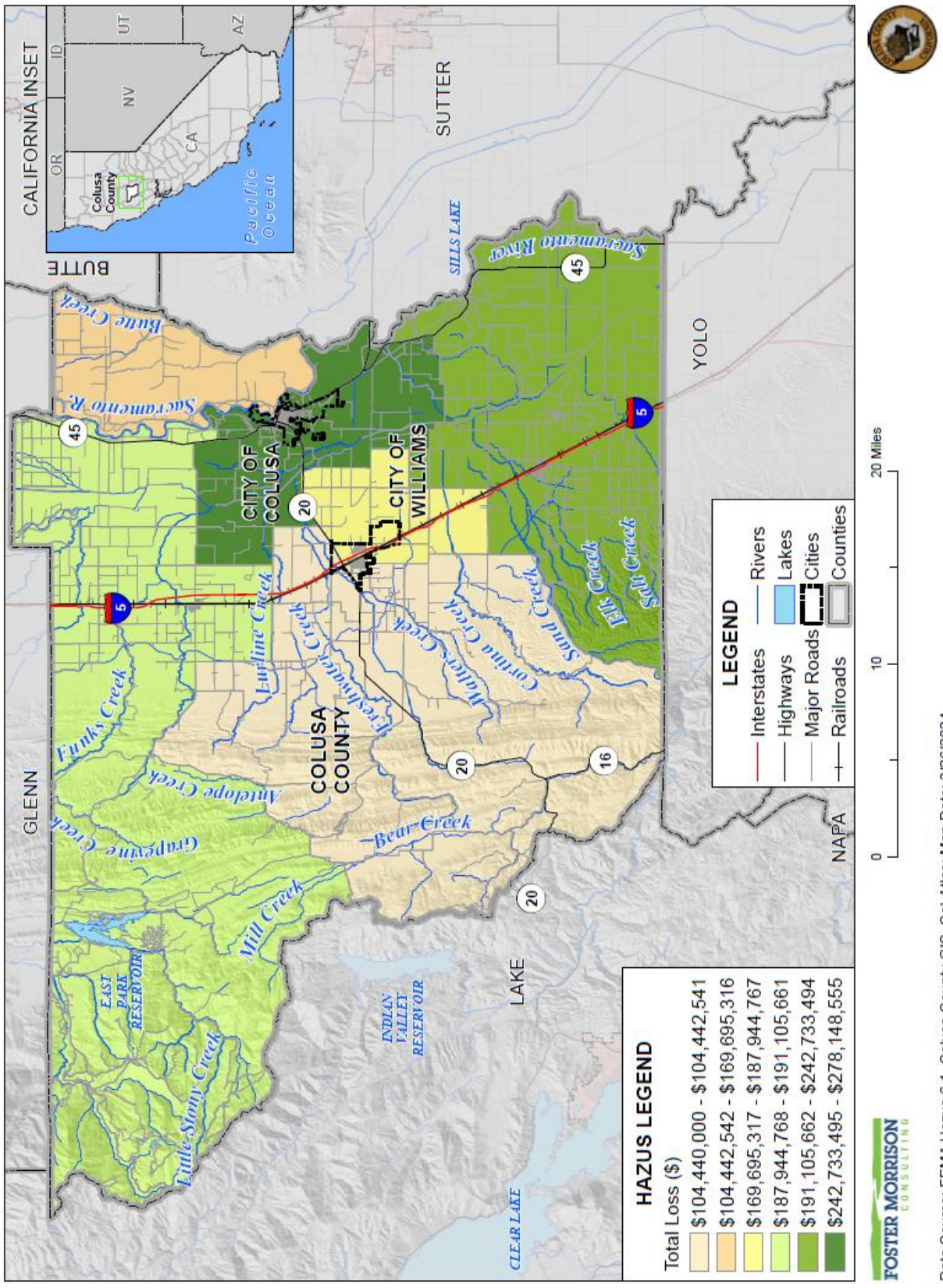
Type of Impact	7.0 Probabilistic Scenario
Total Buildings Damaged (based on 8,000 buildings)	Slight: 2,791 Moderate: 2,668 Extensive: 801 Complete: 310
Building and Income Related Losses	$1,174,080,000
Total Economic Losses (Includes building, income and lifeline losses)	$2,151,030,000
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 87 Requiring hospitalization: 18 Life threatening: 2

Type of Impact	7.0 Probabilistic Scenario	
	Fatalities: 3	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 210 Requiring hospitalization: 58 Life threatening: 9 Fatalities: 17	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 136 Requiring hospitalization: 40 Life threatening: 13 Fatalities: 12	
Damage to Transportation Systems	16 road bridges and one airport facility with at least moderate damage	
Damage to Essential Facilities	1 hospital, 24 schools, 1 EOC, 4 police stations, and 9 fire stations with at least moderate damage. 0 facilities with complete damage.	
Damage to Utility Systems	3 wastewater facilities, 1 natural gas facility, 2 electrical power facilities, and 1 communication facility with at least moderate damage. 0 facilities with complete damage. 406 potable water line breaks, 204 wastewater line breaks, and 13 natural gas line breaks.	
Households without Power/Water Service (Based on 7,227 total households)	Power loss, Day 1: 6,098 Power loss, Day 3: 4,600 Power loss, Day 7: 2,389 Power loss, Day 30: 352 Power loss, Day 90: 7	Water loss, Day 1: 4,522 Water loss, Day 3: 4,058 Water loss, Day 7: 2,850 Water loss, Day 30: 0 Water loss, Day 90: 0
Displaced Households	529 displaced households	
Shelter Requirements	333 persons	
Debris Generation	216,000 tons	

Source: Hazus 6.1

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.). The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Figure 4-71 Colusa County Planning Area – Probabilistic 7.0 Magnitude Hazus Total Loss



Hazus Scenario Comparisons

A comparison of the results of the deterministic 7.03 Great Valley Fault and 7.0 probabilistic scenarios is shown on Table 4-77.

Table 4-77 Colusa County – Comparison of Hazus Scenarios

Type of Impact	7.03 Great Valley Fault Deterministic		7.0 Probabilistic	
Total Buildings Damaged (based on 8,000 buildings)	Slight: 2,125 Moderate: 799 Extensive: 120 Complete: 23		Slight: 2,791 Moderate: 2,668 Extensive: 801 Complete: 310	
Building and Income Related Losses	$257,320,000		$1,174,080,000	
Total Economic Losses (Includes building, income and lifeline losses)	$624,160,000		$2,151,030,000	
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 15 Requiring hospitalization: 2 Life threatening: 0 Fatalities: 0		Without requiring hospitalization: 87 Requiring hospitalization: 18 Life threatening: 2 Fatalities: 3	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 27 Requiring hospitalization: 5 Life threatening: 1 Fatalities: 1		Without requiring hospitalization: 210 Requiring hospitalization: 58 Life threatening: 9 Fatalities: 17	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 19 Requiring hospitalization: 4 Life threatening: 1 Fatalities: 1		Without requiring hospitalization: 136 Requiring hospitalization: 40 Life threatening: 13 Fatalities: 12	
Damage to Transportation Systems	None with at least moderate damage		16 road bridges and one airport facility with at least moderate damage	
Damage to Essential Facilities	None with at least moderate damage		1 hospital, 24 schools, 1 EOC, 4 police stations, and 9 fire stations with at least moderate damage. 0 facilities with complete damage.	
Damage to Utility Systems	1 electrical power facility with at least moderate damage. 101 potable water line breaks, 51 wastewater line breaks, and 3 natural gas line breaks.		3 wastewater facilities, 1 natural gas facility, 2 electrical power facilities, and 1 communication facility with at least moderate damage. 0 facilities with complete damage. 406 potable water line breaks, 204 wastewater line breaks, and 13 natural gas line breaks.	
Households without Power/Water Service (Based on 7,227 total households)	Power loss, Day 1: 1,427 Power loss, Day 3: 802 Power loss, Day 7: 272 Power loss, Day 30: 16	Water loss, Day 1: 411 Water loss, Day 3: 16 Water loss, Day 7: 0 Water loss, Day 30: 0	Power loss, Day 1: 6,098 Power loss, Day 3: 4,600 Power loss, Day 7: 2,389 Power loss, Day 30: 352 Power loss, Day 90: 7	Water loss, Day 1: 4,522 Water loss, Day 3: 4,058 Water loss, Day 7: 2,850 Water loss, Day 30: 0

Type of Impact	7.03 Great Valley Fault Deterministic		7.0 Probabilistic	
	Power loss, Day 90: 2	Water loss, Day 90: 0		Water loss, Day 90: 0
Displaced Households	55 displaced households		529 displaced households	
Shelter Requirements	35 persons		333 persons	
Debris Generation	38,000 tons		216,000 tons	

Source: Hazus 6.1

Impacts from Earthquake

Earthquakes can strike without warning and cause dramatic changes to the landscape of an area that can have devastating impacts on the built environment. The greatest impact is to life safety of Colusa County residents and visitors. Other impacts to the Colusa County Planning Area would include damages to infrastructure such as roads, bridges, and dams; damages and loss of services to utilities and critical infrastructure, including those related to gas, power, water, wastewater and communication systems; damages to structures and other development; and possible loss of life and injuries.

Earthquakes can also cause failure of dams, levees, and reservoirs. Facilities and land downslope from dams or water reservoirs or behind levees might be subject to flooding, if the dams, reservoirs, or levees fail as a result of an earthquake. The County has locations with significant flood risk that include facilities downslope from dams or reservoirs or behind levees.

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

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to have no effect on future earthquake conditions and associated impacts and vulnerability of the County.
- Population growth in Colusa County has recently slowed. Any additional growth in the County would place additional populations at risk to earthquake. Additional population growth would likely bring

continued diversity to the County. Vulnerable population groups could face disproportionate effects from an earthquake and should be planned for. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.

- Land use planning should be proactive to address future hazard conditions. County building codes are in effect to reduce structure damage, including damage to critical facilities and infrastructure, and should be updated as necessary to continue to address future earthquake conditions. Depending on the location of new development and adherence to protective building codes, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more resilient community. 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 the Colusa County Planning Area. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect or influence this hazard.

Hazard/Problem Description

Flooding is the rising and overflowing of a body of water onto normally dry land. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities and can cause life safety issues. Floods can be extremely dangerous. 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. 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.

There are three primary types of freshwater flood events in the Colusa County Planning Area: riverine and lake, flash flooding, and urban stormwater. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reaches.

- **Riverine and lake flooding** is the most common type of flood event and occurs when a watercourse exceeds its "bank-full" capacity. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with already saturated soils from previous rain events. The 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. The warning time associated with slow rise floods assists in life and property protection.
- The term "**flash flood**" describes localized floods of great volume and short duration. In contrast to riverine flooding, this type of flood usually results from 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.
- **Stormwater/Urban** flood events have increased as land has been converted from fields or woodlands to roads and parking lots and lost its ability to absorb rainfall. Urbanization increases runoff by two to six times that of natural terrain. This is discussed in the Section 4.3.12 below.

The Colusa County Planning Area is also at risk to flooding resulting from dam and levee failures. Dam failure flooding is discussed separately in Section 4.3.8 of this document, while levee failures are discussed in Section 4.3.14. Regardless of the type of flood, the cause is often the result of severe weather and excessive rainfall, either in the flood area or upstream reach.

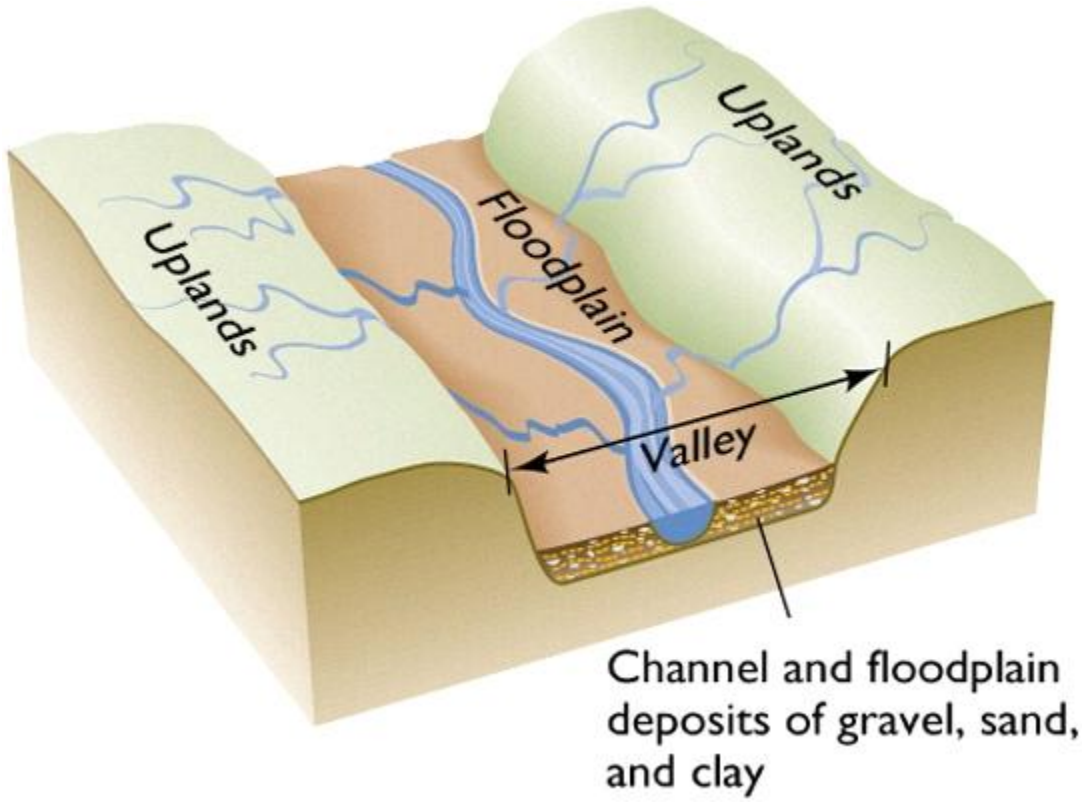
The potential for flooding can change and increase through various land use changes and changes to land surface, resulting in a change to the floodplain. Environmental changes can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels.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

Location and Extent

Floodplains

The area adjacent to a channel is the floodplain (see Figure 4-72). 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 200-year flood is one that has 0.5% 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 4-72 Floodplain Schematic



Source: FEMA

Hydrologic Regions

According to Cal DWR, California is divided into 10 hydrologic regions. The Colusa County Planning Area is traversed by one hydrologic region – 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 4-73.

Figure 4-73 California Hydrologic Regions

Source: California Department of Water Resources

The Colusa County Waterway System

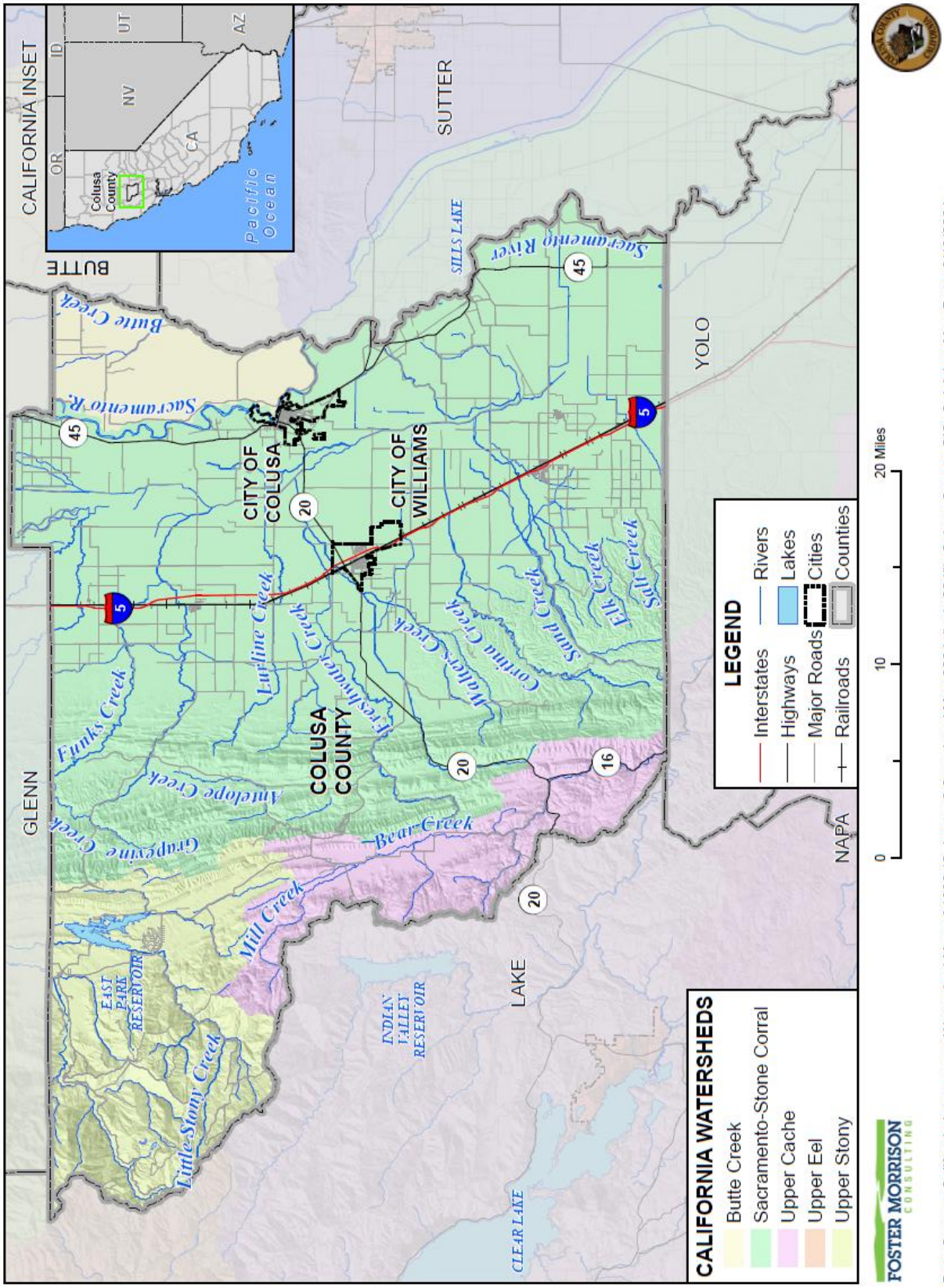
Colusa County encompasses multiple rivers, streams, creeks, and associated watersheds. Colusa County crosses five watersheds. These include the following watersheds:

- Butte Creek
- Cache Watershed
- Eel Watershed
- Sacramento-Stone Watershed

- Stony Watershed

Figure 4-74 illustrates the primary watersheds of Colusa County, as well as the primary waterways in the County.

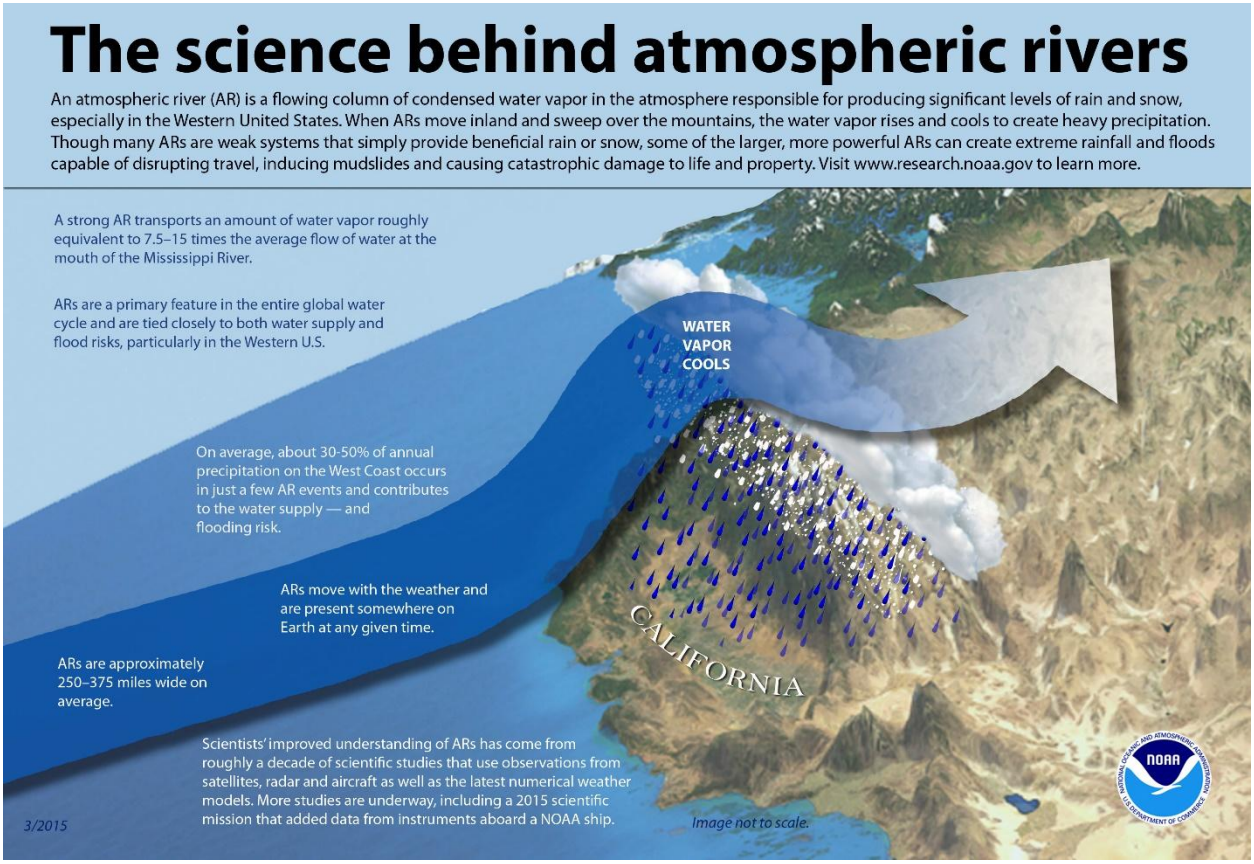
Figure 4-74 Primary Watersheds and Waterways of Colusa County



Other Sources of Flooding

Colusa County and much of California can be affected by a phenomenon known as an atmospheric river. These types of storms occurred frequently in the winter of 2022/2023. 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 4-75.

Figure 4-75 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 can bring 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. This also occurred in and around the County in the winter of 2022/2023. In 2023, it resulted in two federal disaster declarations.

Colusa County Flood Mapping

As part of the County's ongoing efforts to identify and manage their flood prone areas, Colusa County relies on a variety of different mapping efforts. What follows is a brief description of FEMA and DWR mapping efforts covering the Colusa 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 shown in the Vulnerability Assessment below.

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 Colusa County FIS is dated March 27, 2024. 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.

Levee Considerations in Floodplain Mapping

Also, as part of FEMA's Map Modernization program, FEMA is mapping levees within communities, with a primary focus on maps determined to provide a 1% annual chance level of flood protection.

In August of 2005, FEMA Headquarters' issued Memo 34 Interim Guidance for Studies Including Levees. This memo recognizes the risk and vulnerability of communities with levees. The memo mandates the inclusion of levee evaluations for those communities that are undergoing map changes such as the conversion to DFIRMs. No maps can become effective without an evaluation of all levees within a community against the criteria set forth in 44 CFR 65.10 Mapping of Areas Protected by Levee Systems. Generally, these levee certification requirements include evaluations of freeboard, geotechnical stability and seepage, bank erosion potential due to currents and waves, closure structures, operations and maintenance, and wind wet and wave run-up. In short, these guidelines require certification of levees before crediting any levee with providing protection from the 1 percent annual event (e.g., the 100-year flood).

In Colusa County, similar to other locations in California, levees and flood control facilities have been built and are maintained variously by public and private entities, including reclamation, irrigation and flood control districts, other state and local agencies, and private interests. Many of these facilities were constructed with flood control as secondary or incidental to their primary purpose, so are not considered as providing protection from the 1% annual chance or greater flood. Levees in the County are discussed in Section 4.3.14 of this Plan Update.

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.

New DFIRMs for Colusa County have been developed and are dated March 27, 2024, and are being used for the flood analysis for this LHMP Update. The DFIRM is shown in Figure 4-76, and DFIRM flood zones are shown on Table 4-78. These new DFIRM flood maps reflect the decertification of all the levees in the County. A comparison of how the DFIRM has changed since the 2018 Plan is shown on Figure 4-77 and Table 4-79.

Figure 4-76 Colusa County - DFIRM

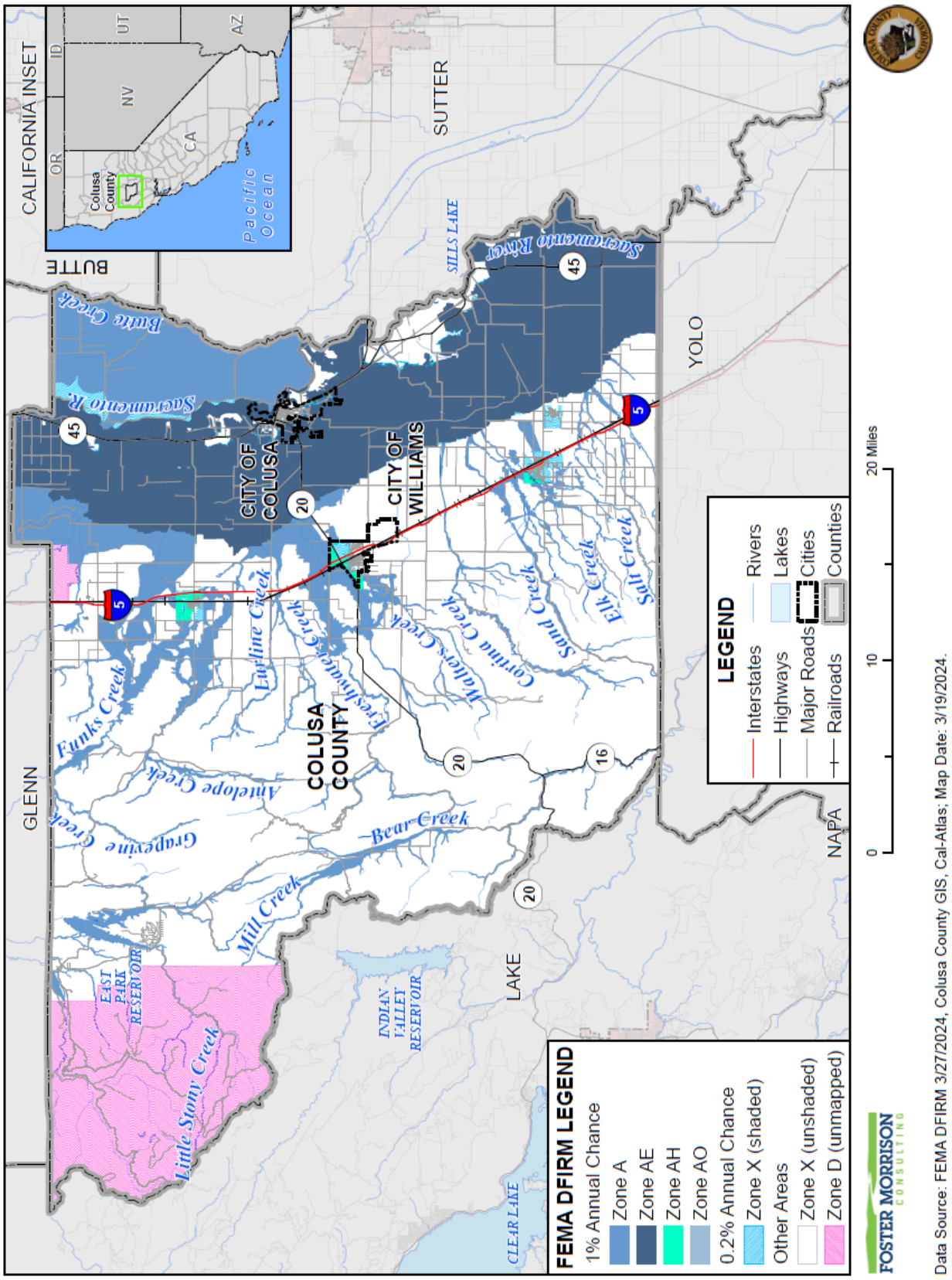


Table 4-78 Colusa County – FEMA DFIRM Flood Zones by Jurisdiction

Flood Zone	Description	Flood Zone Present in City of Colusa	Flood Zone Present in City of Williams	Flood Zone Present in unincorporated County
A	1% annual chance flooding: No base flood elevations provided		X	X
AE	1% annual chance flooding: Base flood elevations provided	X		X
AH	1% annual chance flood areas of shallow flooding between one to three feet deep. Regulatory floodway; Base flood elevations provided		X	X
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.		X	X
Shaded X	0.2% annual chance flooding: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	X	X	X
X (unshaded)	No flood hazard	X	X	X
D	Areas with a potentially moderate to high risk of flooding, but the probability has not been determined.			X

Source: FEMA DFIRM 03/24

Figure 4-77 Colusa County Planning Area – Comparison of DFIRM from 2018 Plan to 2024 Plan

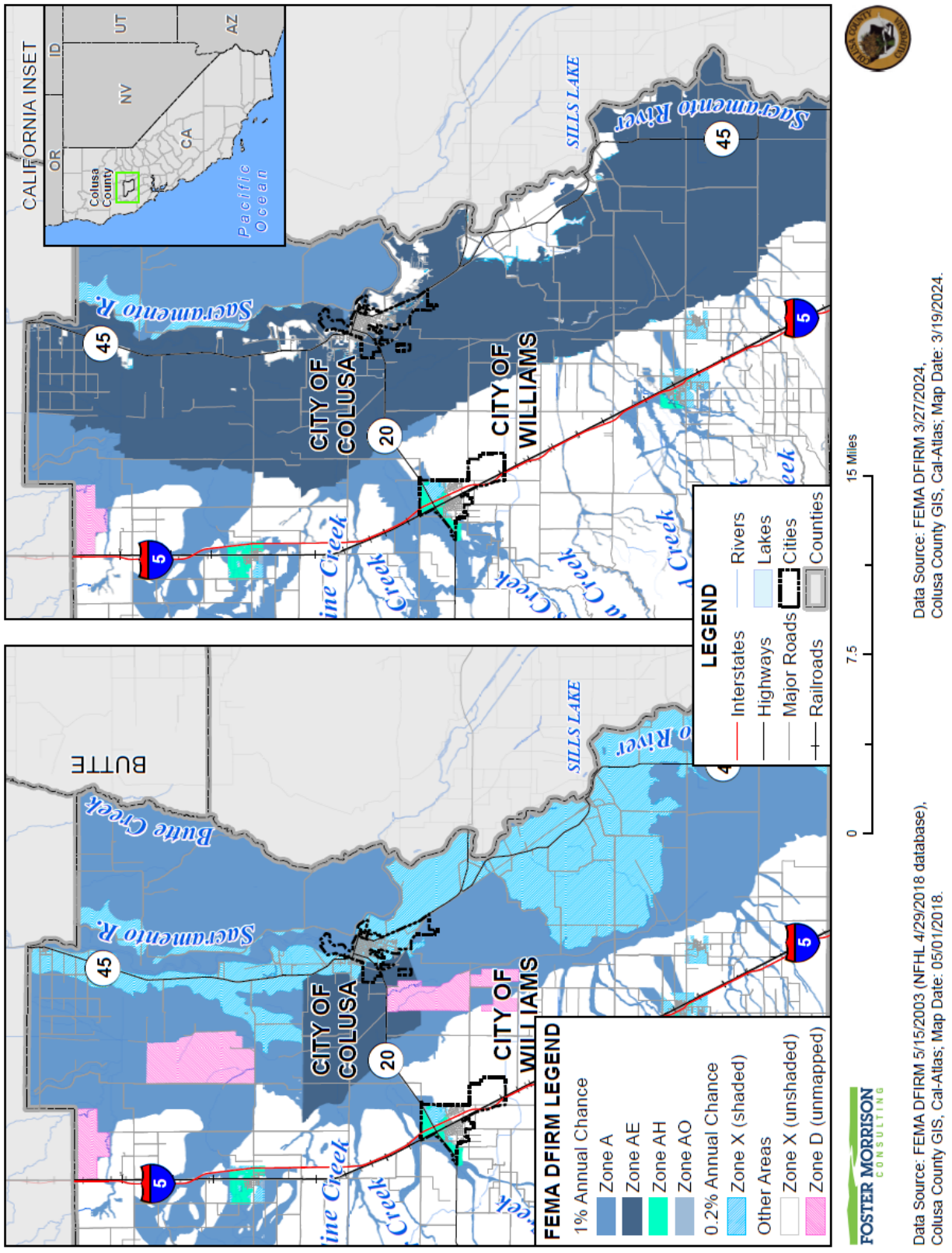


Table 4-79 Colusa County Planning Area – Comparison of DFIRM from 2018 Plan to 2024 Plan

Jurisdiction / Flood Zone	2018 Total Flooded Acres	2024 Total Flooded Acres	Change in Total Flooded Acres
City of Colusa			
1% Annual Chance Flood Hazard			
Zone A	6.33	-	-6.33
Zone AE	432.13	1,682.17	1,250.04
Zone AH	-	-	0.00
Zone AO	-	-	0.00
1% Annual Chance Flood Hazard Total	**438.46**	**1,682.17**	**1,243.71**
0.2% Annual Chance Flood Hazard			
Zone X (shaded)	1,091.25	33.58	-1,057.67
0.2% Annual Chance Flood Hazard Total	**1,091.25**	**33.58**	**-1,057.67**
Other Areas			
Zone X (unshaded)	-	695.99	695.99
Zone D (unmapped)	-	-	0.00
Other Areas Total	**-**	**695.99**	**695.99**
City of Colusa Total	**1,529.70**	**2,411.73**	**882.03**
City of Williams			
1% Annual Chance Flood Hazard			
Zone A	0.14	44.56	44.42
Zone AE	5.55	5.67	0.12
Zone AH	537.00	577.62	40.62
Zone AO	21.98	23.10	1.12
1% Annual Chance Flood Hazard Total	**564.67**	**650.95**	**86.28**
0.2% Annual Chance Flood Hazard			
Zone X (shaded)	367.82	369.72	1.89
0.2% Annual Chance Flood Hazard Total	**367.82**	**369.72**	**1.89**
Other Areas			
Zone X (unshaded)	1,843.47	1,879.81	36.34
Zone D (unmapped)	-	-	0.00
Other Areas Total	**1,843.47**	**1,879.81**	**36.34**
City of Williams Total	**2,775.96**	**2,900.47**	**124.52**

Jurisdiction / Flood Zone	2018 Total Flooded Acres	2024 Total Flooded Acres	Change in Total Flooded Acres
Unincorporated Colusa County			
1% Annual Chance Flood Hazard			
Zone A	158,300.10	92,843.63	-65,456.46
Zone AE	12,210.60	134,240.57	122,029.97
Zone AH	1,177.57	1,148.63	-28.93
Zone AO	150.87	150.78	-0.08
1% Annual Chance Flood Hazard Total	**171,839.13**	**228,383.62**	**56,544.50**
0.2% Annual Chance Flood Hazard			
Zone X (shaded)	55,011.10	5,125.47	-49,885.63
0.2% Annual Chance Flood Hazard Total	**55,011.10**	**5,125.47**	**-49,885.63**
Other Areas			
Zone X (unshaded)	412,329.34	414,367.59	2,038.25
Zone D (unmapped)	84,985.46	76,122.61	-8,862.86
Other Areas Total	**497,314.80**	**490,490.19**	**-6,824.61**
Unincorporated Colusa County Total	**724,165.03**	**723,999.29**	**-165.74**
Grand Total	**728,470.69**	**729,311.50**	**840.81**

Source: FEMA

California Floodplain Mapping

Also to be considered when evaluating the flood risks in Colusa County are various floodplain maps and measures implemented by Cal DWR for various areas throughout California, and in the Sacramento-San Joaquin Valley cities and counties.

State Flood Protection Measures (Urban Level of Flood Protection – 200-year)

In 2007, Senate Bill 5 (SB 5), and additional clarifying legislation, were signed into law in order to strengthen the alignment between flood risk reduction investments, land-use decisions, and statewide flood planning objectives. These bills collectively require cities and counties within California's Central Valley Watershed to make findings related to an urban level of flood protection before making certain land-use decisions. California Government Code Section 65007(n) state: "Urban level of flood protection" means the level of protection that is necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources. The legislation also provided that the Urban Level of Flood Protection does not mean shallow flooding and local drainage.

The applicability of SB 5 to cities and counties and the requirement to consider the 0.5% or 200-year annual chance flood was further defined to cover properties located within: 1) the Sacramento-San Joaquin Valley

watershed, 2) an urban area of 10,000 residents, or within an urbanizing area that will have 10,000 people within 10-year, 3) a flood hazard zone that is mapped as either a special flood hazard area or an area of moderate hazard on FEMA's FIRM, 4) a watershed of more than 10 square miles, and 5) an area with a potential flood depth above 3.0 feet.

While, Colusa County and its cities fall within the Sacramento-San Joaquin Valley watershed area, the urban and urbanizing areas of Colusa County remain well below the 10,000 residents threshold for applicability of SB5. Thus, this LHMP Update focuses on the 1% (100-year) and 0.2% (500-year) floodplains within the Planning Area.

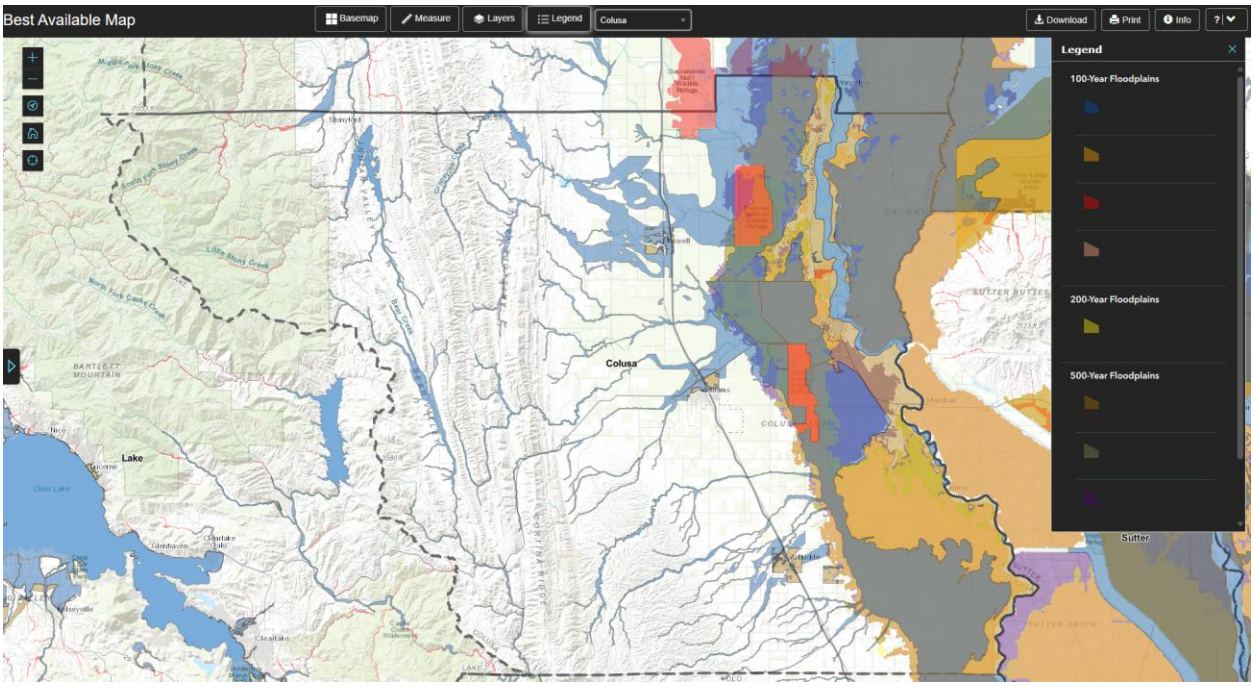
California Department of Water Resources Best Available Maps (BAM)

Also to be considered when evaluating the flood risks in Colusa County are various floodplain maps developed by the California 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 Colusa County. Senate Bill 5 (SB 5), enacted in 2007, authorized Cal-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 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 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 4-78 shows the BAM for the Colusa County Planning Area.

Figure 4-78 Colusa County– Flood Awareness (Best Available) Map



Source: California DWR. Retrieved 3/3/2024

Legend explanation: **Blue** - FEMA 100-Year, Orange – Local 100-Year (developed from local agencies), **Red** – DWR 100-year (Awareness floodplains identify the 100-year flood hazard areas using approximate assessment procedures.), **Pink** – USACE 100-Year (2002 Sac and San Joaquin River Basins Comp Study), **Yellow** – USACE 200-Year (2002 Sac and San Joaquin River Basins Comp Study), **Tan** – FEMA 500-Year, **Grey** – Local 500-Year (developed from local agencies), **Purple** – USACE 500-Year (2002 Sac and San Joaquin River Basins Comp Study).

Flood extents are usually measured in depths of flooding and area flooded. Expected flood depths in the Colusa County Planning Area vary. 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 extents of DFIRM flood zones for the Colusa County Planning Area are detailed in Table 4-80.

Table 4-80 Colusa County Planning Area –Geographical DFIRM Flood Zone Extents

Jurisdiction / Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
City of Colusa						
1% Annual Chance Flood Hazard	2,857	26.82%	1,175	21.95%	1,682	31.74%
0.2% Annual Chance Flood Hazard	2,935	27.56%	1,618	30.23%	1,318	24.86%
Other Areas	4,858	45.62%	2,558	47.82%	2,300	43.40%
City of Colusa Total	**10,651**	**100.00%**	**5,350**	**100.00%**	**5,300**	**100.00%**

Jurisdiction / Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
City of Williams						
1% Annual Chance Flood Hazard	1,866	27.72%	226	12.13%	1,640	33.67%
0.2% Annual Chance Flood Hazard	855	12.70%	245	13.19%	610	12.52%
Other Areas	4,010	59.57%	1,388	74.67%	2,621	53.81%
City of Williams Total	**6,731**	**100.00%**	**1,859**	**100.00%**	**4,871**	**100.00%**
Unincorporated Colusa County						
1% Annual Chance Flood Hazard	642,665	41.09%	287,197	43.37%	355,468	39.41%
0.2% Annual Chance Flood Hazard	69,452	4.44%	54,577	8.24%	14,875	1.65%
Other Areas	852,035	54.47%	320,451	48.39%	531,584	58.94%
Unincorporated Colusa County Total	**1,564,152**	**100.00%**	**662,225**	**100.00%**	**901,926**	**100.00%**
Grand Total	**1,581,533**	**100.00%**	**669,435**	**100.00%**	**912,098**	**100.00%**

Source: FEMA DFIRM 3/27/2024

Past Occurrences

Disaster Declaration History

A list of federal and state disaster declarations for Colusa County from flooding, (including heavy rains and storms) is shown on Table 4-81.

Table 4-81 Colusa County – Federal and State Disaster Declaration from Flood 1950-2023

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood	17	1955, 1958, 1963 (twice), 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2017, 2019 (twice), 2023 (twice)	19	1950, 1955, 1958 (twice), 1963 (twice), 1973, 1978, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017, 2019 (twice)

Source: Cal OES, FEMA

NCDC Events

The NCDC tracks flooding events for the County. Events have been tracked for flooding since 1993. Table 4-82 shows events in Colusa County since 1993.

*Table 4-82 NCDC Flood Events in Colusa County 1993 to 8/31/2023**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Flash Flood	1	0	0	0	0	$0	$0
Flood	13	0	0	0	0	$32,900,000	$0
Total	**14**	**0**	**0**	**0**	**0**	**$32,900,000**	**$0**

Source: NCDC

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

FIS Events

The 2024 FIS noted that as a result of limited channel capacities, agricultural lands along the Colusa Basin Drain have experienced relatively frequent flooding. According to studies by the Cal DWR, crop damages were incurred as the result of historic floods during 1958, 1970, 1973, 1980, 1983, and 1986. Because of the predominantly rural nature of the study area, the reported damages to structures were relatively limited. However, approximately 20 homes and agricultural buildings experienced damages as a result of the 1983 flood event. Major flood events, such as those in 1983 and January 1995, resulted in overtopping and closure of State Highway 20. No significant structural damage was reported for the January 1995 flood event.

The City of Williams was inundated by a flood in 1973 caused by a heavy rainstorm in the western mountains. Severe floods also occurred in 1983 and 1984.

EOC Activations

The County maintains a list of EOC activations by hazard. EOC activations from flood and storms and from winter weather (which includes snow in the upper elevations of the County and flood in the lower elevations) from 2008 to 2024 are shown in Table 4-83.

Table 4-83 Colusa County – EOC Activations for Flood and Storms 2008-2024

Disaster Type	EOC Activations	
	Count	Date
Flood and Storms	6	1/2008; 1/2010, 3/2011; 11/2012; 2/2017
Winter Storm	2	1/2021, 1/2023

Source: Colusa County OES

Hazard Mitigation Planning Committee Events

The HMPC provided additional information on the following historical flood events in the County.

- **2023 Floods** - A major winter storm brought strong winds with moderate to heavy rain bringing renewed flooding of already elevated waterways. There was flooding of roadways, urban areas, rivers, streams and creeks, with rockslides and mudslides also reported. Winds gusted up to 60-70 mph in the Central Valley. In the mountains there were gusts up to 80 to 115 mph, which coupled with heavy snow, brought whiteout conditions. There were widespread trees down across the area, blocking roads and causing numerous power outages. Atmospheric river storms affected Colusa County and much of California beginning January 4 and continued well into late February. Colusa County received at least 9 in of rain. There was little to no break between storms, this caused over saturation of soil and flooding in the area. There was minor rockslides up in the hills and debris flows at various county roads. Wing Wall erosion causing over flow of debris onto Old Hwy 99 @ Funks Creek and Walnut Dr @ Salt Creek, causing road closures in these areas. Many culverts damaged due to the storms causing flooding in these areas. Monitoring river levels and notified Grimes Boat landing, Colusa Landing and residents along the river that potentially be affected by increasing river levels that were projected to reach flood stage in those areas. From January 4 – January 30 the river level reached up to 67 feet. Colusa County completed a preliminary estimate of damage to roads, road closures, debris removal, and high river levels of about $800,000 in damage. According to After Action Reports and FEMA project worksheets, multiple areas in the County had debris deposited from flooding. The Colusa Boat Landing had some damages to the private levee, with an estimate of about $200,000.
- **2019 Floods** - A strong atmospheric river brought heavy precipitation with widespread impacts across interior Northern California. These impacts included heavy high elevation snow, flooding, debris flows, strong mountain winds, and periods of whiteout conditions. Heavy snow fell over the mountains and extended down into lower elevations, causing widespread travel problems and road closures. Thunderstorms brought heavy rain and small hail with widespread road flooding. Gusty winds brought down trees and caused power outages. Caltrans reported that multiple vehicles were stuck in water on I-5. Local roadways in Colusa County also had flooding. Colusa County damage inventories showed that gravel roads were inundated with floodwaters. The County removed silt and other deleterious materials from the roadways and then repaired the surface course. County conducted emergency pumping as water management and flood fighting. Police conducted access management utilizing barricades and deployed sheriff officers and their vehicles to manage county wide access controls. In total, just over $725,000 in damages were reported.
- **2017 Floods** – The HMPC noted a flood in February of 2017. A Pacific storm parked itself over Southern California and unloaded, opening sinkholes and leading to the deaths of at least two people. The storm also affected areas farther north that have been lashed by rain for days. The Colusa County Sheriff's Office called for voluntary evacuations in Maxwell because of reports that rising water levels were threatening homes Saturday morning. The HMPC noted that roads turned into streams of brown water that lapped at doorsteps but no injuries were reported. The Red Cross of Northern California has opened evacuation centers for Colusa County residents after the Colusa County Sheriff issued an evacuation warning. The Sheriff's office said it began receiving calls that rising waters were threatening homes in the town of Maxwell. In addition, water rescues were carried out for several residences in Maxwell and at two residences in Williams. Many other rescues were carried out for persons who disregarded road closures and found their vehicle stalled out in flood water on roadways. The majority of the residences in Maxwell received up to three feet of water in them. The floodwater did not recede immediately: efforts to return residents to their homes were hindered. And, while the Small Business Administration set up a registration desk for assistance grants, few homeowners took advantage. A recovery team consisting of a representative from FEMA, Cal OES and the local OES with an interpreter (the majority of the residences in Maxwell are owned by Mexican families) conducted door

to door notification of services available for recovery assistance. Few of those homeowners were interested: if they weren't receiving free cash, they were determined to perform the clean-up and repairs themselves. The schools and businesses experienced insured losses. A large flood fight effort took place in the town of Princeton, which was experiencing water on the town's streets reaching unprecedented levels. Flood fight to protect residences and businesses was active for days on end. Local supplies and resources were depleted and additional supplies were purchased by the county. Mutual aid was requested for fire personnel to assist with the ongoing flood fight. The county's losses consisted mostly of road damages and flood fight expenses. Overtime expenses for first responders and public works were high as well. Public Assistance was granted totaling an amount reaching $735,000. Highway 99 was closed from the Glenn County Line to Williams, Maxwell Road was closed just west of the I-5 southbound on and off ramps, and many roads in the town of Maxwell are flooded. Damages to these roads was reported. Pictures of damages can be found in the past occurrences in Section 4.3.15. Photos of flooding can be seen in Figure 4-79.

Figure 4-79 Colusa County – 2017 Flooding

- **May 1998** Floods – On May 31, 1998, heavy rains and storms affected the County. Overland flooding can be seen on Figure 4-80.

Figure 4-80 Colusa County – May 31, 1998, Flooding

Source: Colusa County OES

- **1978 Floods** – The HMPC noted that the County experienced flooding in January of 1978. The Moulton Weir was overflowing, and the river overtopped the secondary levee of River Road. This can be seen in Figure 4-81.

Figure 4-81 Colusa County - January 1978 Flooding

Source: Colusa County OES

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.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and flood can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Flood

Climate change and its effect on flooding is discussed using three sources:

- 2021 CAS
- Cal-Adapt
- National Center for Atmospheric Research

California Climate Adaptation Strategy

According to the 2021 CAS, climate change may affect flooding in California and the Planning Area. 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 temperatures, 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.

Cal Adapt

Cal Adapt future precipitation projections were shown in Figure 4-42 in Section 4.3.4. These could affect flooding in the Colusa County Planning Area.

National Center for Atmospheric Research

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

Historically, the Colusa County Planning Area has always been at risk to flooding during the rainy season from November through April. The Colusa County FIS noted that floods result from prolonged heavy rainfall and are characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. Several areas of the Planning Area are subject to flooding by the overtopping of rivers and creeks, levee failures, and the failure of urban drainage systems that cannot accommodate large volumes of water during severe rainstorms. In addition to the major rivers, there are many streams, channels, canals, and creeks that serve the drainage needs of the Planning Area and communities surrounding it. There is significant threat of flooding in areas of the Planning Area from several of these streams. These streams can be prone to rapid flooding with little notice.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The 2010 General Plan Background Report noted the flood issues and areas at risk. In the northwestern area of the County, 1% annual chance flood zones are delineated along Stony Creek northwest of Stonyford and around the East Park Reservoir, Little Stony Creek and Little Indian Creek near Lodoga. Near Delevan and Maxwell, delineated floodplains are identified along several streams, such as Hunters Creek, Funks Creek, Stone Coral Creek and the Glenn-Colusa Canal. Moving south, delineated floodplains coincide with several drainages, such as Lurline Creek, Freshwater Creek and Salt Creek, while floodplains near Arbuckle have been delineated along Cortina Creek, Sand Creek, Whiskey Creek and Elk Creek.

The lands to the east of Interstate 5 are crisscrossed with levees, canals and natural drainages. In addition, the Colusa Basin and Butte Sink frame the Sacramento River near the northeastern corner of the County. The flood control and water delivery facilities within the County are the product of a complex history of agencies, districts, plans, programs, and regulations.

The HMPC also noted that with the decertification of levees, additional homes have been placed into the 1% annual chance floodplain. In order to secure a federally backed mortgage, flood insurance would also be required on the homes recently put into the floodplain by the levee decertification

Assets at Risk

Assets at risk from 1% and 0.2% annual chance floods include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources, economic assets, and community activities of value). These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

The Planning Area has mapped FEMA flood hazard areas. GIS was used to determine the possible impacts of flooding within the Planning Area and how the risk varies across the Colusa County Planning Area. The following methodology was utilized in determining assets at risk to the 1% annual chance flood event and 0.2% annual chance flood event.

Methodology (Parcel and Structures)

2023 Colusa County Parcel/Assessor Data was used as the basis for the Colusa County inventory of parcels, values, and acres. Colusa County has a FEMA effective DFIRM dated 3/27/2024, which was obtained from FEMA's National Flood Hazard Layer 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.

Once the DFIRM flood zones were intersected, land and improved (structure) values from the Assessor data were included for each parcel and estimated content replacement values were added to the analysis. Improved parcels include those with improved structure values identified in the Colusa County Assessor's database. The property use categories for the Colusa County Planning Area (derived from general plan property use descriptions) were used to develop estimated content replacement values (CRV) that are potentially at loss from hazards, using FEMA Hazus methodologies as previously described in Section 4.2. The CRVs were added to the land and improved parcel values.

The parcels and associated values were segregated and analyzed in this fashion to determine parcels and values at risk to the flood hazard for the Colusa County Planning Area.

Methodology (Loss Estimate)

The loss estimate for flood is based on the total of improved and contents value. 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 is primarily present to show the value of the land associated with each flood zone.

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 percentage 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.

People and Populations

All people and populations located in the 1% and 0.2% annual chance floodplains are at some risk to flooding. Certain vulnerable populations located within areas prone to flooding may be at increased risk to this hazard, especially during a large event with minimal advance notice. These vulnerable populations include: the unhoused, those with limited mobility, and those that lack the resources to leave the area.

Colusa County Planning Area residents that live in the 1% and 0.2% annual chance floodplains are often the most vulnerable. Not only are the residents at risk, but their homes and contents are all at risk, compounding the impacts associated with significant hazard events. To further evaluate the impact to the Planning Area's residential population residing within these hazard areas, the DFIRM flood zones were overlayed on the parcel layer and linked to the Assessor Data. Those residential parcel centroids that intersect the flood zones were counted and multiplied by the 2020 Census Bureau average household factors for each jurisdiction. This is shown in Table 4-84.

Table 4-84 Colusa County Planning Area – Improved Residential Parcels and Population by FEMA DFIRM Flood Zone by Jurisdiction

Jurisdiction	1% Annual Chance		0.2% Annual Chance	
	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk
City of Colusa	300	870	13	38
City of Williams	19	48	168	428
Unincorporated Colusa County	492	1,761	953	3,412

Source: FEMA DFIRM 3/27/2024, 2023 Colusa County Parcel/Assessor Data, 2020 US Census Bureau Average Household Size– City of Colusa (2.90); City of Williams (2.55); Unincorporated Colusa County (3.58)

These numbers reflect low end estimates as the property use categories based on the Assessor data utilized for this LHMP Update assumes all residential properties are single family residences. However, some of the residential parcels actually include multi-family units, including apartments, condominiums, as well as duplexes and triplexes. These variations in residential property use were not accounted for in the analysis, which skews populations results to be lower.

Structures

Results are presented here first for the Colusa County Planning Area and secondly for unincorporated County.

Colusa County Planning Area

Certain structures in the Colusa County Planning Area are at risk of DFIRM flooding and primarily include those structures located within the 1% and 0.2% annual chance floodplains. GIS was used to determine the possible impacts of flooding on parcels and structures within the Planning Area. Table 4-85 shows parcel counts, land and improved values (i.e., those with a structure improvement on the parcel), estimated content replacement values, and total values in the Planning Area. This is shown for the 1% and 0.2% annual chance flood zones, as well as for those properties that fall outside of the mapped FEMA DFIRM flood zones.

Table 4-85 Colusa County Planning Area – Count and Value of Parcels (and Structures) in FEMA DFIRM 1% and 0.2% Annual Chance Flood Zones by Jurisdiction

Jurisdiction / Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Total Value
City of Colusa						
1% Annual Chance Flood Hazard	476	355	$41,614,561	$118,703,421	$12,800,623	$173,118,605
0.2% Annual Chance Flood Hazard	18	15	$796,791	$3,866,267	$0	$4,663,058
Other Areas	1,840	1,707	$101,892,192	$321,198,099	$36,427,920	$459,518,211
City of Colusa Total	**2,334**	**2,077**	**$144,303,544**	**$443,767,787**	**$49,228,543**	**$637,299,874**
City of Williams						
1% Annual Chance Flood Hazard	115	53	$9,814,990	$22,835,847	$3,087,632	$35,738,469
0.2% Annual Chance Flood Hazard	204	183	$17,819,160	$61,549,910	$26,998,809	$106,367,879
Other Areas	1,436	1,241	$82,539,836	$265,076,793	$96,815,520	$444,432,149
City of Williams Total	**1,755**	**1,477**	**$110,173,986**	**$349,462,550**	**$126,901,961**	**$586,538,497**
Unincorporated Colusa County						
1% Annual Chance Flood Hazard	3,193	1,468	$751,354,019	$220,816,491	$53,782,824	$1,025,953,334
0.2% Annual Chance Flood Hazard	1,189	1,059	$72,344,377	$182,185,719	$5,850,126	$260,380,222
Other Areas	6,500	3,071	$741,971,756	$515,571,053	$139,714,432	$1,397,257,241

Jurisdiction / Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Total Value
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$2,683,590,797**
Grand Total	**14,971**	**9,152**	**$1,820,147,682**	**$1,711,803,600**	**$375,477,886**	**$3,907,429,168**

Source: FEMA DFIRM 3/27/2024, 2023 Colusa County Parcel/Assessor 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 4-86 shows Planning Area loss estimates and improved values at risk by FEMA 1% and 0.2% annual chance flood zones. More detailed tables and discussions can be found in each jurisdiction's respective annex to this Base Plan.

Table 4-86 Colusa County Planning Area – FEMA DFIRM Flood Loss Estimates

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance	3,784	1,876	$802,783,570	$362,355,759	$69,671,079	$311,463,844	$743,490,682	$148,698,136.00	0.05%
0.2% Annual Chance	1,411	1,257	$90,960,328	$247,601,896	$32,848,935	$157,188,784	$437,639,615	$87,527,924	0.03%
Total	**5,195**	**3,133**	**$893,743,898**	**$609,957,655**	**$102,520,014**	**$468,652,628**	**$1,181,130,297**	**$236,226,060**	**0.08%**

Source: FEMA DFIRM 3/27/2024, 2023 Colusa County Parcel/Assessor 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.

According to the information in Table 4-85 and Table 4-86, the Colusa County Planning Area has 1,876 improved parcels and roughly $743.5 million of structure and contents value in the 1% annual chance floodplain. There are an additional 1,257 improved parcels and roughly $437.6 million of structure and contents value in the 0.2% annual chance flood event. A loss ratio of 0.05% and 0.02% indicates that while the Colusa County Planning Area does have structural assets at risk to flood, the County should be able to effectively recover from a major flood event.

Unincorporated Colusa County

Numerous structures in unincorporated Colusa County are at risk of DFIRM flooding and primarily include those structures located within the 1% and 0.2% annual chance floodplains. GIS was used to determine the possible impacts of flooding on parcels and structures within the unincorporated County. Table 4-87 shows parcel counts, land and improved values (i.e., those with a structure improvement on the parcel), other

values, estimated content replacement values, and total values in the unincorporated County. This is shown for the detailed flood zones by the 1% and 0.2% annual chance flood zones, as well as for those properties that fall outside of the mapped FEMA DFIRM flood zones.

Table 4-87 Unincorporated Colusa County– Count and Value of Parcels (and Structures) in Detailed FEMA DFIRM 1% and 0.2% Annual Chance Flood Zones by Property Use

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard							
Zone A							
Agricultural	754	315	$234,743,845	$43,627,424	$13,129,505	$43,627,424	$335,128,198
Commercial	13	8	$1,125,315	$5,666,198	$8,644,193	$5,666,198	$21,101,904
Government	54	2	$1,241,498	$139,339	$0	$139,339	$1,520,176
Industrial	3	3	$778,474	$6,384,279	$857,571	$9,576,418	$17,596,742
Institutional	7	0	$543,932	$0	$0	$0	$543,932
Miscellaneous	97	2	$16,460,628	$299,790	$1,579,253	$299,790	$18,639,461
Residential	91	73	$4,729,043	$12,512,049	$497,943	$6,256,026	$23,995,061
Zone A Total	**1,019**	**403**	**$259,622,735**	**$68,629,079**	**$24,708,465**	**$65,565,195**	**$418,525,474**
Zone AE							
Agricultural	1,327	531	$422,276,166	$60,273,876	$9,366,080	$60,273,876	$552,189,998
Commercial	60	44	$3,768,368	$13,036,277	$3,285,446	$13,036,277	$33,126,368
Government	99	11	$20,159,971	$793,399	$3,485	$793,399	$21,750,254
Industrial	9	5	$1,188,962	$1,750,252	$118,954	$2,625,378	$5,683,546
Institutional	13	3	$401,239	$293,916	$424,813	$293,916	$1,413,884
Miscellaneous	58	15	$11,002,308	$675,151	$90,670	$675,151	$12,443,280
Residential	304	246	$16,470,218	$39,577,850	$1,299,564	$19,788,928	$77,136,560
Zone AE Total	**1,870**	**855**	**$475,267,232**	**$116,400,721**	**$14,589,012**	**$97,486,925**	**$703,743,890**
Zone AH							
Agricultural	38	16	$6,308,885	$678,688	$5,533	$678,688	$7,671,794
Commercial	27	13	$2,106,718	$4,794,417	$3,270,868	$4,794,417	$14,966,420
Government	5	2	$291,276	$851,096	$24,100	$851,096	$2,017,568
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	3	1	$42,613	$1,919,497	$0	$1,919,497	$3,881,607
Miscellaneous	6	0	$1,059	$0	$0	$0	$1,059
Residential	178	138	$6,122,831	$18,284,397	$259,353	$9,142,199	$33,808,780
Zone AH Total	**257**	**170**	**$14,873,382**	**$26,528,095**	**$3,559,854**	**$17,385,897**	**$62,347,228**
Zone AO							
Agricultural	6	3	$212,189	$64,958	$0	$64,958	$342,105
Commercial	1	1	$5,237	$959	$0	$959	$7,155

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Government	0	0	$0	$0	$0	$0	$0
Industrial	2	1	$303,140	$6,100,489	$10,764,410	$9,150,734	$26,318,773
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0	$0
Residential	38	35	$1,070,104	$3,092,190	$161,083	$1,546,094	$5,869,471
Zone AO Total	**47**	**40**	**$1,590,670**	**$9,258,596**	**$10,925,493**	**$10,762,745**	**$32,537,504**
1% Annual Chance Flood Hazard Total	**3,193**	**1,468**	**$751,354,019**	**$220,816,491**	**$53,782,824**	**$191,200,762**	**$1,217,154,096**
0.2% Annual Chance Flood Hazard							
Zone X (shaded)							
Agricultural	90	70	$23,389,838	$11,859,628	$3,165,643	$11,859,628	$50,274,737
Commercial	27	21	$2,668,506	$5,500,237	$1,450,719	$5,500,237	$15,119,699
Government	21	7	$256,413	$710,194	$6,118	$710,194	$1,682,919
Industrial	1	1	$181,086	$1,146,913		$1,720,370	$3,048,369
Institutional	5	4	$114,466	$3,049,234	$369,211	$3,049,234	$6,582,145
Miscellaneous	24	3	$1,526,605	$3,178,676		$3,178,676	$7,883,957
Residential	1,021	953	$44,207,463	$156,740,837	$858,435	$78,370,409	$280,177,144
Zone X (shaded) Total	**1,189**	**1,059**	**$72,344,377**	**$182,185,719**	**$5,850,126**	**$104,388,748**	**$364,768,970**
0.2% Annual Chance Flood Hazard Total	**1,189**	**1,059**	**$72,344,377**	**$182,185,719**	**$5,850,126**	**$104,388,748**	**$364,768,970**
Other Areas							
Zone X (unshaded)							
Agricultural	3,201	1,709	$628,384,629	$243,574,227	$87,660,998	$243,574,227	$1,203,194,081
Commercial	132	92	$11,295,115	$42,538,977	$15,372,418	$42,538,977	$111,745,487
Government	232	16	$7,613,406	$1,583,898	$3,746	$1,583,898	$10,784,948
Industrial	36	20	$7,536,728	$56,124,516	$29,943,644	$84,186,776	$177,791,664
Institutional	27	18	$204,718	$2,664,515	$2,655,728	$2,664,515	$8,189,476
Miscellaneous	222	9	$2,955,560	$943,952	$181,750	$943,952	$5,025,214
Residential	2,398	1,152	$66,446,067	$160,209,004	$3,666,602	$80,104,503	$310,426,176
Zone X (unshaded) Total	**6,248**	**3,016**	**$724,436,223**	**$507,639,089**	**$139,484,886**	**$455,596,848**	**$1,827,157,046**
Zone D (unmapped)							
Agricultural	74	34	$9,641,023	$3,172,324	$229,546	$3,172,324	$16,215,217
Commercial	0	0	$0	$0	$0	$0	$0
Government	15	1	$2,395,245	$3,451,260	$0	$3,451,260	$9,297,765

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	125	0	$4,965,902	$0	$0	$0	$4,965,902
Residential	38	20	$533,363	$1,308,380	$0	$654,189	$2,495,932
Zone D (unmapped) Total	**252**	**55**	**$17,535,533**	**$7,931,964**	**$229,546**	**$7,277,773**	**$32,974,816**
Other Areas Total	**6,500**	**3,071**	**$741,971,756**	**$515,571,053**	**$139,714,432**	**$462,874,621**	**$1,860,131,862**
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$758,464,131**	**$3,442,054,928**

Source: FEMA DFIRM 3/27/2024, Colusa County Parcel/Assessor 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 4-88 shows unincorporated Colusa County loss estimates and improved values at risk by FEMA 1% and 0.2% annual chance flood zones.

Table 4-88 Unincorporated Colusa County – FEMA DFIRM Flood Loss Estimates

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance	3,193	1,468	$751,354,019	$220,816,491	$53,782,824	$191,200,762	$465,800,077	$93,160,015	0.03%
0.2% Annual Chance	1,189	1,059	$72,344,377	$182,185,719	$5,850,126	$104,388,748	$292,424,593	$58,484,919	0.02%
Total	**4,382**	**2,527**	**$823,698,396**	**$403,002,210**	**$59,632,950**	**$295,589,510**	**$758,224,670**	**$151,644,934**	**0.05%**

Source: FEMA DFIRM 3/27/2024, Colusa County Parcel/Assessor 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.

According to the information in Table 4-87 and Table 4-88, the unincorporated Colusa County has 1,468 improved parcels and roughly $465.8 million of structure and contents value in the 1% annual chance floodplain. There are an additional 1,059 improved parcels and roughly $292.4 million of structure and contents value in the 0.2% annual chance flood event. A loss ratio of 0.03% and 0.02% indicates that while the County does have structural assets at risk to flood, the County should be able to effectively recover from a major flood event.

Insurance Coverage, Claims Paid, and Repetitive Losses

Standard property insurance does not include flood coverage because of the relatively high risk. The National Flood Insurance Program (NFIP) provides flood insurance to residents in those communities that participate in the NFIP. Federal financial assistance requires the purchase of flood for structures located within a 1% annual chance floodplain – a requirement that affects nearly all mortgages financed through commercial lending institutions. Flood insurance is also recommended for all structures protected by levees, even if not mapped within a floodplain. However, with the release of the new DFIRMs as detailed above, all levees within the Colusa County Planning Area have been deaccredited placing all structures previously protected by levees into the 1% annual chance flood. Flood insurance promotion and outreach will be important moving forward to ensure these vulnerable structures are adequately insured and protected.

Unincorporated Colusa County joined the NFIP on September 18, 1985. The County does not participate in the CRS program. NFIP insurance data indicates that as of February 2, 2024, there were 243 policies in force in the unincorporated County, resulting in $65,642,000 of insurance in force and $153,363 in annual premiums paid. Of these, 202 are for residential properties and 41 are nonresidential. 110 of these are in A zones; and 113 policies are for parcels in the B, C, & X zones.

There have been 142 closed paid losses totaling $3,120,729.86. 106 of these were for residential properties and 36 were for nonresidential. Of these 142 paid losses, 32 were parcels in A zones, 83 parcels were in B, C, & X zones, and 27 had no zone data attached to them. Of the 142 claims, 91 claims were associated with pre-FIRM structures and 23 with post-FIRM structures, with 28 had no data attached to them. There have been 7 substantial damage claims since 1978. There has been 1 Increased Cost of Compliance (ICC) loss totaling $30,000. According to FEMA's Community Information System data, there are 25 repetitive loss (RL) and 0 Post-FIRM Severe Repetitive Loss (SRL) buildings.

FEMA also supplied data from their PIVOT database, which looks at RL and SRL properties differently than the CIS data above. PIVOT data consider whether a structure has been mitigated or not, and also includes pre-FIRM SRL buildings. According to this database, there are 19 RL properties and 4 SRL properties in the unincorporated County. This can be seen on Table 4-89.

Table 4-89 Colusa County Planning Area – SRL and RL Properties and their Status

Community ID	Jurisdiction	RL Properties	SRL Properties	Mitigated	Single Family	Two-Four Family	Other Non-Residential	Non-Residential - Business
060023	City of Colusa	0	0	0	0	0	0	0
060024	City of Williams	0	0	0	0	0	0	0
060022	Unincorporated Colusa County	19	4	0	18	3	1	1

Source: FEMA, PIVOT, 5/8/2024

Based on this analysis of insurance coverage, unincorporated Colusa County has significant values at risk to the 1% and 0.2% annual chance and greater floods. Of the 1,468 improved parcels within the 1% annual

chance flood zone, only 110 (or 7.5 percent) of those parcels maintain flood insurance. This can be seen on Table 4-90, along with insurance information from the 2 incorporated communities in the County.

Table 4-90 Colusa County Planning Area– 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
City of Colusa	355	0	0.0%
City of Williams	53	3	5.7%
Unincorporated County	1,468	110	7.5

Source: FEMA DFIRM 3/27/2024, FEMA CIS 2024, 2023 Colusa County Parcel/Assessor's Data

As the levees are de-accredited, an increased number of Colusa County residents are placed in the floodplain. Table 4-91 illustrates the changes in the number of insured structures in the 1% annual chance floodplain. As seen in the table, the overall percentage of policy holders dropped from 22.2% in 2018 to 6.0% in 2024.

Table 4-91 Colusa County Planning Area– Comparison of 2024 and 2018 Percentage of Policy Holders to Improved Parcels in the 1% Annual Chance Floodplain

	2024 LHMP			2018 LHMP		
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	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
City of Colusa	355	0	0.0%	7	0	0.0%
City of Williams	53	3	5.7%	53	11	20.8%
Unincorporated County	1,468	110	7.5%	879	206	23.4%
Total	**1,876**	**113**	**6.0%**	**939**	**217**	**22.2%**

Source: FEMA DFIRM 3/27/2024, FEMA CIS 2024, 2023 Colusa County Parcel/Assessor's Data, 2018 Colusa County LHMP Update

Critical Facilities and Infrastructure

Flooding presents a threat to critical facilities and infrastructure, and community lifelines. Critical facilities and infrastructure plays an immensely important role in our communities. As previously noted, communities rely on roads, rail corridors, and related biking and pedestrian routes for transportation, and on water infrastructure for drinking water, wastewater service, and draining streets of rainwater. Damage to any one of these systems can threaten public safety, wreak havoc on daily life, impact properties far from flood zones, and result in economic impacts that cascade throughout California. The following GIS analysis

identifies critical facilities and infrastructure at risk to 1% and 0.2% annual chance flooding, followed by a discussion on vulnerability of community lifelines.

A separate analysis was performed on the critical facility inventory in the Colusa County Planning Area to determine critical facilities in the 1% and 0.2 annual chance flood zones. Using GIS, the DFIRM flood zones were overlayed on the critical facility GIS layer. Figure 4-82 shows critical facilities and the detailed DFIRM flood zones. Table 4-92 details critical facilities in detailed DFIRM flood zones by facility type and count for the Colusa County Planning Area broken out by jurisdiction. Details of critical facilities by type, name, and address by flood zone are listed in Appendix F.

Figure 4-82 Colusa County Planning Area – Critical Facilities in DFIRM Flood Zones

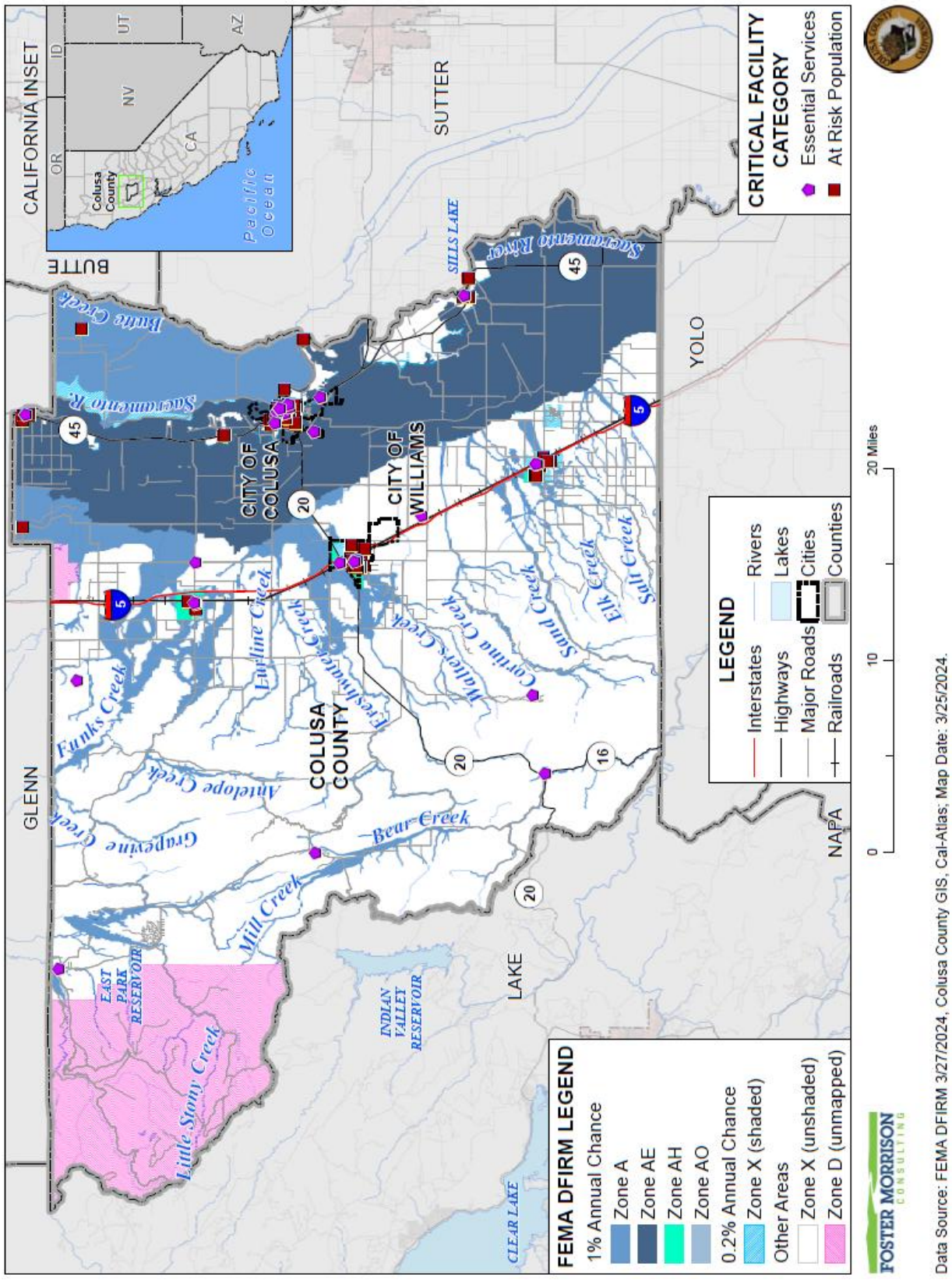


Table 4-92 Colusa County Planning Area – Critical Facilities in Detailed DFIRM Flood Zones by Category, Type, and Jurisdiction

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
City of Colusa		
1% Annual Chance Flood Hazard		
Zone AE		
Essential Services Facilities	Emergency Response	1
	Public Services	2
	Total	***3***
At Risk Population Facilities	Apartment Complex	3
	Mobile Home Park	4
	Total	***7***
Zone AE Total		**10**
1% Annual Chance Flood Hazard Total		**10**
Other Areas		
Zone X (unshaded)		
Essential Services Facilities	Fire Station	2
	Medical	1
	Police Station	1
	Public Services	1
	Utility Facility	2
	Total	***7***
At Risk Population Facilities	Apartment Complex	19
	Assisted-Living	1
	Hotel or Motel	2
	Jail	1
	Mobile Home Park	1
	School	8
	Senior Living Facility	1
	Total	***33***
Zone X (unshaded) Total		***40***
Other Areas Total		**40**
City of Colusa Total		**50**
City of Williams		
1% Annual Chance Flood Hazard		
Zone AH		
Essential Services Facilities	Utility Facility	1

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
	Total	***1***
At Risk Population Facilities	Hotel or Motel	2
	Mobile Home Park	1
	Total	***3***
Zone AH Total		***4***
1% Annual Chance Flood Hazard Total		**4**
0.2% Annual Chance Flood Hazard		
Zone X (shaded)		
At Risk Population Facilities	Hotel or Motel	3
	Total	**3**
Zone X (shaded) Total		***3***
0.2% Annual Chance Flood Hazard Total		**3**
Other Areas		
Zone X (unshaded)		
Essential Services Facilities	Emergency Response	2
	Fire Station	1
	Public Services	1
	Total	***4***
At Risk Population Facilities	Apartment Complex	4
	Hotel or Motel	3
	Migrant Housing	1
	Mobile Home Park	1
	School	4
	Senior Living Facility	3
	Total	***16***
Zone X (unshaded) Total		***20***
Other Areas Total		**20**
City of Williams Total		**27**
Unincorporated Colusa County		
1% Annual Chance Flood Hazard		
Zone A		
At Risk Population Facilities	Mobile Home Park	2
	Total	***2***
Zone A Total		***2***
Zone AE		
Essential Services Facilities	Fire Station	1

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
	Total	***1***
At Risk Population Facilities	Apartment Complex	1
	Mobile Home Park	4
	School	2
	Total	***7***
Zone AE Total		***8***
Zone AH		
At Risk Population Facilities	Apartment Complex	1
	Mobile Home Park	1
	School	1
	Total	***3***
Zone AH Total		***3***
1% Annual Chance Flood Hazard Total		**13**
0.2% Annual Chance Flood Hazard		
Zone X (shaded)		
Essential Services Facilities	Utility Facility	1
	Total	***1***
At Risk Population Facilities	Apartment Complex	1
	Mobile Home Park	1
	School	4
	Total	***6***
Zone X (shaded) Total		***7***
0.2% Annual Chance Flood Hazard Total		**7**
Other Areas		
Zone D (unmapped)		
Essential Services Facilities	Native American Reservation	1
	Total	***1***
At Risk Population Facilities	Casino	1
	Hotel or Motel	1
	Total	***2***
Zone D (unmapped) Total		***3***
Zone X (unshaded)		
Essential Services Facilities	Fire Station	6
	Utility Facility	4
	Total	***10***
At Risk Population Facilities	Apartment Complex	2

Jurisdiction/Critical Facility Category	Facility Type	Facility Count
	Mobile Home Park	1
	School	2
	Total	**5**
Zone X (unshaded) Total		***15***
Other Areas Total		**18**
Unincorporated Colusa County Total		**38**
Grand Total		**115**

Source: FEMA 3/27/2024 DFIRM, Colusa County GIS

Community Lifelines

1% and 0.2% annual chance flooding presents a threat to life and property, including community lifelines in the Planning Area. Community lifelines that would be vulnerable to flooding include:

- **Safety and Security** – Search and rescue and swiftwater teams may be called on to perform riskier duties during times of flooding. Police, Fire, EMS, and Public Works personnel are often called on to respond during flood emergencies. During large events, these services may become stretched.
- **Food, Hydration, and Shelter -** Public health can also be at risk from flooding. Floodwater is often contaminated with sewage, which can lead to illness and affect clean drinking water.
- **Health and Medical** – Loss of life and injuries can occur during significant flood events, Flooding may complicate the ability to transport the injured possibly requiring rerouting of injured to other facilities.
- **Energy** – Floods can cause power grid issues and lead to power outages. During extreme flood events gas lines may break or otherwise be damaged from erosion and debris in floodwaters.
- **Communications** – Communication infrastructure can be inundated by a flood event causing damage and disruption in service. As well an influx of service calls to dispatch centers for reporting of flooding, power outages, or other issues can occur. Messaging systems need to be deployed during these times to let the public know about lane and road closures, washouts, debris on roads, and requirements for evacuations or sheltering.
- **Transportation** – Transport networks can be affected, such as flood damage to bridges, railways and roads. This can cause lane and road closures. These closures can affect response personnel (EMS, Fire, Police) as well as cause additional traffic issues for residents and impact evacuation routes. Life safety can also be an issue on flooded roads.
- **Hazardous Material** – Hazardous material facilities can be affected by flooding. Releases during these times can be comingles with flood waters, contaminate drinking water, as well as create additional exposures to the environment.
- **Water Systems** – Floods can affect the ability for water and wastewater systems to operate, since many are located near flood zones.

Generally, even major flood events are temporary events with flood waters receding back to pre-storm levels at the conclusion of the storm. However, depending on the location, duration, and magnitude and severity of any given flood event, some of these community lifelines may be overwhelmed in the short term.

Natural, Historic, and Cultural Resources

Large flood events can affect natural, historic, and cultural resources. There are a number of ways floodwaters can impact natural resources and the environment: Wildlife habitats can be destroyed by floodwaters. Contaminated floodwater can pollute rivers and habitats. Silt and sediment can destroy natural areas. Riverbanks and natural levées can be eliminated as rivers reach bankfull capacity. Rivers can be widened, and deposition can increase downstream. Trees can be uprooted by high-velocity water flow. Plants that survive the initial flood may die due to being inundated with water. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to structures within the flooded areas, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged and lost during extreme flood events. Any of these resources that fall in the flood zones would be vulnerable.

Economic Assets and Community Activities of Value

Major flood events could affect any economic asset that lies in the floodplain and can have long lasting effects. This could cause those businesses and economic assets within these areas to close or relocate. This could cause temporary or permanent loss of sales tax revenue. This is also true if agricultural areas are flooded in the County (discussed in greater detail in Section 4.3.6) resulting in losses. These events can also affect those economic assets outside of the floodplain, at least in the short term until the Planning Area has sufficiently recovered. Community activities of value can also be disrupted by floods, though many of these events take place in the summer months, when flooding is less likely to occur. This includes the County Fair, Farm Show, rodeos, craft fairs, the Lantern Festival, and hunting and fishing seasons.

Impacts from Flood: 1% and 0.2% Annual Chance Flood

Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Large flood events, including those associated with 1% and 0.2% annual chance floods, can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. People may be swept away in floodwaters, causing injuries or deaths. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short outs. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Floodwaters can transport large objects downstream which can damage or remove stationary structures. Structures can be damaged directly from floodwaters and can also be damaged from trees falling as a result of water-saturated soils. 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 causing power outages. The interruption of power causes major problems and can result in the closure of governmental offices and community businesses. Public 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.

Standing water can cause damage to crops, roads, foundations, and electrical circuits. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

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

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

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.

Mercury in Waterways in Colusa County

As a result of historical releases of mercury associated with mining in Colusa County and the surrounding region, mercury contamination is a significant hazard to County residents and visitors, as well as wildlife. This Mercury contamination can become a greater concern during flood events. The State Resources Agency, as well as Cal EPA and US EPA, have recognized this contamination. The presence of mercury in the groundwater under the Colusa National Wildlife Refuge. The Colusa National Wildlife Water Management Plan dated March 3, 2011, details the contamination. This contamination is a potential hazard for local wildlife at the Refuge but also the food web for aquatic life in the lower Sacramento River and Delta due to the reduction of the mercury contamination into methylmercury by biotic microorganisms. The contamination from one of the sites identified on the State Water Resources Board 303(d) list to be submitted to the US EPA. These sites include Bear Creek, East Park Reservoir, Freshwater Creek to Salt Creek, Powell Slough, Sand Creek, Spring Creek, Stone Corral Creek, and Sulfur Creek in Colusa County.

Various factors in the region can affect the amount of mercury that enters the food chain and poses a hazard to human health and the environment. Some of these factors may be subject to some level of influence by human activity. Factors that affect the hazard caused by mercury include but are not limited nutrient levels, sediment transport, streambed modification, food chain and ecological effects, fish consumption practices, management of water levels, water exports and diversions, irrigation practices, salinity, oxygen concentrations, wetland restoration and management practices, flooding of affected areas, dredging, reservoir management, stormwater and wastewater discharges and treatment processes, source control and pollution prevention activities, and levels of mercury in sediments, water bodies, and discharges.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future flood conditions and associated impacts and vulnerability of the County to 1% and 0.2% annual chance flooding.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County
- Land use planning should be proactive to address future hazard conditions. Locating new development, structures and critical facilities and infrastructure within or near areas of flood risk may put additional development at risk. However, County building codes and the County's floodplain ordinance are in effect to reduce this risk and should be updated as necessary to continue to address future flood conditions. Depending on the location of new development and adherence to protective building codes and the floodplain ordinance, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more resilient community.

This section provides an analysis of the flood hazard and proposed future development within the County based on FEMA floodplains 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 (SFHAs) and enforce those requirements through their local floodplain management ordinances through the issuance of permits. Colusa County's floodplain management ordinance provides standards for development, subdivision of land, construction of buildings, and improvements and repairs to buildings that generally 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 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.

Future development in the County may be built in the floodplain, in conformance to the standards of the floodplain ordinance. The County enforces the floodplain ordinance on new development in unincorporated Colusa County. With the release of the new DFIRMs it is anticipated that the flood ordinance will be updated. Future development areas and their vulnerability to DFIRM flooding is discussed further in the below GIS analysis.

Future Development: GIS Analysis

Colusa County provided 53 future development areas which were used as the basis for the inventory of future development for the unincorporated County. These were mapped in GIS. Where multiple parcels are listed, the parcels are merged to form one polygon, and the hazards assigned are based on the centroid

of the polygon. Figure 4-83 show the locations of the future development areas and FEMA DFIRM flood zones. Table 4-93 shows the details of the future development areas that are located in each FEMA DFIRM flood zone.

Figure 4-83 Unincorporated Colusa County – Future Development in FEMA DFIRM Flood Zones

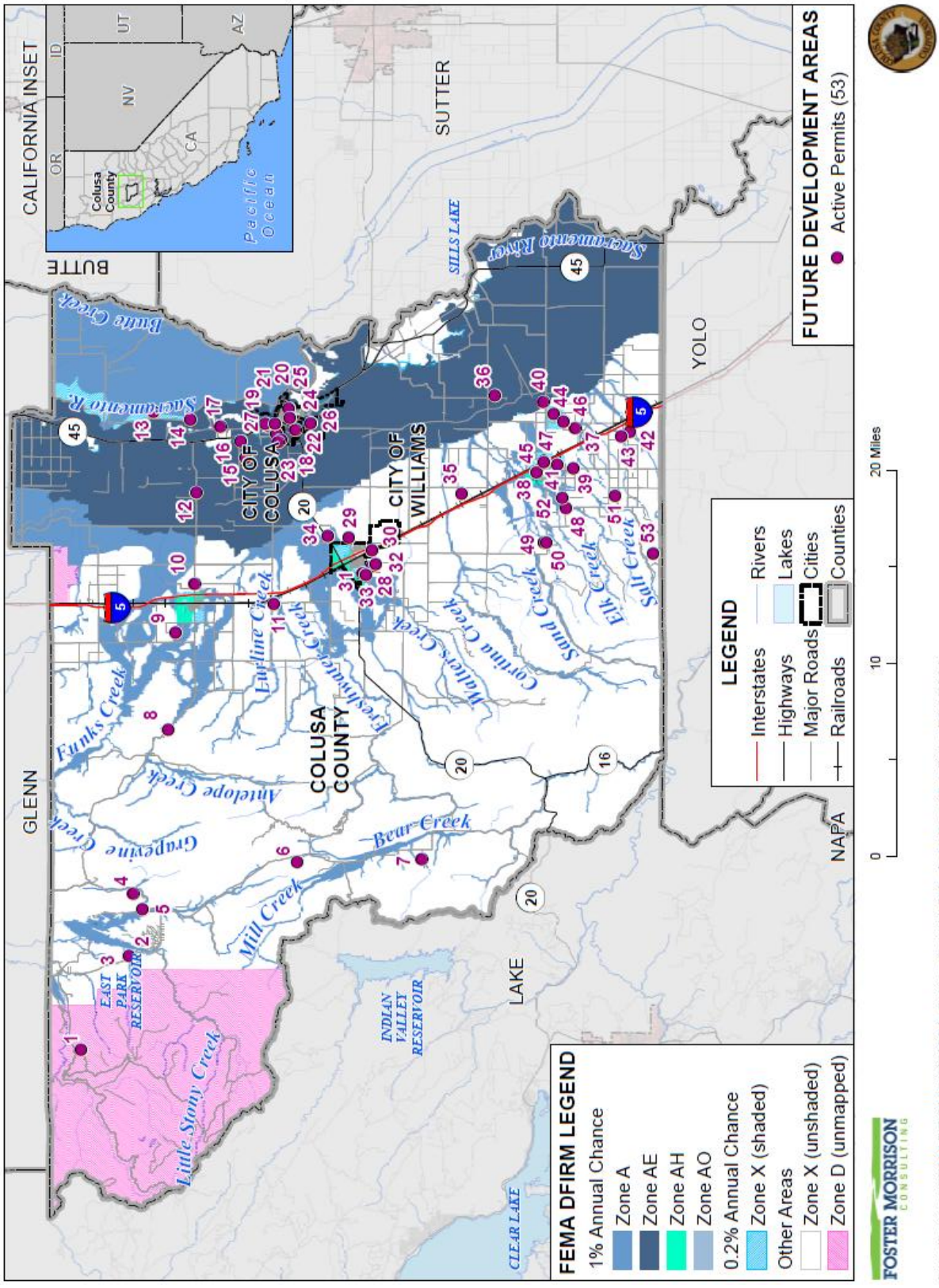


Table 4-93 Unincorporated Colusa County – Future Development in FEMA DFIRM Flood Zones with Parcel Counts and Acreages

Flood Zone	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
1% Annual Chance Flood Hazard				
Zone A	9	4105 RIORDAN RD	1	76.26
	13	4374 RIVER RD	1	402.44
	48	821 WYER RD	1	10.79
	Zone A Total		**3**	**489.49**
Zone AE	12	6458 MAXWELL RD	1	319.89
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	17	015-030-094-000	1	17.03
	18	3258 MCCOY RD	1	6.01
	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	23	3286 RANCH RD	1	1.85
	26	015-380-019-000	1	1.00
	36	019-090-058-000	1	10.00
	40	7251 TULE RD	1	2.64
	Zone AE Total		**12**	**874.91**
Zone AH	47	720 FIFTH ST	1	0.55
	Zone AH Total		**1**	**0.55**
1% Annual Chance Flood Hazard Total			**16**	**1,364.94**
0.2% Annual Chance Flood Hazard				
Zone X (shaded)	14	4073 RIVER RD	1	10.32
	38	805 GAIL AVE	1	0.38
	44	507 MAIN ST	1	0.47
	45	707 FIRST ST	1	0.13
	Zone X (shaded) Total		**4**	**11.30**
0.2% Annual Chance Flood Hazard Total			**4**	**11.30**
Other Areas				
Zone X (unshaded)	2	4564 LODOGA STONYFORD RD	1	2.49

Flood Zone	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
	3	4564 LODOGA STONYFORD RD	1	2.49
	4	010-280-079-000	1	13.90
	5	4481 SITES LODOGA RD	1	86.68
	6	014-250-019-000	1	219.76
	7	2001 BEAR VALLEY RD	1	637.09
	8	011-200-012-000	1	282.12
	10	5603 MAXWELL RD	1	30.89
	11	5498 LURLINE AVE	1	12.18
	19	015-310-050-000	1	11.97
	24	1232 FIFTH ST	1	0.60
	25	002-101-004-000	1	4.48
	27	1773 LURLINE AVE	1	3.40
	28	016-230-101-000	1	2.49
	29	2668 HUSTED RD	1	10.00
	30	2461 OLD HIGHWAY 99W	1	8.53
	31	2533 VENICE AVE	1	2.06
	32	016-230-065-000	1	1.45
	33	016-220-099-000	1	1.37
	34	017-010-045-000	1	56.35
	35	1707 LONE STAR RD	1	121.30
	37	7020 FRIEL RD	1	9.92
	39	758 WILDWOOD RD	1	25.08
	41	887 WILDWOOD RD	1	1.89
	42	021-290-070-000	1	30.47
	43	6901 HARRINGTON AVE	1	15.16
	46	7072 PERKINS RD	1	9.29
	49	6031 HILLGATE RD	1	9.65

Flood Zone	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
	50	6011 HILLGATE RD	1	9.72
	51	6439 MARINE AVE	1	27.77
	52	853 JENSEN AVE	1	9.92
	53	5875 SILLS RD	1	618.41
	Zone X (unshaded) Total		**32**	**2,278.87**
Zone D (unmapped)	1	010-200-001-000	1	161.29
	Zone D (unmapped) Total		**1**	**161.29**
Other Areas Total			**33**	**2,440.16**
Grand Total			**53**	**3,816.40**

Source: FEMA 3/27/2024 DFRIM, Colusa County GIS

4.3.12. Flood: Localized Flooding

Hazard Profile

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

In addition to flooding, damage to these areas during heavy storms can include pavement deterioration, washouts, landslides/mudslides, debris areas, and downed trees. 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. In the City this happens more often during the winter months, as was shown on Figure 4-35 above. Localized flooding often has a short duration. Specific locations in the County can be seen in the Local Concerns section below in Table 4-94.

Past Occurrences

Disaster Declarations

There are no identified state or federal disaster declarations for 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

2023 – Localized flooding occurred throughout the County. An area especially hit was Goat Mountain Road. Goat Mountain Road is a mountainous, rural gavel road, located in westerly Colusa County. The subject location is approximately 20 wide with a 24" corrugated galvanized culvert. The culvert failed during the event which was exasperated by the recurrence of natural spring in the toe of the roadway cutback up gradient of the culvert failure. The spring then began saturating the remaining road prism at the culvert failure, destabilizing the entire slope. In order to preserve the road way, a 'French Drain' was installed up gradient of the failed culvert to intercept the subsurface water from the spring. This water was then directed across the road and away from the failed 24' culvert by way of a new 18" culvert. The 24" cross culvert was replaced and both the new 18" and 24" culverts were backfilled with native material and class II road base.

2019 – Flooding was both local and along the RD 2048 canal and included erosion along roadways and the deposit of sediment on roadways which required clean up and also on unimproved roads, additional aggregate base needed to be imported and graded.

2017 – During the February storms, the HMPC noted that portions of the County suffered localized flooding. This can be seen in Figure 4-84.

Figure 4-84 Colusa County – February 2017 Localized Flooding

Source: Colusa County

The HMPC noted that Walnut Avenue east of Williams was flooded out, restricting access to Spring Valley Road and the Cortina Rancheria in 2017. Gridley Highway was closed for over a month in 2017 due to flooding.

Typically, localized flooding inundates roads and properties for a short period of time before receding. As Colusa County was fighting with torrential downpours, a need arose to combat runoff water from higher elevations encroaching on already saturated ground and storm drains. Unmaintained canals and ditches contributed to the excessive water in areas that had not historically experienced flooding such as the town of Maxwell. Roads and drains were damaged from the excessive water runoff, causing the need for repairs.

Once the river level receded, seepage water came up and areas adjacent to the river that had not experienced seepage in the past, did. East Clay Street in Colusa typically sees seepage each year. The road will close for a short period of time until the river level goes down, leaving only minor damage to the surface and shoulders of the road. In 2017, it saw that seepage, but at a depth of 3 feet and flowing across the road. One resident was unable to use their well or septic tank for a period of 38 days. The road's condition was greatly affected from the pressure of the water.

The Town of Grimes is also river-adjacent. There were areas of sloughing on the riverbank in the area, as well as seepage and boils. With the river maintained a higher than average depth for a longer than average period of time, the residents in Grimes were on high alert for weeks, concerned about the levee failing. The responsible agencies, Reclamation District 108 and the Sacramento River Westside Levee District, worked with the Department of Water Resources to monitor these areas. The SRWLD performed several repairs to the levee and sandbagged the boils to prevent further damages and protect the town of Grimes. After the

water receded and the river level stabilized, they carried out a large levee repair project, extending the wall of the levee's width in the area. More projects are planned as noted in the Project Worksheets located later in this Plan.

In the City of Williams excessive water caused two residences on Walnut Road to flood and water rescues had to be carried out to evacuate the tenants. Flood fight efforts built up an abandoned railroad right of way to control the water however it caused other flooding issues. Many businesses were affected by the water backing up.

Flooding on the roadway causes traffic safety concerns several times a year, as Highway 20 (also known as Bridge Street) in the City of Colusa experiences water encroaching up to the center line from the westside of the roadway between Jay Street to Webster Street. CalTrans places signage to warn drivers of flooding on this major east-east travel route. Fire, law enforcement and ambulance services are affected as the local hospital and county jail are located on the eastside of the roadway, obviously hindering emergency response.

Two weirs in Colusa County flow during high river levels, typically once every couple of years, with one closing the through-roadway completely when it flows. The Colusa Bridge gauge will need to read 64 feet in order for the Moulton Weir to flow, closing River Road twelve miles northeast of the town of Colusa. Runoff water or standing water typically do not affect this area. Several other roads on the eastside of Colusa will close when the weirs overflow, isolating some residents and duck club members on Laux Road when they are in-resident during hunting season. Should they need assistance, air or water response will be utilized to achieve rescues.

2004 – The LHMP noted that Colusa County has experienced localized flooding in repetitive damage areas, one tractor dealerships, agribusinesses, and a residential area west of the City of Colusa. Two tractor dealerships and one residential area with approximately 30 homes exist in this localized flooding area. Winter storms depositing large amounts of water in short periods of time are the catalyst for the flooding in those areas and on roadways, causing closures on major east-west transportation routes.

It was also noted in the 2004 LHMP that in an area of north Williams, there is a section of a low-income residential neighborhood that has seen repetitive damage due to stream bank overflows during periods of heavy rains. Approximately 15 homes are located here, with no businesses or industry. Irrigation water conveyance or runoff present in the streams contributes to the cause of the overflows.

1997 – Freshwater Creek topped its bank and caused a small breach at the top of the creek bank north of Williams. Eleven residents needed to be evacuated with the local Fire Department taking the lead on evacuation, flood fight and sheltering. They were able to handle the event with their own resources. The responsible private property owner repaired the creek bank to its original condition with no financial assistance requested.

Likelihood of Future Occurrence

Highly Likely—Natural drainage systems located throughout the Colusa County Planning Area have a finite capacity to convey water. Likewise, storm drainage systems have a finite capacity generally based on the design criteria. When rainfall exceeds the capacity of natural and storm drainage systems or systems

clog, water accumulates until it reaches a level of overland release. Due to aging and often undersized infrastructure, this type of flooding will continue to occur annually during heavy rains.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and localized flood can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

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.

Vulnerability Assessment

Vulnerability—Medium

Flood vulnerability and their impacts vary by location and severity of any given flood event and will likely only affect certain areas of the Colusa County Planning Area during specific times. Based on the risk assessment, it is evident that floods will continue to have potentially significant economic impacts to certain areas of the Colusa Planning Area. However, while flooding can cause significant impacts depending on the duration and volume of precipitation and the drainage in any given area, many of the floods in the Planning Area are minor, localized flood events that are more of a nuisance than a disaster.

Many areas of the Planning Area are at some measure of vulnerability to localized flooding. An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The 2010 General Plan Background Report noted that while information on areas most affected by drainage issues and flooding is available for most of the County's incorporated cities, data on the severity of drainage problems in the unincorporated areas - which comprise much of the county - is more limited. 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.

The amount and type of damage or flooding that occurs varies from year to year, depending on the quantity of runoff. These primary areas of localized flooding and the types of damage are presented in Table 4-94.

Table 4-94 Colusa County Localized Flooding Areas

Road Name	Flooding	Pavement Deterioration	Washouts	High Water/ Creek Crossing	Landslides/ Mudslides	Debris	Downed Trees
Lonestar Road	X	X	X			X	
Lurline Avenue	X	X		X		X	
San Jose Road	X	X		X		X	
Brim Road	X	X			X	X	X
East Clay Street	X	X				X	
Goat Mountain Rd		X	X		X	X	X
Fouts Springs Rd	X	X	X	X		X	
Lodoga Stonyford	X	X		X		X	X
Cook Springs Rd	X	X	X	X	X	X	
Sites Lodoga Rd	X	X	X			X	X
Corbin Road	X	X	X	X		X	X
Walnut Ave	X	X	X	X		X	X
Gridley Highway	X	X	X	X		X	X

Source: Colusa County OES

Assets at Risk

Assets at risk from localized flood include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

People and populations are traditionally not highly vulnerable to localized flooding, but their structures and contents can be at risk. Localized flooding may also cause transportation issues as roads and lanes are impacted or closed and affect the ability for people to travel throughout the Planning Area.

Structures

Structures in areas with localized flooding can be affected if floodwaters intrude into the structure. Structures in low lying areas, or those with basements can be at greater risk. Buildings with older foundations that are prone to water intrusion are also at greater risk. Once water finds its way into a structure, it tends to continue to do so until the path that brings water into a structure is mitigated. Ground saturation can result in instability, collapse, or other damage to structures. Trees can also be compromised and uprooted falling on structures causing damage.

Critical Facilities and Infrastructure

Localized flooding, while often more of a nuisance, can cause damage to critical facilities and infrastructure during a heavy rain and storm event. Any facility that experiences localized flooding can be impacted. Utilities and other critical infrastructure can all be affected, causing interruptions in service until repairs can be made. For example, water and wastewater systems can be vulnerable to heavy rains and flood events. Rainfall creates a high water table, surging streams and creeks, and saturates soil. Infiltration of stormwater into water and wastewater systems may occur and presents a threat to public health and safety, when the infrastructure is no longer able to meet operational needs and local demands.

Community Lifelines

Due to the relatively minor nature of localized flooding, community lifelines are unlikely to be overwhelmed. There may be minor vulnerabilities to the following:

- **Safety and Security** – Law Enforcement/Security, Fire Service, and Community Safety officials may be needed to close roads and redirect traffic during localized flood events. These agencies may also experience flooded roads when responding to emergencies.
- **Communications** – Unless directly affected by flooding, communication systems are not likely to be impacted. Warnings and Messaging may be required to reroute traffic away from localized flooding areas.
- **Transportation** – Highways, roads, and bridges may be temporarily blocked until localized floodwaters recede.
- **Water Systems** – Water and wastewater systems can be infiltrated during localized flooding events. Stormwater drainage systems are often undersized and inadequate to convey the volume of flood waters.

Natural, Historic, and Cultural Resources

Natural resource assets may have some vulnerabilities to localized flood during major storm events, but can benefit from floodwaters, often by design. Many parks and green spaces are designed to take overflow water and release it into the underlying soils and natural areas. Wetlands areas in the Planning Area actually help reduce the risk of flooding, as they can absorb excess rainfall that would have to be drained away from impervious surfaces. Flooding can provide many benefits to the natural environment, including recharging wetlands and groundwater, increasing fish production, creating wildlife habitat, and rejuvenating soil fertility. These smaller localized flooding events often provide more benefits to the environment in comparison to negative impacts associated with large flood events. Historic and cultural resources may be at some measure of vulnerability if they are located in areas subject to repeated localized flooding.

Economic Assets and Community Activities of Value

Localized flooding occurs on an annual basis throughout the Colusa County Planning Area during storm events. Most of these events have limited impacts and include those associated with localized flooding due to undersized drainage systems, affecting nearby roads, structures, and other nearby assets. Unless directly affected by localized flooding, these events are unlikely to affect the Planning Area's key economic assets.

Community activities of value may have minor vulnerabilities if a localized flood event were to occur during the activity. Though unlikely, this may cause the activity to be relocated, cancelled, or rescheduled. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Impacts from Localized Flood

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Life safety issues from localized flooding would be more limited. The amount and type of damage or flooding that occurs varies from year to year and from storm to storm, depending on the quantity of precipitation and runoff. Localized flooding impacts may be exacerbated in the future due to the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future heavy rain conditions and associated impacts and vulnerability of the County to localized flood.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. Additional population growth would likely bring continued diversity to the County. Vulnerable population groups such as low-income individuals and households living in floodprone areas could face disproportionate effects from localized flood and should be planned for. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. While limited, much of the growth in Colusa County is occurring through expansion of the more urban areas, causing an increase in peak flow and stormwater runoff. Such growth will consume previously undeveloped acres, and the impacts may overwhelm existing drainage and flood control facilities. Locating new development, structures and critical facilities and infrastructure within or near areas of localized flooding risk may

put additional development at risk. County building codes are in effect to reduce this risk and should be updated as necessary to continue to address future localized flood conditions. Depending on the location of new development and adherence to protective building codes, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more resilient community.

The potential for flooding may increase as stormwater is channeled due to land development. Such changes can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. 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. Floodplain modeling and master planning should be based on build out property conditions to ensure that all new development remains safe from future flooding.

4.3.13. Landslides, Mudslides, and Debris Flows

Hazard Profile

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

Hazard/Problem Description

Like its earthquake-generating faults, California's mountainous terrain is a consequence of dynamic geologic processes in operation as the North American Plate grinds past the Pacific Plate. According to the CGS, a landslide is a general term for a variety of mass-movement processes that generate a down-slope movement of mud, soil, rock, and/or vegetation. Landslides are classified into many different types based on form and type of movement. They range from slow-moving rotational slumps and earth flows, which can slowly distress structures but are less threatening to personal safety, to fast-moving rock avalanches and debris flows that are a serious threat to structures and have been responsible for most fatalities during landslide events. For the purposes of this LHMP Update, the term landslide includes mudslides, debris flows, and rockfalls that tend to occur suddenly; as well as hillside erosion, which is a similar process that tends to occur on smaller scales and more gradually but can exacerbate landslide events.

Landslides, debris flows and mudslides are closely related to flooding, as both processes are related to precipitation, runoff, and the saturation of ground by water. In addition, landslides, mud flows, and debris flows can occur on small, steep stream channels and are often mistaken for floods. However, landslide events may be much more destructive than floods because of their higher densities, high debris loads, and high velocities.

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 and can eventually impact stream flows and contribute to flooding potential. Conditions that contribute to landslide, mudslides, debris flows, hillside and streambank erosion (as discussed in Section 4.3.13), include the following:

- Degree of slope
- Water (heavy rain, river flows, or wave action)
- Unconsolidated soil or soft rock and sediments
- Lack of vegetation (no stabilizing root structure)
- Previous wildfires and other forest disturbances (discussed in Section 4.3.17)
- Road building, excavation, and grading
- Earthquake

The 2023 State of California Hazard Mitigation Plan noted that more than one third of California is mountainous terrain that generally trends parallel to the coast, forming a barrier that captures moisture from offshore storms originating in the Gulf of Alaska and Mexico. Steep topography, weak rocks, heavy winter rains, and occasional earthquakes all lead to slope failures more frequently than would otherwise occur under gravity alone. This is true in the mountainous, sloped areas within the Planning Area where the topography is characterized by rolling hills elevation changes.

Location and Extent

Landslides can be expected in areas with steep slopes and weak soils. It can also occur in areas where erosion has previously occurred. Both winter storms (precipitation-induced) and earthquake triggered landslides tend to occur in or near places that have experienced previous landslides. However, landslides may also occur in other locations over time.

Figure 4-85 shows the CGS areas at susceptible to deep seated landslides. The legend on Figure 4-85 shows the susceptibility scale (from 0-X with 0 being the least and X being the most susceptible) that the CGS uses to show the susceptibility of landslides. It is a primarily a combination of slope class and rock strength. Geographic extents of these classes for the Planning Area are shown on Table 4-95. According to the 2023 State Hazard Mitigation Plan, the susceptibility classes were further categorized into Very High (susceptibility class X) and High (susceptibility classes VII, VIII, & IX) for exposure analysis. The rest of the classes were not categorized. CGS mapping indicates that the eastern portions of the Planning Area and surrounding area are at high to very high susceptibility areas for landslides. This can be seen in the darker orange and red colors. 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 Colusa County, landslides generally occur where there is very little population or infrastructure.

Figure 4-85 Colusa County Planning Area – Susceptibility to Deep Seated Landslides

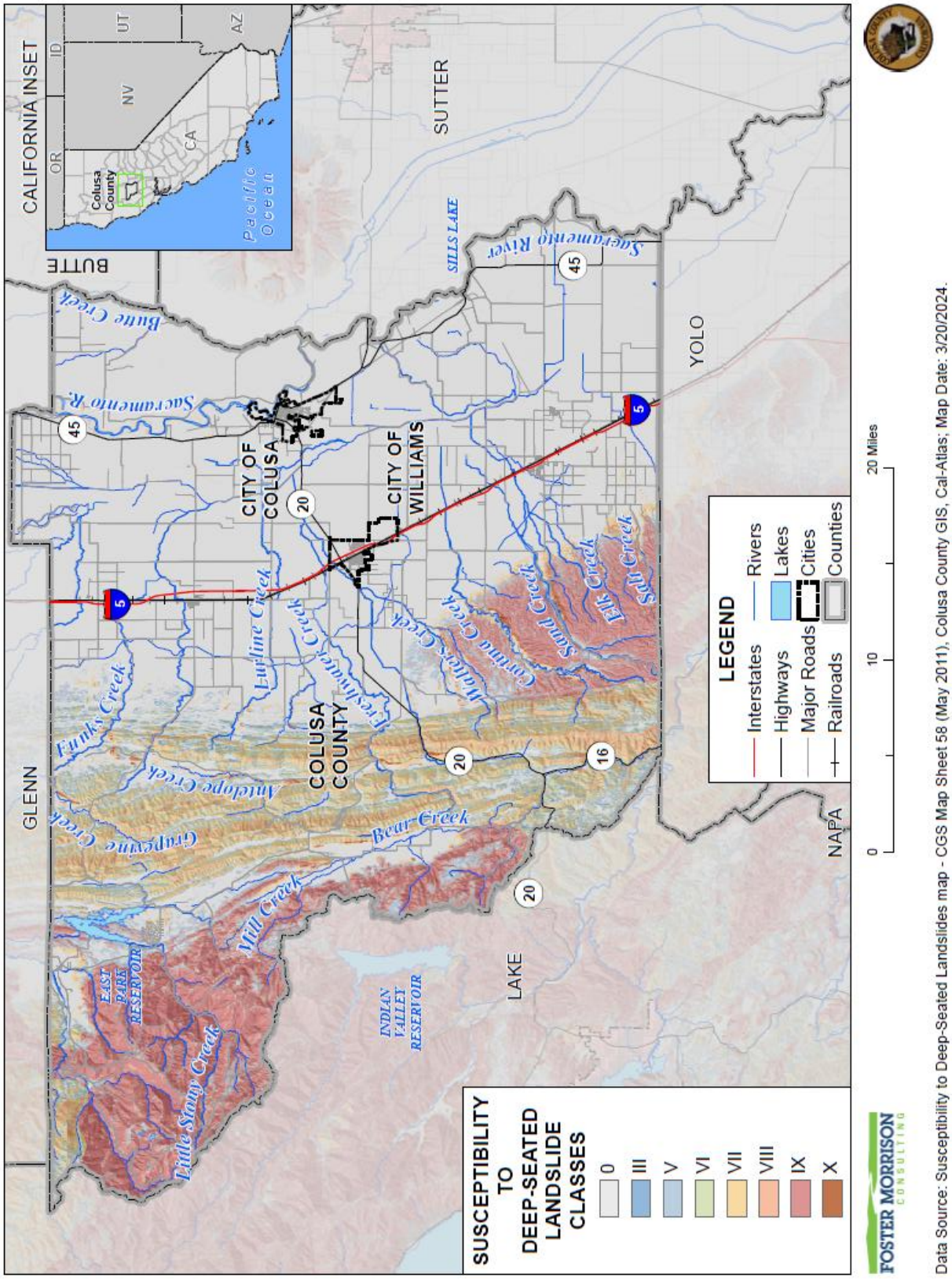


Table 4-95 Colusa County Planning Area – Susceptibility to Deep Seated Landslides Geographical Extents by Class and Jurisdiction

Jurisdiction / Susceptibility to Deep-Seated Landslide Class	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
City of Colusa						
0	2,389	99.07%	1,387	99.88%	1,002	97.97%
III	0	0.00%	0	0.00%	0	0.00%
V	0	0.00%	0	0.00%	0	0.00%
VI	0	0.00%	0	0.00%	0	0.00%
VII	22	0.93%	2	0.12%	21	2.03%
VIII	0	0.00%	0	0.00%	0	0.00%
IX	0	0.00%	0	0.00%	0	0.00%
X	0	0.00%	0	0.00%	0	0.00%
City of Colusa Total	**2,412**	**100.00%**	**1,388**	**100.00%**	**1,023**	**100.00%**
City of Williams						
0	2,900	100.00%	1,062	99.99%	1,838	100.00%
III	0	0.00%	0	0.00%	0	0.00%
V	0	0.00%	0	0.00%	0	0.00%
VI	0	0.00%	0	0.00%	0	0.00%
VII	0	0.00%	0	0.01%	0	0.00%
VIII	0	0.00%	0	0.00%	0	0.00%
IX	0	0.00%	0	0.00%	0	0.00%
X	0	0.00%	0	0.00%	0	0.00%
City of Williams Total	**2,900**	**100.00%**	**1,062**	**100.00%**	**1,838**	**100.00%**
Unincorporated Colusa County						
0	446,915	61.71%	222,085	89.97%	224,831	47.10%
III	22,627	3.12%	3,277	1.33%	19,350	4.05%
V	27,683	3.82%	3,597	1.46%	24,086	5.05%
VI	27,146	3.75%	3,031	1.23%	24,116	5.05%
VII	61,866	8.54%	8,426	3.41%	53,440	11.19%
VIII	40,496	5.59%	2,455	0.99%	38,041	7.97%
IX	95,439	13.18%	3,556	1.44%	91,883	19.25%
X	2,039	0.28%	425	0.17%	1,614	0.34%
Unincorporated Colusa County Total	**724,212**	**100.00%**	**246,851**	**100.00%**	**477,360**	**100.00%**

Jurisdiction / Susceptibility to Deep-Seated Landslide Class	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Grand Total	**729,524**	**100.00%**	**249,302**	**100.00%**	**480,221**	**100.00%**

Source: Susceptibility to Deep-Seated Landslides map – CSG Map Sheet 58 (05/2011)

Past Occurrences

Disaster Declaration History

There have been no disaster declarations associated with landslides in Colusa County, as shown in Table 4-4.

NCDC Events

The NCDC contains no records for landslides in Colusa County.

Hazard Mitigation Planning Committee Events

There have been no major landslides in Colusa County to note. Minor slides have caused rocks to tumble onto foothill roads such as Lodoga Stonyford Road. The Public Works Department works diligently to remove the hazards as soon as possible, 24-hours a day. As a result of the Mendocino Complex Fire (August 2018) and more recent 2022 August Complex and Hennessey fires, there may be various remote locations that would be susceptible to landslides in the burn scar areas. Given the remote area, few homes would likely be affected; however, roadways may become closed should debris encroach upon them.

The County noted that there have been landslides in the Leesville Road, Stonyford, and Ladoga areas. The HMPC noted that the landslides within this have typically been smaller. However, they are frequent and under all conditions rocks and debris slide onto the road and must be plowed off. The roads include Leesville Road, Sites Ladoga Road as well as all other roads within the mountainous western portion of Colusa County. One of the larger landslides recently occurred in 2023 on Goat Mountain and resulted in the County hiring a contractor to reconstruct the road and the storm water conveyance system.

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 Colusa County's mountainous terrain in the western portion 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 and in post wildfire burn areas, as they have in the past.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and landslide and debris flow can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Landslide and Debris Flows

According to the 2021 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 4.3.4. 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

According to historical hazard data and landslide hazard mapping, landslides can occur in the Colusa County Planning Area. An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

The 2010 General Plan Background Report noted that the landslide susceptibility in the eastern one-half of the county is generally low. A north-south band of moderate landslide potential stretches from East Park Reservoir south to the Bear Valley. Generally, this area of moderate potential frames the north-south trending valleys at the Coast Range/Central Valley boundary. Only the northwestern portion of the county is within a sub-region of high landslide susceptibility. This area of high susceptibility is almost entirely within the boundaries of the Mendocino National Forest.

The HMPC noted that many areas in western Colusa County are also rated high or very high in their susceptibility to landslide due to erosive soils, and from hydrophobic soils from past wildfire burn scars. There is very little population or improved parcels in this area. Currently there are no active landslides requiring repair in the County.

Assets at Risk

Assets at risk from landslide include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

Methodology

The 2011 California Geologic Survey Deep Seated Landslide Susceptibility data was obtained for the Colusa County Planning Area. The 2023 Colusa County Parcel/Assessor Data was used as the basis for the inventory of all parcels within the Colusa County Planning Area. GIS was used to overlay the landslide hazard layer onto the parcel layer, and where the landslide susceptibility classes intersected a parcel centroid, it was assigned with that hazard class for the entire parcel.

People and Populations

All populations located within areas of landslide susceptibility, especially in the High to Very High hazard areas (i.e., Classes VII to X) are at some vulnerability to landslide. This includes those people residing in these landslide potential areas as well as those that might reside or work within the landslide run out areas. People residing in these areas may also be cut off from transportation routes if roads and streets providing a means of ingress and egress are impacted. Certain vulnerable populations may be at greater risk due to the often sudden onset of a landslide event and include: the unsheltered, those with limited mobility, and those that lack the resources to leave the area.

Colusa County Planning Area residents that live in the High and Very High landslide susceptibility areas are often the most vulnerable, but those who live in in the landslide run out areas (which are not mapped) are also vulnerable. Not only are the residents at risk, but their homes and contents are all at risk, compounding the impacts associated with significant hazard events. To further evaluate the impact to Planning Area's residential population residing within these hazard areas, an analysis was conducted of those who physically reside in the mapped landslide susceptibility areas. The CGS Susceptibility to Deep Seated Landslide maps were overlayed on the parcel layer and linked to the assessor data. Those residential parcel centroids that intersect the High or Very High risk areas (Class VII or higher) were counted and multiplied by the 2020 Census Bureau average household factors each jurisdiction in the Planning Area. Analysis results are shown in Table 4-96.

Table 4-96 Colusa County Planning Area – Improved Residential Parcels and Population in Susceptibility to Deep Seated Landslides (Classes VII, VIII, IX, and X) by Jurisdiction

Deep Seated Landslide Class/Jurisdiction	Improved Residential Parcels	Population at Risk
Class VII		
City of Colusa	4	12
City of Williams	0	0

Deep Seated Landslide Class/Jurisdiction	Improved Residential Parcels	Population at Risk
Unincorporated County	52	186
Class VIII		
City of Colusa	0	0
City of Williams	0	0
Unincorporated County	7	25
Class IX		
City of Colusa	0	0
City of Williams	0	0
Unincorporated County	12	43
Class X		
City of Colusa	0	0
City of Williams	0	0
Unincorporated County	1	4

Source: Susceptibility to Deep-Seated Landslides map – CSG Map Sheet 58 (05/2011), 2023 Colusa County Parcel/Assessor Data, 2020 US Census Bureau Average Household Size– City of Colusa (2.90); City of Williams (2.55); Unincorporated Colusa County (3.58).

These numbers reflect low end estimates as the property use categories based on the Assessor data utilized for this LHMP Update assumes all residential properties are single family residences. However, some of the residential parcels actually include multi-family units, including apartments, condominiums and well as duplexes and triplexes. These variations in residential property use were not accounted for in the analysis, which skews populations results to be lower.

Structures

Landslides can affect the built environment of the Colusa County Planning Area and those structures located within the high to very high hazard areas (i.e., Classes VII to X) are especially vulnerable, as are the structures located within the landslide run out areas. The CGS Deep Seated Landslide Susceptibility layer was overlaid with the County parcel (structure) layer in GIS and linked to the assessor data. The mapped landslide areas are shown on Figure 4-85. Table 4-97 summarizes parcel counts, land and improved values (i.e., those with a structure improvement on the parcel), other values, estimated content replacement values, and total values in the Planning Area for deep seated landslide classes. Table 4-98 summarizes parcel counts, land and improved values (i.e., those with a structure improvement on the parcel), other values, estimated content replacement values, and total values by property use for the unincorporated County for deep seated landslide classes. As shown, very few improved parcels fall in that Classes VII to X.

Table 4-97 Colusa County Planning Area – Count and Value of Parcels (and Structures) Susceptible to Deep Seated Landslide by Class and Jurisdiction

Jurisdiction / Susceptibility to Deep-Seated Landslide Class	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa							
0	2,330	2,073	$144,046,221	$442,968,788	$49,228,543	$309,096,464	$945,340,016
VII	4	4	$257,323	$798,999	$0	$399,499	$1,455,821
City of Colusa Total	**2,334**	**2,077**	**$144,303,544**	**$443,767,787**	**$49,228,543**	**$309,495,963**	**$946,795,837**
City of Williams							
0	1,755	1,477	$110,173,986	$349,462,550	$126,901,961	$254,199,840	$840,738,337
City of Williams Total	**1,755**	**1,477**	**$110,173,986**	**$349,462,550**	**$126,901,961**	**$254,199,840**	**$840,738,337**
Unincorporated Colusa County							
0	9,146	5,347	$1,490,489,633	$883,243,587	$197,157,808	$730,090,834	$3,300,981,862
III	104	14	$5,558,789	$928,874	$0	$876,363	$7,364,026
V	447	78	$16,418,201	$7,977,574	$122,839	$4,797,858	$29,316,472
VI	128	12	$6,936,430	$765,037	$3,400	$753,407	$8,458,274
VII	401	99	$20,182,733	$12,655,016	$1,994,611	$9,533,532	$44,365,892
VIII	268	21	$10,936,383	$3,651,556	$0	$3,321,520	$17,909,459
IX	376	25	$14,885,662	$7,970,216	$68,724	$7,719,011	$30,643,613
X	12	2	$262,321	$1,381,403	$0	$1,371,606	$3,015,330
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$758,464,131**	**$3,442,054,928**
Grand Total	**14,971**	**9,152**	**$1,820,147,682**	**$1,711,803,600**	**$375,477,886**	**$1,322,159,934**	**$5,229,589,102**

Source: Susceptibility to Deep-Seated Landslides map – CSG Map Sheet 58 (05/2011), 2023 Colusa County Parcel/Assessor Data

Table 4-98 Unincorporated Colusa County – Count and Value of Parcels (and Structures) Susceptible to Deep Seated Landslide by Class and Property use

Susceptibility to Deep-Seated Landslide Class / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
0							
Agricultural	4,677	2,571	$1,267,327,821	$345,359,449	$111,441,407	$345,359,449	$2,069,488,126
Commercial	260	179	$20,969,259	$71,537,065	$32,023,644	$71,537,065	$196,067,033
Government	361	38	$28,276,807	$4,077,926	$37,449	$4,077,926	$36,470,108

Susceptibility to Deep-Seated Landslide Class / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Industrial	51	30	$9,988,390	$71,506,449	$41,684,579	$107,259,676	$230,439,094
Institutional	54	25	$1,291,943	$7,904,619	$3,449,752	$7,904,619	$20,550,933
Miscellaneous	324	28	$30,528,176	$5,046,122	$1,851,673	$5,046,122	$42,472,093
Residential	3,419	2,476	$132,107,237	$377,811,957	$6,669,304	$188,905,977	$705,494,475
0 Total	**9,146**	**5,347**	**$1,490,489,633**	**$883,243,587**	**$197,157,808**	**$730,090,834**	**$3,300,981,862**
III							
Agricultural	71	9	$4,183,538	$823,852		$823,852	$5,831,242
Commercial	0	0	$0	$0	$0	$0	$0
Government	14	0	$981,011	$0	$0	$0	$981,011
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	4	0	$197,717	$0	$0	$0	$197,717
Residential	15	5	$196,523	$105,022	$0	$52,511	$354,056
III Total	**104**	**14**	**$5,558,789**	**$928,874**	**$0**	**$876,363**	**$7,364,026**
V							
Agricultural	97	16	$12,441,400	$1,618,145	$55,077	$1,618,145	$15,732,767
Commercial	0	0	$0	$0	$0	$0	$0
Government	6	0	$86,257	$0	$0	$0	$86,257
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	16	0	$484,995	$0	$0	$0	$484,995
Residential	328	62	$3,405,549	$6,359,429	$67,762	$3,179,713	$13,012,453
V Total	**447**	**78**	**$16,418,201**	**$7,977,574**	**$122,839**	**$4,797,858**	**$29,316,472**
VI							
Agricultural	93	9	$5,246,699	$690,329	$3,400	$690,329	$6,630,757
Commercial	0	0	$0	$0	$0	$0	$0
Government	13	0	$1,367,762	$0	$0	$0	$1,367,762
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	16	1	$197,448	$51,447	$0	$51,447	$300,342
Residential	6	2	$124,521	$23,261	$0	$11,631	$159,413
VI Total	**128**	**12**	**$6,936,430**	**$765,037**	**$3,400**	**$753,407**	**$8,458,274**
VII							
Agricultural	233	46	$16,448,104	$6,389,510	$1,994,611	$6,389,510	$31,221,735
Commercial	0	0	$0	$0	$0	$0	$0

Susceptibility to Deep-Seated Landslide Class / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Government	15	0	$551,971	$0	$0	$0	$551,971
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	1	1	$15,025	$22,543	$0	$22,543	$60,111
Miscellaneous	19	0	$306,520	$0	$0	$0	$306,520
Residential	133	52	$2,861,113	$6,242,963	$0	$3,121,479	$12,225,555
VII Total	**401**	**99**	**$20,182,733**	**$12,655,016**	**$1,994,611**	**$9,533,532**	**$44,365,892**
VIII							
Agricultural	132	14	$8,877,286	$2,991,487	$0	$2,991,487	$14,860,260
Commercial	0	0	$0	$0	$0	$0	$0
Government	8	0	$335,484	$0	$0	$0	$335,484
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	44	0	$1,234,967	$0	$0	$0	$1,234,967
Residential	84	7	$488,646	$660,069	$0	$330,033	$1,478,748
VIII Total	**268**	**21**	**$10,936,383**	**$3,651,556**	**$0**	**$3,321,520**	**$17,909,459**
IX							
Agricultural	183	12	$10,211,057	$4,016,544	$62,810	$4,016,544	$18,306,955
Commercial	0	0	$0	$0	$0	$0	$0
Government	9	1	$358,517	$3,451,260	$0	$3,451,260	$7,261,037
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	109	0	$3,962,239	$0	$0	$0	$3,962,239
Residential	75	12	$353,849	$502,412	$5,914	$251,207	$1,113,382
IX Total	**376**	**25**	**$14,885,662**	**$7,970,216**	**$68,724**	**$7,719,011**	**$30,643,613**
X							
Agricultural	4	1	$220,670	$1,361,809	$0	$1,361,809	$2,944,288
Commercial	0	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
Residential	8	1	$41,651	$19,594	$0	$9,797	$71,042
X Total	**12**	**2**	**$262,321**	**$1,381,403**	**$0**	**$1,371,606**	**$3,015,330**

Susceptibility to Deep-Seated Landslide Class / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$758,464,131**	**$3,442,054,928**

Source: Susceptibility to Deep-Seated Landslides map – CSG Map Sheet 58 (05/2011), 2023 Colusa County Parcel/Assessor Data

Critical Facilities and Infrastructure

Landslides present a threat to critical facilities and infrastructure. The following analysis discusses critical facilities and infrastructure. A separate analysis was performed on the critical facility inventory in the Colusa County Planning Area to determine critical facilities by deep-seated landslide class. Using GIS, the landslide classes were overlayed on the critical facility GIS layer. Figure 4-86 shows critical facilities, as well as the deep-seated landslide classes. Table 4-99 details critical facilities by deep seated landslide class by facility type and count for the Planning Area. Details of critical facility category, type, name and address by deep-seated landslide classes are listed in Appendix F. As shown, very few critical facilities fall in the Classes VII to X.

Figure 4-86 Colusa County Planning Area – Critical Facilities in Deep-Seated Landslide Class

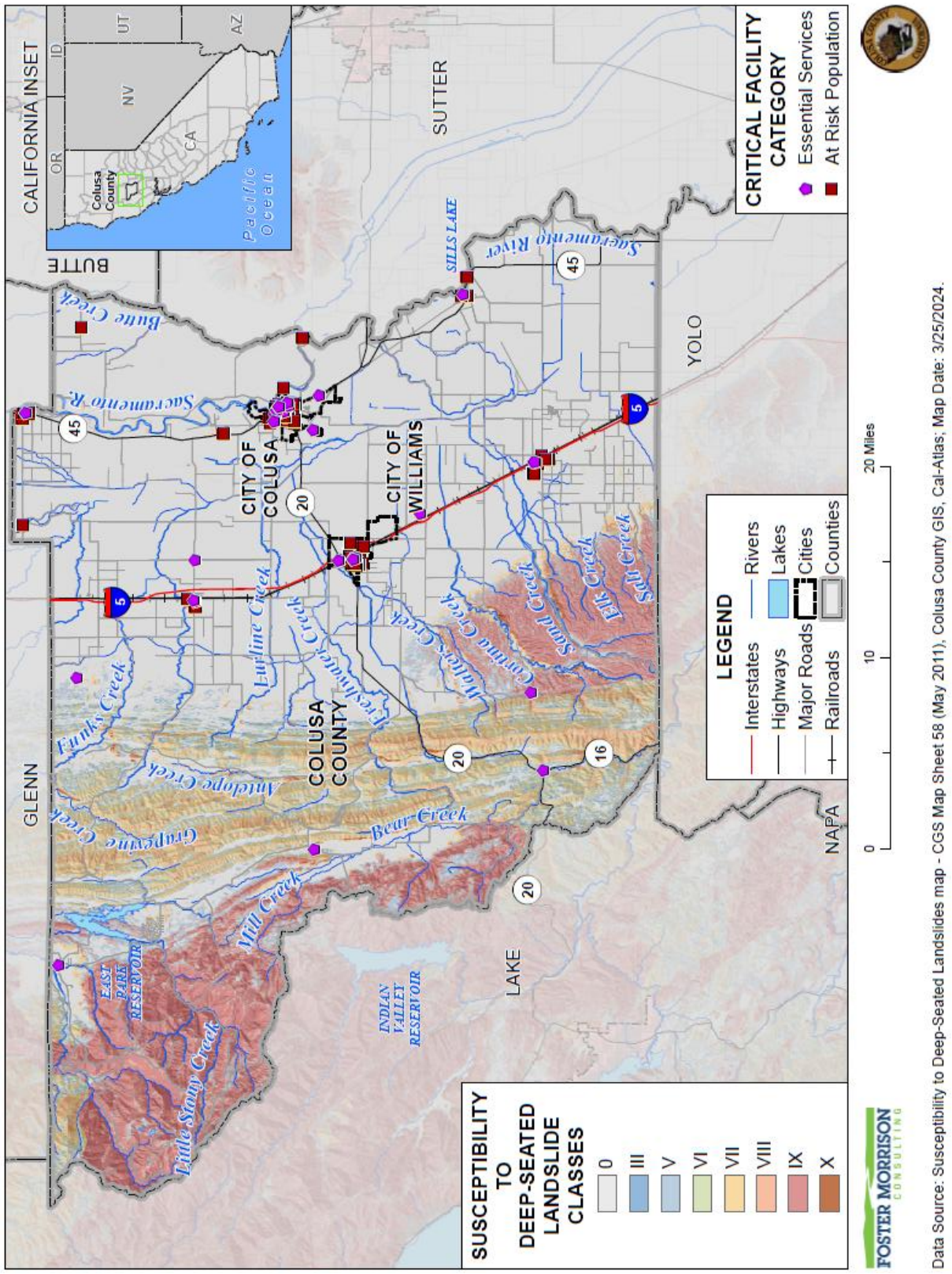


Table 4-99 Colusa County Planning Area – Critical Facilities in Deep-Seated Landslide Class by Category, Type, and Jurisdiction

Jurisdiction / Susceptibility to Deep-Seated Landslide Class	Critical Facility Category	Facility Type	Facility Count
City of Colusa			
0	Essential Services Facilities	Emergency Response	1
		Fire Station	2
		Medical	1
		Police Station	1
		Public Services	3
		Utility Facility	2
		Total	**10**
	At Risk Population Facilities	Apartment Complex	22
		Assisted-Living	1
		Hotel or Motel	2
		Jail	1
		Mobile Home Park	5
		School	8
		Senior Living Facility	1
		Total	**40**
0 Total			**50**
City of Colusa Total			**50**
City of Williams			
0	Essential Services Facilities	Emergency Response	2
		Fire Station	1
		Public Services	1
		Utility Facility	1
		Total	**5**
	At Risk Population Facilities	Apartment Complex	4
		Hotel or Motel	8
		Migrant Housing	1
		Mobile Home Park	2
		School	4
		Senior Living Facility	3
		Total	**22**
0 Total			**27**
City of Williams Total			**27**

Jurisdiction / Susceptibility to Deep-Seated Landslide Class	Critical Facility Category	Facility Type	Facility Count
Unincorporated Colusa County			
0	Essential Services Facilities	Fire Station	5
		Utility Facility	5
		Total	10
	At Risk Population Facilities	Apartment Complex	5
		Casino	1
		Hotel or Motel	1
		Mobile Home Park	9
		School	9
		Total	**25**
0 Total			**35**
III	Essential Services Facilities	Fire Station	1
		Total	1
III Total			**1**
V	Essential Services Facilities	Native American Reservation	1
		Total	**1**
V Total			**1**
VII	Essential Services Facilities	Fire Station	1
		Total	**1**
VII Total			**1**
Unincorporated Colusa County Total			**38**
Grand Total			115

Source: Susceptibility to Deep-Seated Landslides map – CSG Map Sheet 58 (05/2011), Colusa County GIS

Community Lifelines

Community lifelines at risk to a landslide event include:

- **Safety and Security** –Planning Area personnel would be involved in response and recovery efforts. This includes police, fire, EMS, public works, and other personnel.
- **Food, Hydration, and Shelter** – As homes are damaged, shelter needs would significantly increase. Temporary housing would need be to be established. Water supplies could be offline for an extended period. Residents, visitors and others caught in a large event would need to find sources of food and water until the Planning Area recovers.
- **Health and Medical** – Injuries and deaths can occur. This causes EMS calls and ER visits to spike. Transporting patients to medical facilities may be difficult. Depending on the extent of injuries and deaths the capacity of medical facilities could be strained and eventually overwhelmed.

- **Energy** – The power grid may be damaged from landslide. Fuel transportation may need to be delayed or rerouted, causing temporary shortages.
- **Communications** – Communications systems may be damaged during landslide events. Messaging boards and alerts need to be then put into place to ensure public safety and order.
- **Transportation** – Major damage can occur to roads and bridges in the Planning Area. Damage can also occur to rail lines and airports in and near the Planning Area. Roads may be closed due to damage, or to debris on the roads from earthquake events. These closures could be place for an extended period while debris clearing efforts are undertaken to allow repairs to be made.
- **Hazardous Material** – Hazardous materials facilities can be compromised during times of landslide events causing releases of contaminants into the environment. Natural gas pipelines can be affected by earthquakes. This can affect not only residents, but those who are charged with responding to or resolving the spill/rupture.
- **Water Systems** – Water, drainage, and wastewater systems can be damaged.

As shown on Figure 4-85, the Colusa County Planning Area has limited areas of landslide vulnerability, with most of these areas located in the upper elevations in the western portion of the County. These areas are more sparsely populated. As such, impacts to community lifelines from landslides in the Planning Area would be limited. Community lifelines are not likely to be overwhelmed by a landslide event.

Natural, Historic, and Cultural Resources

Landslides can affect natural, historic, and cultural resources that lie in the landslide area, or the landslide run out area. Landslides can destroy large tracts of forest and open space areas, destroy wildlife habitat, and remove productive soils and vegetation from slopes. It can also fill in waterways, impact water quality, and potentially affect flooding potential. Natural resources that fall in the High or Very High susceptibility classes shown on Figure 4-85 would be most vulnerable, as well as those in the run out areas. As shown on the map, this would include a relatively small area of the developed area, since most of the higher risk areas occur in the undeveloped areas in the Planning Area.

Economic Assets and Community Activities of Value

Landslides can affect economic assets and community activities of value if they fall into the higher landslide susceptibility areas, the landslide run out areas, or if economic assets are cut off from transportation routes in the Planning Area. Since most of the landslide risk is in the lightly populated western areas of the County, most economic assets in the Planning Area are unlikely to be affected. Very few community activities of value occur in areas threatened by landslide.

Impacts from Landslide

Any type of landslide may result in damages or complete destruction of buildings in their path, as well as deaths and injuries. Landslides can cause road blockages by depositing debris on road surfaces or road damage if the road surface itself slides downhill. Utility lines and pipes are also prone to breakage in slide areas.

Landslides can collapse into water bodies, causing tsunamis or seiches. In 1958, a magnitude 8 earthquake collapsed a hillside into Lituya Bay, Alaska, causing a water splash wave that reached 1,720 feet up a

mountain slope, stripping all vegetation. A massive landslide into the Vaoint Reservoir in Italy in 1963 caused a water splash wave that swept 800 feet over the top of a dam, causing a major flood that killed an estimated 2,600 people below. Landslides can relocate river channels, as occurred during the Oso mudslide in Washington State in March 2014. This occurred in an area not considered landslide prone on local maps. Landslides and debris flows can impact water quality and the storage capacity of surface water reservoirs used to store potable water.

Landslides, debris flows, and mud flows impacts vary by location and severity of any given event and will likely only affect certain areas of the Planning Area susceptible to landslide. Based on the risk assessment, there is limited potential for significant landslides to occur in the Planning Area. Most, but not all, of the historic landslides in the Colusa County Planning Area have been 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

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future landslide conditions and associated impacts and vulnerability of the County to landslides. This is especially true in burn scar areas that are at greater risk to landslides.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. The areas of landslide risk in the County are areas that traditionally have been undeveloped or along those areas bordering transportation routes. Additional population growth would likely bring continued diversity to the County. Vulnerable population groups could face disproportionate effects from a landslide, though it would be unlikely for these or any populations to build in the landslide risk areas. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. Locating new development, structures and critical facilities and infrastructure within or near areas of landslide risk may put

additional development at risk. However, County building codes are in effect to reduce this risk and should be updated as necessary to continue to address future wildfire conditions. It should be noted that most of the growth in the County is occurring in areas outside the landslide risk areas. Thus, depending on the location of new development and adherence to protective building codes, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more resilient community.

GIS Analysis

Colusa County provided 53 future development areas which were used as the basis for the inventory of future development for the unincorporated County. These were mapped in GIS. Where multiple parcels are listed, the parcels are merged to form one polygon, and the hazards assigned are based on the centroid of the polygon. Figure 4-87 show the locations of the future development areas and deep-seated landslide classes. Table 4-100 shows the details of the future development areas that are located in each deep-seated landslide class.

Figure 4-87 Unincorporated Colusa County – Future Development in Deep-Seated Landslide Classes

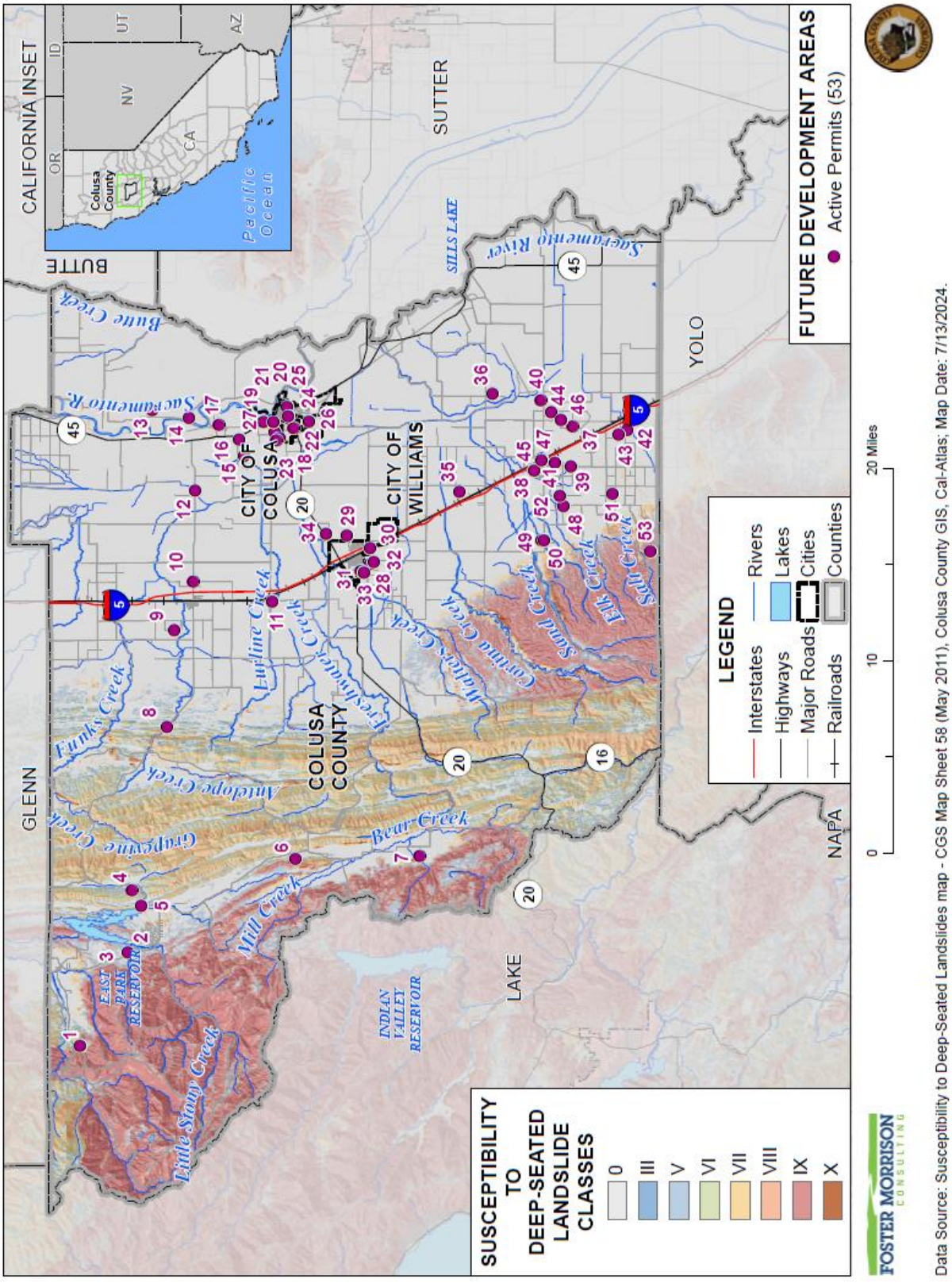


Table 4-100 Unincorporated Colusa County – Future development in Deep-Seated Landslide Classes with Parcel Counts and Acreages

Susceptibility to Deep-Seated Landslide Class	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
0	2	4564 LODOGA STONYFORD RD	1	2.49
	3	4564 LODOGA STONYFORD RD	1	2.49
	6	014-250-019-000	1	219.76
	7	2001 BEAR VALLEY RD	1	637.09
	9	4105 RIORDAN RD	1	76.26
	10	5603 MAXWELL RD	1	30.89
	11	5498 LURLINE AVE	1	12.18
	12	6458 MAXWELL RD	1	319.89
	13	4374 RIVER RD	1	402.44
	14	4073 RIVER RD	1	10.32
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	17	015-030-094-000	1	17.03
	18	3258 MCCOY RD	1	6.01
	19	015-310-050-000	1	11.97
	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	23	3286 RANCH RD	1	1.85
	24	1232 FIFTH ST	1	0.60
	25	002-101-004-000	1	4.48
	26	015-380-019-000	1	1.00
	27	1773 LURLINE AVE	1	3.40
	28	016-230-101-000	1	2.49
	29	2668 HUSTED RD	1	10.00
	30	2461 OLD HIGHWAY 99W	1	8.53
	31	2533 VENICE AVE	1	2.06
	32	016-230-065-000	1	1.45
	33	016-220-099-000	1	1.37
	34	017-010-045-000	1	56.35
	35	1707 LONE STAR RD	1	121.30
	36	019-090-058-000	1	10.00
	37	7020 FRIEL RD	1	9.92
	38	805 GAIL AVE	1	0.38

Susceptibility to Deep-Seated Landslide Class	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
	39	758 WILDWOOD RD	1	25.08
	40	7251 TULE RD	1	2.64
	41	887 WILDWOOD RD	1	1.89
	42	021-290-070-000	1	30.47
	43	6901 HARRINGTON AVE	1	15.16
	44	507 MAIN ST	1	0.47
	45	707 FIRST ST	1	0.13
	46	7072 PERKINS RD	1	9.29
	47	720 FIFTH ST	1	0.55
	48	821 WYER RD	1	10.79
	49	6031 HILLGATE RD	1	9.65
	50	6011 HILLGATE RD	1	9.72
	51	6439 MARINE AVE	1	27.77
	52	853 JENSEN AVE	1	9.92
	0 Total		**48**	**2,654.01**
III	4	010-280-079-000	1	13.90
	5	4481 SITES LODOGA RD	1	86.68
	8	011-200-012-000	1	282.12
	III Total		**3**	**382.69**
V	1	010-200-001-000	1	161.29
	V Total		**1**	**161.29**
IX	53	5875 SILLS RD	1	618.41
	IX Total		**1**	**618.41**
Grand Total			**53**	**3,816.40**

Source: CGS, Colusa County GIS

4.3.14. Levee Failure

Hazard Profile

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

Hazard/Problem Description

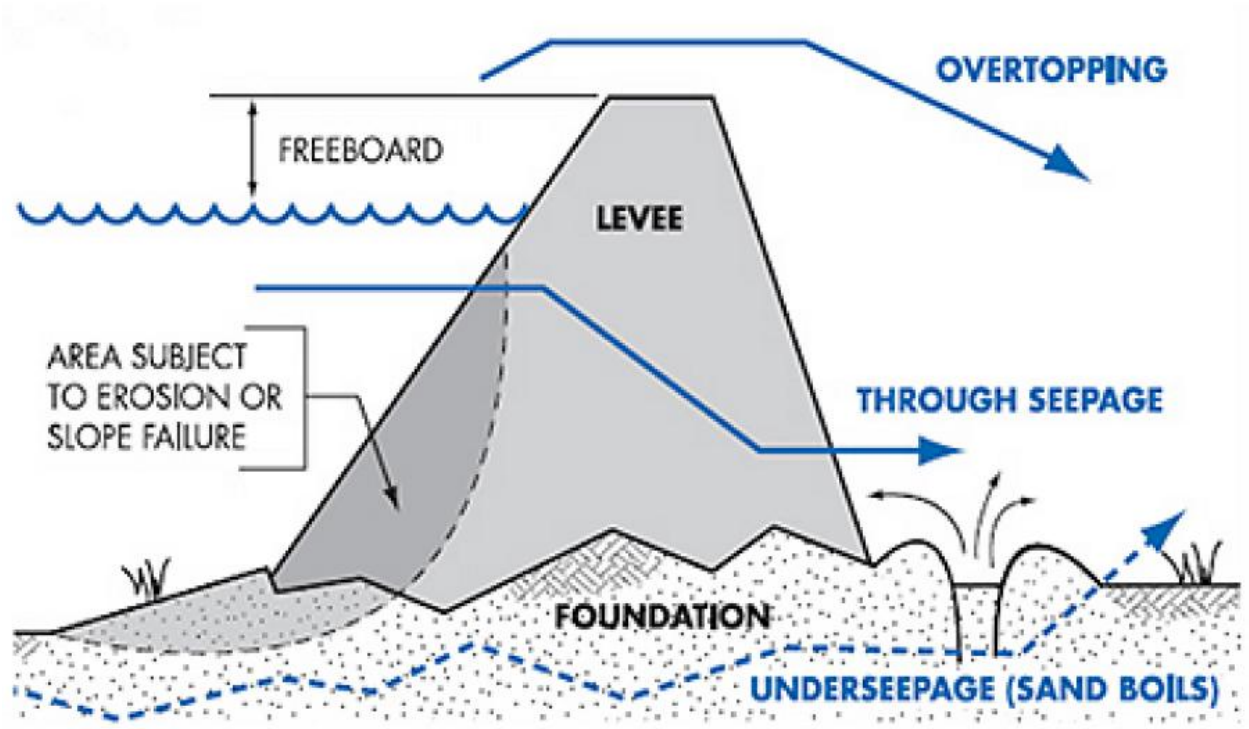
A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be 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. Man-made levees are formed by the hauling of sediment and fill in order to protect the area behind the levee.

Levees can provide strong flood protection, but they are not failsafe. Levees are often designed to protect against a specific flood level and could be overtopped during severe weather events or a 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's 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 burrowing into and compromising the levee system can also contribute to a levee failure as can erosion of the leveed area. Levee failure can also be caused by high winds creating wave action and high tides, especially combined with storm events. Figure 4-88 depicts the causes of levee failure.

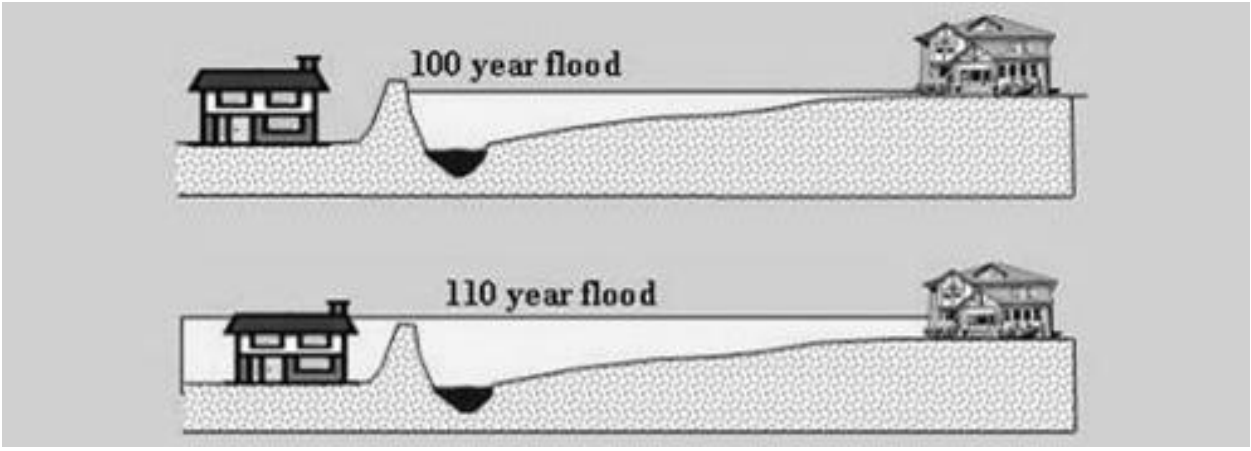
Figure 4-88 Potential Causes of Levee Failure



Source: USACE

Overtopping failure occurs when the flood water level rises above the crest of a levee. As shown in Figure 4-89, overtopping of levees can cause greater damage than a traditional flood due to the often lower topography behind the levee.

Figure 4-89 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.

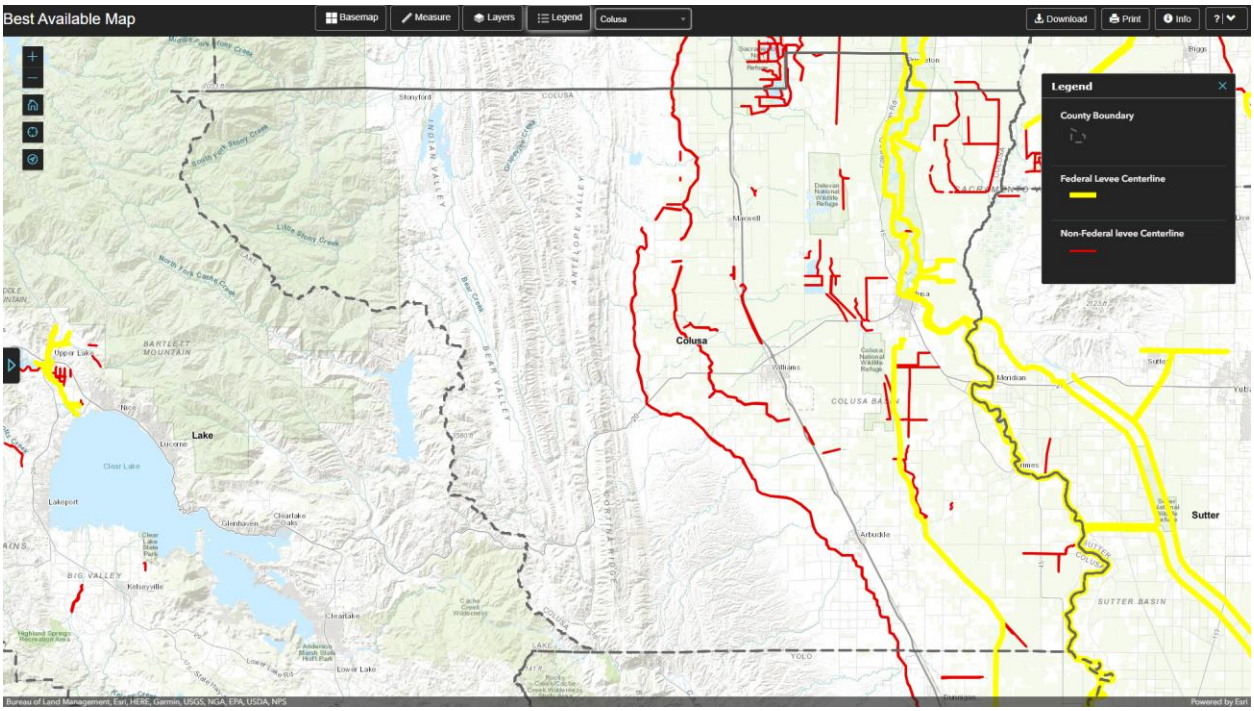
Location and Extent

Levees occur throughout Colusa County. They are primarily located in the eastern half of the County. Cal DWR has mapped these locations. There are two types of levees in their mapped database. The following is their definition:

- Federal levees are Flood Control Works (Levees/Flood Protection Projects) built and maintained by the United State Army Corps of Engineers (USACE) or are locally maintained. In addition, these projects are included in the USACE Inspection of Completed Works (ICW) program, and are automatically incorporated into the USACE Rehabilitation and Inspection Program (RIP). Within the Central Valley, certain Federal levees are considered State-Federal Project Levees as defined by the State Plan of Flood Control under the California Public Resources Code Section 5096.805
- Non-Federal levees are levees that are not part of the State Plan of Flood Control and are not constructed by the USACE. These facilities are any man-made facility that alters the direction of the natural flow path. The location of the facilities shown was developed from various sources of information that included digital orthophoto maps and United States Geological Service (USGS) 1:24,000 quadrangle maps.

A map of these levees is shown in Figure 4-90.

Figure 4-90 Colusa County – Levee Centerlines

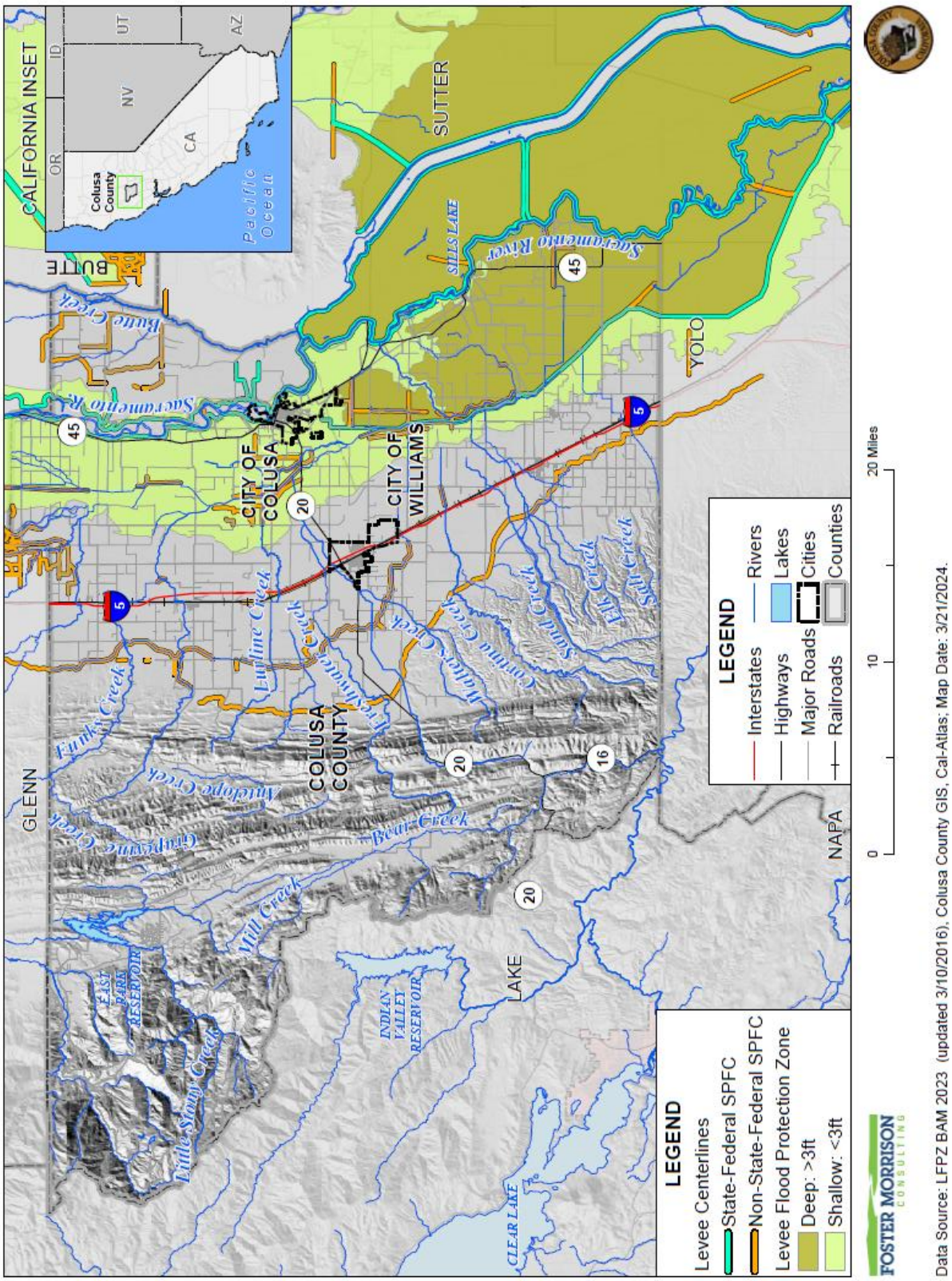


Source: CA DWR Best Available Maps

In addition to the map above, CA DWR has put together Levee Flood Protection Zone (LFPZ) maps. These LFPZ maps were developed by CA DWR as required by Water Code Section 9130 to increase awareness of flood risks associated with State-Federal levees. The maps should not be confused with Federal Emergency Management Agency's Flood Insurance Rate Maps used for the National Flood Insurance

Program. They are not showing the same type of flood hazard and they were prepared for different purposes. Levee Flood Protection Zone maps estimate the maximum area that may be flooded if a State-Federal levee fails with flows at maximum capacity that may reasonably be conveyed. These maps specifically focus on flood risks associated with State-Federal levees. Lands within the Levee Flood Protection Zone may also be subject to flooding due to other factors including, but not limited to, levee failure at flows less than design capacity, overtopping of a levee, drainage problems, or other types of flooding from sources on the land side of the levee. Lands not mapped within a Levee Flood Protection Zone may also be subject to flood. LFPZ zones in the County can be seen in Figure 4-91.

Figure 4-91 Colusa County – Levee Flood Protection Zones



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. The 2004 LHMP noted that since dredging of the river bottom has been discontinued, the bottom of the river has become higher, thus the water levels reach higher on the banks of the levees. When northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees. The potential for levee breaches and erosion damage has increased. Geographical extents of the LFPZ flood sones are detailed in Table 4-101 .

Table 4-101 Colusa County Planning Area – LFPZ Geographical Extents by Depth and Jurisdiction

Jurisdiction / Levee Flood Protection Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
City of Colusa						
Shallow: <3ft	2,062	85.504%	1,377	99.194%	685	66.927%
City of Colusa Total	**2,062**	**85.504%**	**1,377**	**99.194%**	**685**	**66.927%**
City of Williams						
Shallow: <3ft	0	0.000%	0	0.000%	0	0.000%
City of Williams Total	**0**	**0.000%**	**0**	**0.000%**	**0**	**0.000%**
Unincorporated Colusa County						
Shallow: <3ft	92,181	12.724%	49,075	19.879%	43,105	9.025%
Unincorporated Colusa County Total	**92,181**	**12.724%**	**49,075**	**19.879%**	**43,105**	**9.025%**
Grand Total	**94,243**	**12.913%**	**50,453**	**20.236%**	**43,790**	**9.114%**

Source: LFPZ BAM (2023)

It is important to note that all levees in the County were de-accredited by FEMA in the most recent 2024 DFIRMs and thus do not provide protection against the 1% annual chance flood. Although de-accredited, the levees are all in place and functional and provide some level of protection against future flood events. A discussion of the levees in the Colusa County Planning Area follows.

According to CA DWR, the Sacramento River Flood Control Project (SRFCP) is actually six, interrelated projects undertaken by the USACE, including reservoirs constructed on major rivers, which constitute the largest flood control system in the state. Project facilities extend from north of Colusa County southward to the Sacramento-San Joaquin Delta, about 230 miles along the Sacramento River corridor. Levees and

associated facilities of the SRFCP have been constructed along 5 rivers, 15 creeks and 13 sloughs. In addition, human-made or human-modified facilities include 6 bypasses and 11 channels.

The FIS noted that Colusa County has two of the Sacramento River by-pass weirs within its boundaries: the Colusa Weir just northeast of the City of Colusa and the Moulton Weir, 12 miles northeast of Colusa. When the Sacramento River level gauge reads 60 feet, the water flows at the Colusa Weir into a bypass area that is uninhabited and does not affect any major roadways. When the Colusa Bridge gauge reads 64 feet, the river overtops the bank at the Moulton Weir. During extended flow, the water crosses River Road and closes the roadway. There are alternate roads to travel from that area so that no residences become isolated. Along with the other bypasses, most designed in 1930, urban flooding is deterred and offers a high level of protection as the weirs are not gated: they do not need to be opened manually to properly function.

Levee failure inundation maps have not been developed locally. Any failure would be scenario-based depending on the river depth and surface water and creek/stream levels in the area of failure. Planning efforts rely on the Department of Water Resources inundation maps. Any assumption will be based on the land elevation of each town: the town of Princeton is 82 feet above sea level; the City of Colusa is 53 feet above sea level. Grimes is 46 feet. The warning levels at the Colusa Bridge gauge are determined by the DWR: 63' is Monitor Stage, 70' is Flood Stage and 71' is Danger Stage.

More information on levees specific to the Colusa County Planning Area can be found in the Reclamation District 108 and Sacramento River West Side Levee District Annexes to this Plan Update.

Past Occurrences

Disaster Declaration History

There have been no disasters declarations related to levee failure in Colusa County, as shown on Table 4-5.

NCDC Events

There have been no NCDC levee failure events in Colusa County.

Hazard Mitigation Planning Committee Events

The HMPC could provide no events of levee failure. However, the HMPC did note that:

- In **2017**, there were areas of sloughing on the riverbank in the area near Grimes, as well as seepage and boils. With the river maintained a higher than average depth for a longer than average period of time, the residents in Grimes were on high alert for weeks, concerned about the levee failing. The responsible agencies, Reclamation District 108 and the Sacramento River Westside Levee District, worked with the Department of Water Resources to monitor these areas. The SRWLD performed several repairs to the levee and sandbagged the boils to prevent further damages and protect the town of Grimes. After the water receded and the river level stabilized, they carried out a large levee repair project, extending the wall of the levee's width in the area. More projects are planned as noted in the Project Worksheets located later in this Plan.

- In **2015** the County observed a large cut through the levee, although not down to the surface elevation. This was not the Sacramento River levee, but a dry levee named the Powell Slough Levee that would protect a portion of the City of Colusa during a ground flood event, not a river event. The cut was located at the beginning of the levee by the east gate off Highway 20, just to the right as the levee rises, clearly visible from the road. In addition, the berm/old railroad right of way has a cut through it down to ground surface level as it runs parallel with Arnold's (north side) just off Highway 20. It appears there is a cut through it to access a dirt road leading to a side gate, and built the spoils up onto the berm in large piles which would restrict some vehicles from crossing it. These items were fixed before any damage could occur.
- **1978 Floods** – The HMPC noted that the County experienced flooding in January of 1978. The Moulton Weir was overflowing, and the river overtopped the secondary levee of River Road. This was shown on Figure 4-81 in Section 4.3.11.

Likelihood of Future Occurrence

Occasional – It is important to remember that no levee provides protection from events for which it was not designed: they are not fail-safe. As historically noted, changes to the bottom of the river have affected the protection the levee provides. Proper maintenance is necessary to reduce the probability of failure. Due to the number and age of levees in Colusa County, future levee failures are currently considered occasional.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and levee failure can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

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.

Vulnerability Assessment

Vulnerability—Extremely High

The probability of levee failure is increasing over time due to increased storms and flooding potential from global climate change. Levee failure flooding can occur as the result of partial or complete collapse of an impoundment, and often results from prolonged rainfall and flooding. A levee failure can range from a small uncontrolled release to a catastrophic failure. The primary danger associated with levee failure is the high velocity flooding of those properties downstream of the breach. Vulnerability to levee failures is generally confined to the areas subject to inundation downstream of the levee. In addition, levee failure can cause stream bank erosion, which can in some instances have effects worse than those of flooding itself.

Large portions of the Colusa County Planning Area are at some measure of vulnerability to levee failure. An assessment of a community's vulnerability to levee failure begins with an understanding of local exposure to levee failure. This is included in the discussion of the Planning Area's Assets at Risk to this hazard. The following sections provide an analysis of the Levee Flood Protection Zones.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

Levee failures that could inundate both urbanized areas and rural areas and cause flooding which could close roadways are of great concern. Life safety is of the highest concern followed by property damage and impacts to critical facilities and infrastructure. Specific locations of concern from levee failure would be the Sacramento River and the 2047 Canal.

Assets at Risk

Assets at risk from levee failure include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

Methodology

2023 Colusa County Parcel/Assessor Data was used as the basis for the Colusa County inventory of parcels and values. The levee failure analysis is performed using the LFPZ data for expected flood extents and depths. These LFPZ maps showing deep and shallow flooding areas of flooding. GIS was used to create a centroid, or point representing the center of the parcel polygon. LFPZ flood data was then overlaid on the parcel layer. For the purposes of this analysis, the flood depth that intersected a parcel centroid was assigned the flood depth for the entire parcel. The parcels and associated values were segregated and analyzed in this fashion to determine parcels and values at risk based on the LFPZ maps for the Colusa County Planning Area.

People and Populations

Populations in the LFPZs are at risk to flooding. Certain vulnerable populations may be at greater risk to the effects of levee failure flooding. Certain vulnerable populations may be at a greater risk of a sudden levee failure, including the unsheltered, those with limited mobility and those that lack the resources to leave the area.

Planning Area residents that live in the LFPZs are vulnerable to levees failure flooding. Not only are the residents at risk, but their homes and contents are all at risk, compounding the impacts associated with significant levee failure events. To evaluate the population of residents of the Planning Area that live within LFPZs, these areas were overlayed on the parcel layer and linked to the Assessor data. Those residential parcel centroids that intersect each LFPZ flood depth were counted and multiplied by the 2020 Census Bureau average household factors for each jurisdiction. Results are shown in Table 4-102.

Table 4-102 Colusa County Planning Area – Improved Residential Parcels and Population by LFPZ Flood Depth and Jurisdiction

Jurisdiction	Deep: >3ft		Shallow: <3ft	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population
City of Colusa	0	0	1,778	5,156
City of Williams	0	0	0	0
Unincorporated County	6	21	540	1,933
Total	**6**	**21**	**2,318**	**7,089**

Source: LFPZ BAM 2023, 2023 Colusa County Parcel/Assessor Data, 2020 US Census Bureau Average Household Size– City of Colusa (2.90); City of Williams (2.55); Unincorporated Colusa County (3.58).

These numbers reflect low end estimates as the property use categories based on the Assessor data utilized for this LHMP Update assumes all residential properties are single family residences. However, some of the residential parcels actually include multi-family units, including apartments, condominiums and well as duplexes and triplexes. These variations in residential property use were not accounted for in the analysis, which skews populations results to be lower.

Structures

A levee failure can affect the built environment of the Colusa County Planning Area, with some structures in the Planning Area at risk to a levee failure event. GIS was used to determine the possible impacts of levee failure flooding from LFPZ areas within the Planning Area. Table 4-103 shows the parcel counts, land and improved values (i.e., those with a structure improvement on the parcel), other values, estimated content replacement values, and total values by property use in the Planning Area that fall in LFPZ by flood depth. Table 4-104 breaks down Table 4-104 for the unincorporated County to show what property uses are in the LFPZ areas.

Table 4-103 Colusa County Planning Area – Count and Value of Parcels (and Structures) in LFPZs by Jurisdiction

Jurisdiction / Levee Flood Protection Zone Depths	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa							
Deep: >3ft	4	2	$105,143	$261,230	$309,690	$391,845	$1,067,908

Jurisdiction / Levee Flood Protection Zone Depths	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Shallow: <3ft	2,312	2,075	$143,023,106	$443,506,557	$48,918,853	$309,104,118	$944,552,634
City of Colusa Total	**2,316**	**2,077**	**$143,128,249**	**$443,767,787**	**$49,228,543**	**$309,495,963**	**$945,620,542**
City of Williams							
Deep: >3ft	0	0	$0	$0	$0	$0	$0
Shallow: <3ft	0	0	$0	$0	$0	$0	$0
City of Williams Total	**0**	**0**	**$0**	**$0**	**$0**	**$0**	**$0**
Unincorporated Colusa County							
Deep: >3ft	509	198	$198,182,119	$26,076,001	$4,112,753	$25,651,575	$254,022,448
Shallow: <3ft	2,045	1,205	$363,182,229	$189,921,002	$41,415,608	$159,484,028	$754,002,867
Unincorporated Colusa County Total	**2,554**	**1,403**	**$561,364,348**	**$215,997,003**	**$45,528,361**	**$185,135,603**	**$1,008,025,315**
Grand Total	**4,870**	**3,480**	**$704,492,597**	**$659,764,790**	**$94,756,904**	**$494,631,566**	**$1,953,645,857**

Source: LFPZ BAM 2023, 2023 Colusa County Parcel/Assessor Data

Table 4-104 Unincorporated Colusa County – Count and Value of Parcels (and Structures) in LFPZs by Property Use

Levee Flood Protection Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Deep: >3ft							
Agricultural	477	188	$197,214,771	$20,487,067	$2,982,193	$20,487,067	$241,171,098
Commercial	4	4	$380,841	$4,740,084	$1,130,560	$4,740,084	$10,991,569
Government	8	0	$25,232	$0	$0	$0	$25,232
Industrial	1	0	$237,402	$0	$0	$0	$237,402
Institutional	0	0	$0	$0	$0	$0	$0
Miscellaneous	12	0	$178,377	$0	$0	$0	$178,377
Residential	7	6	$145,496	$848,850	$0	$424,424	$1,418,770
Deep: >3ft Total	**509**	**198**	**$198,182,119**	**$26,076,001**	**$4,112,753**	**$25,651,575**	**$254,022,448**
Shallow: <3ft							
Agricultural	1,069	553	$289,290,968	$77,667,183	$21,692,157	$77,667,183	$466,317,491
Commercial	83	59	$5,018,483	$10,420,583	$2,808,064	$10,420,583	$28,667,713
Government	103	16	$19,080,139	$977,495	$4,375	$977,495	$21,039,504

Levee Flood Protection Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Industrial	30	15	$2,782,477	$18,761,813	$12,621,018	$28,142,721	$62,308,029
Institutional	17	6	$435,833	$1,723,486	$1,885,258	$1,723,486	$5,768,063
Miscellaneous	93	16	$14,799,567	$734,651	$90,670	$734,651	$16,359,539
Residential	650	540	$31,774,762	$79,635,791	$2,314,066	$39,817,909	$153,542,528
Shallow: <3ft Total	**2,045**	**1,205**	**$363,182,229**	**$189,921,002**	**$41,415,608**	**$159,484,028**	**$754,002,867**
Unincorporated Colusa County Total	**2,554**	**1,403**	**$561,364,348**	**$215,997,003**	**$45,528,361**	**$185,135,603**	**$1,008,025,315**

Source: LFPZ BAM 2023, 2023 Colusa County Parcel/Assessor Data

Critical Facilities and Infrastructure

Levee failure flooding presents a threat to critical facilities and infrastructure, and community lifelines. Critical infrastructure failures such as loss of power, impacts to potable and wastewater treatment systems, and road and bridge failures can all be caused by levee failure events, depending on the magnitude of the resulting flood. The following analysis discusses critical facilities and infrastructure at risk to levee failure flooding, followed by a discussion on vulnerability of community lifelines.

A separate analysis was performed on the critical facility inventory in the Colusa County Planning Area to determine critical facilities in LFPZs. Using GIS, the LFPZ areas were overlayed on the critical facility GIS layer. Figure 4-92 shows critical facilities, as well as the LFPZs. Table 4-105 details critical facilities by LFPZ by facility type and count for the Planning Area. Details of critical facility category, type, name and address by LFPZ are listed in Appendix F.

Figure 4-92 Colusa County Planning Area – Critical Facilities in LFPZs

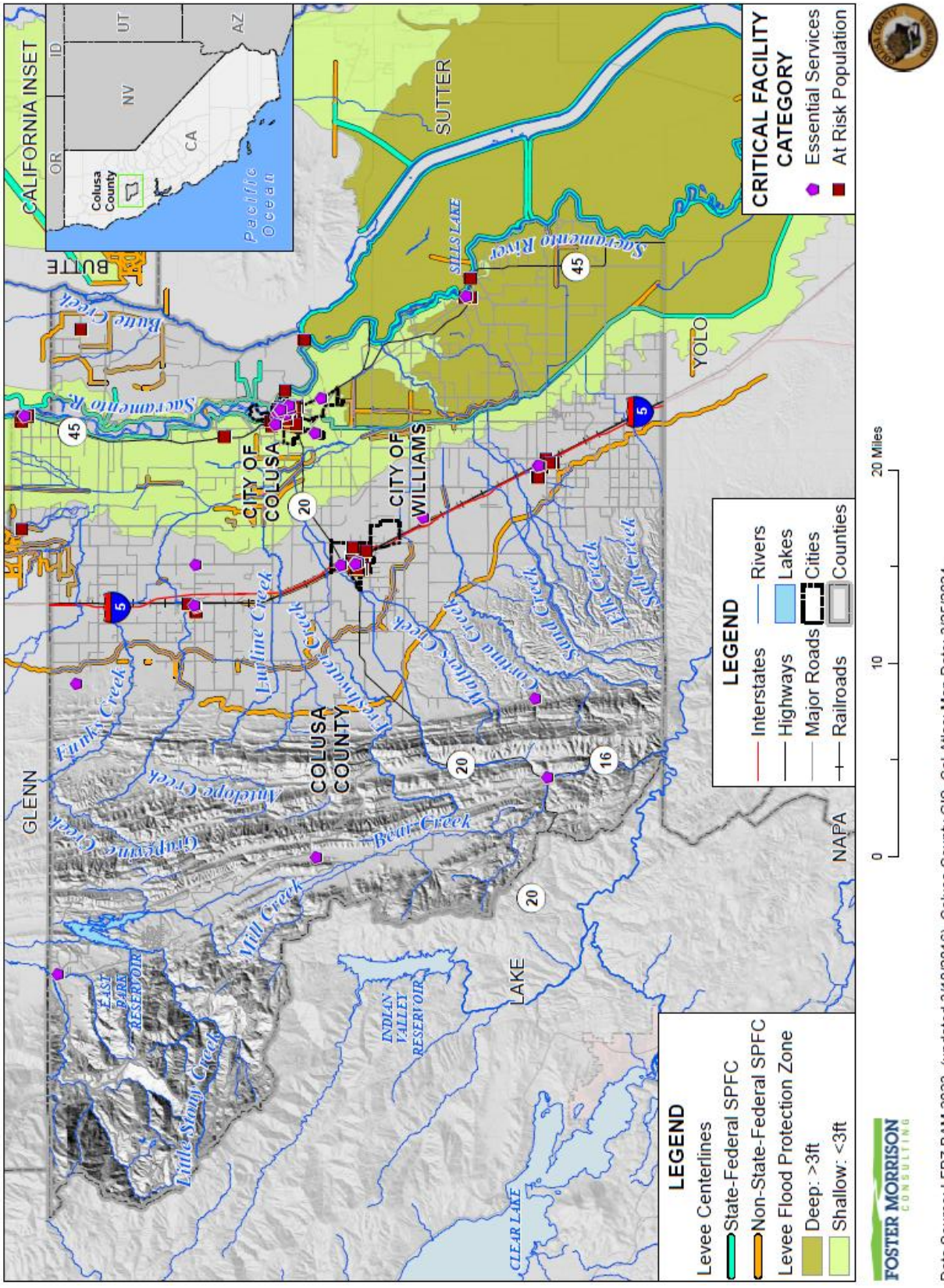


Table 4-105 Colusa County Planning Area – Critical Facilities in Levee Flood Protection Zones by Category, Type, and Jurisdiction

Levee Flood Protection Zone	Critical Facility Category	Facility Type	Facility Count
City of Colusa			
Shallow: <3ft	Essential Services Facilities	Emergency Response	1
		Fire Station	2
		Medical	1
		Police Station	1
		Public Services	3
		Utility Facility	2
		Total	**10**
	At Risk Population Facilities	Apartment Complex	22
		Assisted-Living	1
		Hotel or Motel	2
		Jail	1
		Mobile Home Park	4
		School	8
		Senior Living Facility	1
		Total	**39**
Shallow: <3ft Total			**49**
City of Colusa Total			**49**
Unincorporated Colusa County			
Shallow: <3ft	Essential Services Facilities	Fire Station	2
		Total	**2**
	At Risk Population Facilities	Apartment Complex	3
		Casino	1
		Hotel or Motel	1
		Mobile Home Park	2
		School	3
		Total	**10**
Shallow: <3ft Total			**12**
Unincorporated Colusa County Total			**12**
Grand Total			**61**

Source: LFPZ BAM (2023), Colusa County GIS

Community Lifelines

Levee failure flooding presents a threat to life and property, including community lifelines in the Colusa County Planning Area. Community lifelines that would be vulnerable to levee failure flooding include:

- **Safety and Security** – Search and rescue and swiftwater teams may be called on to perform riskier duties during times of levee failure and flooding. Police, Fire, EMS, and Public Works personnel are often called on to respond during flood emergencies which at times may stretch their capacity.
- **Food, Hydration, Shelter –** Floodwater is often contaminated with sewage and other contaminants, which can lead to illness and affect clean drinking water. These life safety and public health issues can tax the ability of the health and medical systems to provide necessary services, even if only temporarily.
- **Health, and Medical** – Loss of life and injuries can occur during significant levee failure events. Flooding may complicate the ability to transport the injured possibly requiring rerouting of injured to other facilities. Public health can also be at risk from flooding.
- **Energy** – Levee failure flooding could affect power distribution locations in the Planning Area. Power outages may occur. Fuel supplies may be temporarily cut off until levees are repaired (allowing for transport of fuel to resume).
- **Communications** – Communication infrastructure can be inundated by a levee failure event causing damage and an interruption in service. As well, an influx of service calls to dispatch centers for reporting of flooding, power outages, or other issues can occur. Messaging systems may need to be deployed during these times to let the public know about road and lane closures, washouts, and debris or flooding on roads.
- **Transportation** – Highways and local roads may experience levee failure flooding. This can cause lane or road closures, bridge closures and significantly limit mobility in the Planning Area. These closures can affect response personnel (EMS, Fire, Police) as well as cause additional traffic issues for residents and impact evacuation routes.
- **Hazardous Material** – Hazardous material facilities can be affected by levee failure flooding. Hazardous materials releases can occur if waters that overtop levees rupture storage tanks and other containment structures and cause them to spill into streams, rivers or drainage systems. Releases during these times can be comingled with flood waters, contaminate drinking water, as well as create additional exposures to the environment.
- **Water Systems** – Floods from levee failures can affect the ability for water and wastewater systems to operate, since many are located near leveed areas.

Given the high amount of area that falls in the leveed areas in the County (regardless of whether the levees are certified or not), these community lifelines could be overwhelmed during a levee failure event.

Natural, Historic, and Cultural Resources

Large levee failure events can affect natural, historic, and cultural resources. There are a number of ways levee failures and associated floodwaters can impact natural resources and the environment: Wildlife habitats can be destroyed. Contaminated floodwater can pollute rivers and habitats. Silt and sediment can destroy natural areas. Riverbanks and natural levées can be eliminated as rivers reach bankfull capacity. Rivers can be widened, and deposition can increase downstream. Trees can be uprooted by high-velocity water flow. Plants that survive the initial flood may die due to being inundated with water. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to structures within the areas protected by levees, but other cultural resources such as those associated with Native

Americans and old tribal areas can also be disturbed, damaged and lost during extreme levee failure events. Any of these that fall in the LFPZ flood zones would be vulnerable.

Economic Assets and Community Activities of Value

Major levee failure flooding events could affect any economic asset that lies in the areas protected by levees. These events can also affect those economic assets outside of the areas protected by levees, at least in the short term until floodwaters have receded and the Planning Area has sufficiently recovered. The Planning Area felt that a levee failure would have little bearing on community activities of value, unless a failure had a direct impact on the activity while it was occurring.

Impacts from Levee Failure

Floods and their impacts vary by location, including impacts associated with a levee failure flood event, and will only affect certain areas of the Colusa County Planning Area that are in areas protected by levees. Based on the areas of the Colusa County Planning Area surrounded by levees, including a large portion of developed areas of the County, it is evident that levee failure floods could potentially have significant impacts to the Colusa County Planning Area, depending on the severity of the event. Impacts that are not quantified, but could be anticipated in large levee failure event, include:

- Injury and loss of life.
- Commercial and residential structural and property damage.
- Crop damage.
- Disruption of and damage to public critical infrastructure and services.
- Health hazards associated with mold and mildew, contamination of drinking water, etc.
- Impacts to natural resource areas, including stream bank erosion.
- Damage to roads/bridges resulting in loss of mobility.

In addition to flood related levee failures, the levees in the Planning Area are at risk to failure during an earthquake event. Levee failure flooding could accompany an earthquake and could be compounded further if a dam or storage reservoir fails. Channels and water courses with earthen banks and levees are particularly vulnerable and could collapse in a major earthquake resulting in partial or complete blockage of channels causing flooding upstream of the impoundment. Levees are especially susceptible to rapid settlement due to liquefaction or horizontal spreading of underlying soils.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future heavy rain conditions and associated impacts and vulnerability of the County to levee failure flooding.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed; however, additional growth within the recently decertified levee protected areas, including the LFPZs would place additional populations at risk to flood. Additional population growth would likely bring continued diversity to the County. Vulnerable population groups could face disproportionate effects from flooding and should be planned for. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. Locating new development, structures and critical facilities and infrastructure within or near areas at risk to levee failure may put additional development at risk. County building codes are in effect to reduce this risk and should be updated as necessary to continue to address future conditions. Thus, depending on the location of new development and adherence to protective building codes, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes and the floodplain ordinance, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered. can help to make for a more resilient community.

Colusa County is also evaluating the feasibility of projects to bring some area levees up to a 0.1% and 0.5% annual chance or greater level of protection which would likely change future development standards in levee protected areas. These projects would bring a decreased vulnerability to all populations and development within the inundation area.

GIS Analysis

Colusa County provided 53 future development areas which were used as the basis for the inventory of future development for the unincorporated County. These were mapped in GIS. Where multiple parcels are listed, the parcels are merged to form one polygon, and the hazards assigned are based on the centroid of the polygon. Figure 4-93 show the locations of the future development areas and LFPZs. Table 4-106 shows the details of the future development areas that are located in each LFPZ.

Figure 4-93 Unincorporated Colusa County – Future Development in LFPZs

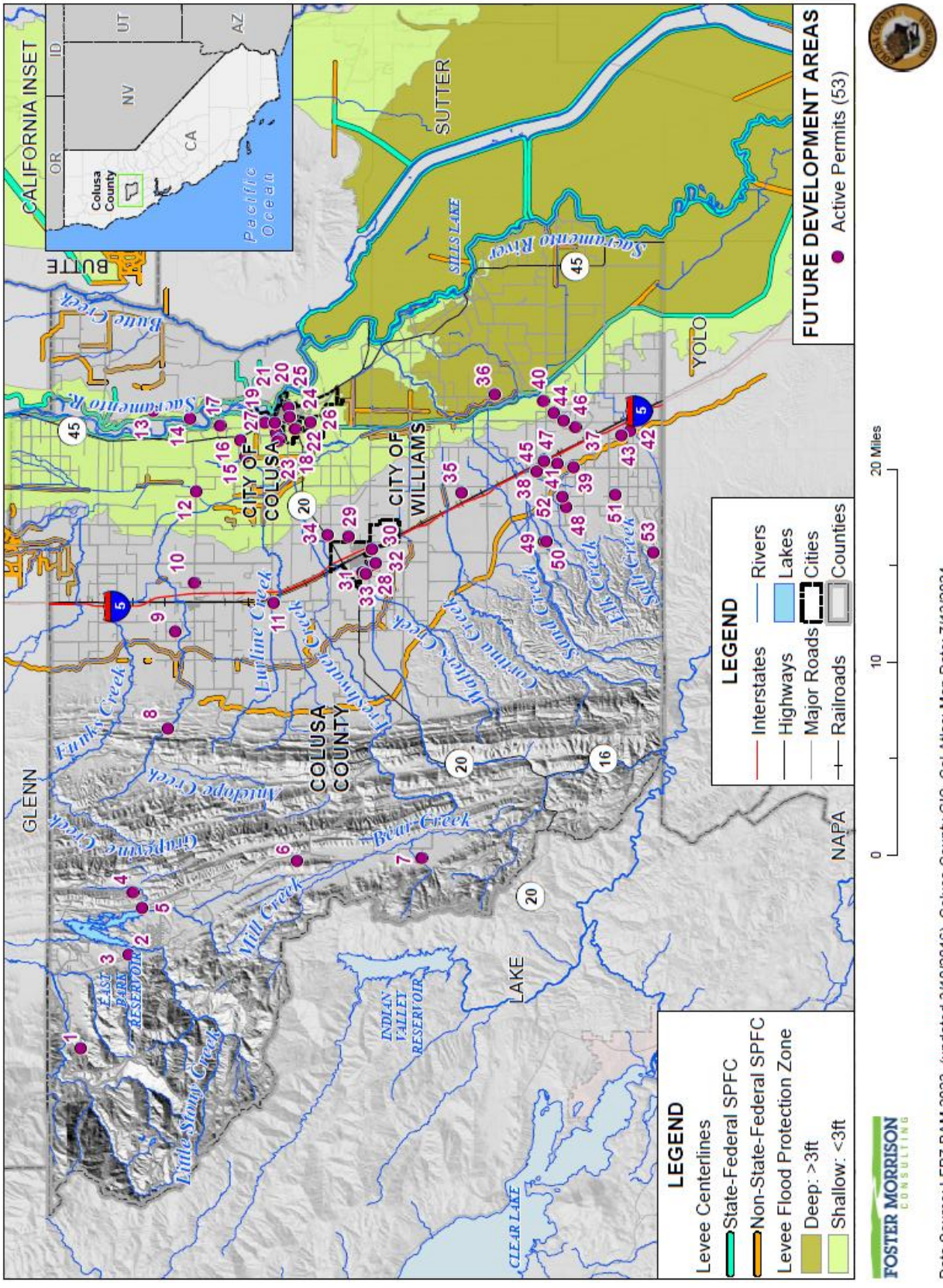


Table 4-106 Unincorporated Colusa County – Future Development in LFPZs with Parcel Counts and Acres

Levee Flood Protection Zone	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
Deep: >3ft	36	019-090-058-000	1	10.00
	Deep: >3ft Total		**1**	**10.00**
Shallow: <3ft	12	6458 MAXWELL RD	1	319.89
	14	4073 RIVER RD	1	10.32
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	17	015-030-094-000	1	17.03
	18	3258 MCCOY RD	1	6.01
	19	015-310-050-000	1	11.97
	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	23	3286 RANCH RD	1	1.85
	24	1232 FIFTH ST	1	0.60
	25	002-101-004-000	1	4.48
	26	015-380-019-000	1	1.00
	27	1773 LURLINE AVE	1	3.40
	40	7251 TULE RD	1	2.64
	Shallow: <3ft Total		**16**	**895.68**
Grand Total			**17**	**905.67**

4.3.15. Stream Bank Erosion

Hazard Profile

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

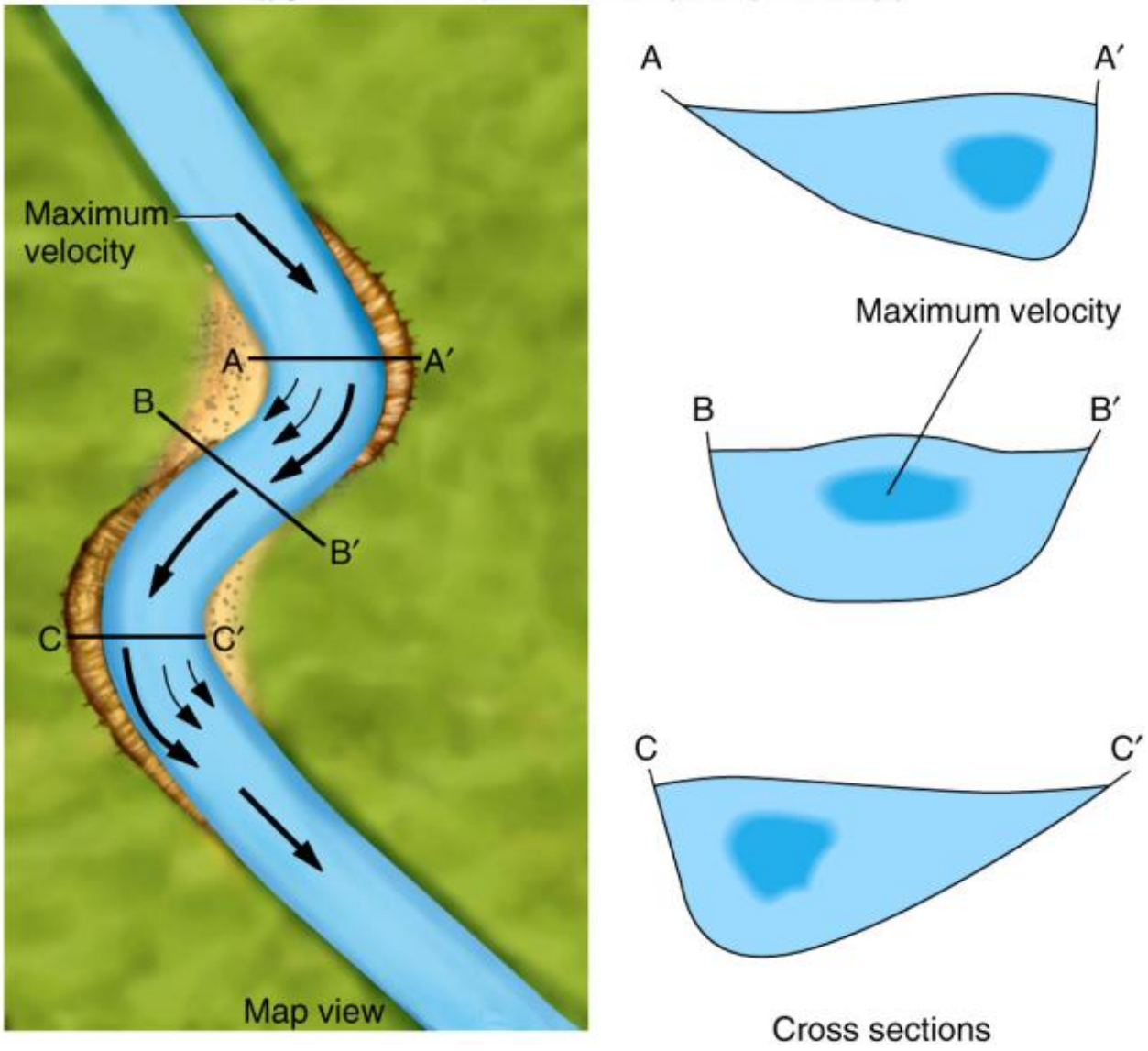
Hazard/Problem Description

Erosion is the general process whereby rocks and soils are broken down, removed by weathering, or fragmented and then deposited in other places by water or air. Water erosion poses problems for Colusa County. The rate of erosion depends on many variables, including the soil or rock texture and composition, soil permeability, slope, extent of vegetative cover, and precipitation amounts and patterns. Erosion increases with increasing slope and precipitation and with decreasing vegetative cover, which includes areas where protective vegetation has been removed by fire, construction, or cultivation. Colusa County is traversed by many waterways, including leveed areas. These locations are all subject to bank erosion. Stream bank erosion is a natural process, but acceleration of this natural process leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects.

According to the DWR, any flowing body of water (brook, creek, stream, river) is a stream. Stream flow is expressed as volume per unit time, usually cubic meters per second, cubic feet per second, sometimes cubic kilometers per second, or acre-feet per second or day. Stream flow varies tremendously with time. Short term effects of streambank erosion come from rainfall, snowmelt, and evaporation conditions. Long term effects of streambank erosion come from land use, soil, groundwater state, and rock type.

Stream bank erosion is a natural process (as shown on Figure 4-94), but acceleration of this natural process leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects. Stream bank erosion processes, although complex, are driven by two major components: stream bank characteristics (erodibility) and hydraulic/gravitational forces. Many land use activities can affect both of these components and lead to accelerated bank erosion. The vegetation rooting characteristics can protect banks from fluvial entrainment and collapse, and also provide internal bank strength. When riparian vegetation is changed from woody species to annual grasses and/or forbs, the internal strength is weakened, causing acceleration of mass wasting processes. Stream bank aggradation or degradation is often a response to stream channel instability. Since bank erosion is often a symptom of a larger, more complex problem, the long-term solutions often involve much more than just bank stabilization. Numerous studies have demonstrated that stream bank erosion contributes a large portion of the annual sediment yield.

Figure 4-94 Meanders and Stream Flows



Location and Extent

Stream bank erosion and deposition are occurring continually at varying rates over the Planning Area. Swiftly moving floodwaters cause rapid local erosion as the water carries away earth materials. This is especially problematic in leveed areas. Severe erosion removes the earth from beneath bridges, roads and foundations of structures adjacent to streams. By undercutting it can lead to increased rockfall and landslide hazard. The deposition of material can block culverts, aggravate flooding, destroy crops and lawns by burying them, and reduce the capacity of water reservoirs as the deposited materials displace water.

Stream bank erosion occurs on rivers, streams, and other moving waterways, including leveed areas, in the County. These leveed areas were shown on Figure 4-74. While this hazard addresses stream bank erosion, there are soil considerations in the greater County outside of these streambank areas that affect erosion.

Certain highly erodible areas of the County occur along streambanks in the County. The discussion below discusses the larger County, as well as the erodible areas of the County based on soil factors that pertain and are related to streambank erosion. These soil factors play a role in the erodibility of the levees.

The US Natural Resources Conservation Service (NRCS) delineates soil units and compiles soils data as part of the National Cooperative Soil Survey. The following description of erosion factors is provided by the NRCS Physical Properties Descriptions:

> ***Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.***

As mentioned above, the Kw factor for a given soil can range from 0.02 to 0.69, with 0.69 being the most "erodible." Soils data for Colusa County were obtained from the NRCS in order to identify the spatial distribution erosion factors. In the following table, erosion factor Kw represents erodibility of the whole soil, as the estimates are modified by the presence of rock fragments. Table 4-107 identifies approximate countywide acreages and percentages of total County area for low, moderate, high, and very high erosion factor soils. This includes the areas along stream banks. The westernmost portion of the County, primarily in the area of the Mendocino National Forest, has not been surveyed. Areas without soils data and surface water are represented in the "No Value" row in the table.

Table 4-107 Colusa County – Soil Erosion

Kw	Acres	Percent
≤0.17	9,345.7	1.30%
0.17-0.35	43,6347.1	59.00%
0.35-0.52	19,6851	26.70%
0.52-0.69	0	0.00%
No Value	97,782.5	13.30%
Total	**740,326**	**100%**

Source: NRCS

As identified in the table, very little of the surveyed portion of the County contains soils with a low erosion factor. This is also true for areas along stream banks. In addition, no soils with a very high erosion factor are identified within the County. Moderate erosion factors dominate the county's surveyed soils. High erosion factors are found primarily along the Sacramento River corridor (where streams may erode bank sides) and along the Coast Range/Central Valley boundary. This is where many of the levees sit.

The speed of onset of streambank erosion is typically slow, as the erosion takes place over periods of years. Duration of erosion is extended. However, during periods of high stream flow and during storm and wind events when wave action contributes to the extent and speed of streambank erosion, the speed of onset can be more sudden and the duration more compressed resulting in significant erosion along waterways

Past Occurrences

Disaster Declarations

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

NCDC Events

The NCDC does not track erosion events.

Hazard Mitigation Planning Committee Events

According to the HMPC, erosion from heavy rains occurs along the stream banks on an annual basis in the County.

2019 and 2023 – Streambank erosion has occurred on most creeks within the County within reason, but the streambeds which have had the most impacts are Sand Creek, Salt Creek, Stone Coral Creek.

2017 Floods – The HMPC noted flood conditions in February of 2017. A Pacific storm parked itself over Southern California and unloaded, opening sinkholes and leading to the deaths of at least two people. The storm also affected areas farther north that have been lashed by rain for days. The HMPC noted that roads turned into streams of brown water that lapped at doorsteps but no injuries were reported. Highway 99 was closed from the Glenn County Line to Williams, Maxwell Road was closed just west of the I-5 southbound on and off ramps, and many roads in the town of Maxwell were flooded and were eroded. Damages to these roads was reported. This can be seen in Figure 4-95.

Figure 4-95 Streambank Erosion from 2017 Floods

Source: Colusa County OES

Likelihood of Future Occurrence

Highly Likely – Due to the high number of linear feet of levees and stream and creek banks within the Colusa County Planning Area and the fact that erosion is constantly occurring, the likelihood of future occurrences of streambank erosion in Colusa County is highly likely.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and stream bank erosion can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Stream Bank Erosion

According to the 2021 CAS, climate change may affect flooding and thereby erosion in Colusa 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 4-42 in Section 4.3.4. 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. All of the events above could exacerbate stream bank erosion in the County.

Vulnerability Assessment

Vulnerability—Medium

Many areas of the County are at risk to streambank erosion. An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

Certain developed areas that abut creeks and rivers in the County are at risk to continued bank erosion. Levees are at risk to erosion as well, due to the channelization of narrow river channels. Significant erosion can cause degradation and loss of levee and bank stability. This is the main concern regarding erosion in Colusa County. This is the case in many locations, but a few examples are included here:

- Lack of shoulder for road on Road 1 at Yolo County Border from Tehama Colusa Canal west to the intersection of Road 1 and Road 84. There has been substantial erosion on both sides of Road 1 which could result in a falling power pole or a car overturning in the steep ditch.
- Deterioration of the east side of the Levee on the Colusa Basin Drain east of the Colusa National Refuge at MA12 7.0 – this has been deteriorating for over a year. There are markers which might indicate the site will be repaired. This levee is under the control of CA DWR out of its Hwy 20 office.

Additionally, the County noted that streambank erosion increases the sediment that a stream must carry, results in the loss of fertile bottomland, and causes a decline in the quality of habitat on land and in the stream. High velocity flows can erode material from the outboard or waterside of the levee (see Section 4.3.14), which may lead to instability and failure. Erosion can occur at once or over time as a function of the storm cycle and the scale of the peak storms.

Furthermore, as noted in the levee discussion in Section 4.3.14, since dredging the river bottom has been discontinued, the bottom of the river has become higher, thus the water levels reach higher on the banks of the rivers and levees. When northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on levees. The potential for levee and stream bank erosion damage has increased.

Assets at Risk from Stream Bank Erosion

Assets at risk from stream bank erosion include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources, economic assets, and community activities of value). These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

Streambank erosion will have a minimal direct effect on people and populations in the County. Indirect effects on people and populations include damages to roads or bridges from streambank erosion, causing transportation issues. Streambank erosion can also cause high sediment loads. This can cause water quality impacts. Water quality can be impacted causing health problems, especially to vulnerable populations where access to clean water supplies can be more challenging. Water quality can have an effect on all of the population in the Planning Area, but often have a greater effect on the unhoused and other vulnerable populations that may be unable to access clean drinking water. There may be higher costs borne by water companies to treat this water. Water companies may pass those costs onto those to whom they provide water services. Those who are economically disadvantaged may be unable to afford the increased costs of potable water.

Structures

Structures near rivers are at some risk from the effects of streambank erosion. Structures that are in areas protected by levees are at greater risk of streambank erosion. Should levees erode quickly, their risk of failure increases. Those structures behind the levees would be at risk. This is discussed in greater detail in Section 4.3.14.

Critical Facilities and Infrastructure

Flooding presents a threat to critical facilities and infrastructure, and community lifelines. Critical infrastructure plays an immensely important role in our communities. As previously noted, communities rely on roads, rail corridors, and related biking and pedestrian routes for transportation, and on water infrastructure for drinking water, wastewater service, and draining streets of rainwater. Damage to any one of these systems can threaten public safety, wreak havoc on daily life, impact properties far from flood zones, and result in economic impacts that cascade throughout California.

Community Lifelines

Typically, streambank erosion is an ongoing process and has limited impact to community lifelines. Streambank erosion that causes significant issues, including levee failures, presents a threat to life and property, including community lifelines in the Colusa County Planning Area. A catastrophic levee failure could challenge local response capabilities and require evacuations to save lives. Community lifelines that would be at risk to levee failure flooding include:

- **Safety and Security** – Police, Fire, EMS, and Public Works personnel are often called on to respond during flood emergencies. This would be especially true in a dam failure event. Search and rescue and swiftwater teams may be called on to perform riskier duties during times of heavy rains and flooding.
- **Food, Hydration, Shelter** – a dam failure would displace many residents in the Planning Area. Some would need shelter, as well as food and water.
- **Health and Medical** – There is the potential for multiple injuries and deaths from a catastrophic dam failure taxing health and medical facilities. Casualty and patient movement from the inundation areas and unrelated incidents by EMS may be significantly impacted and have to be rerouted. Public health facilities can also be at risk from flooding caused by dam failures.
- **Energy** – Dam failure could impact large areas of above ground electric infrastructure, causing widespread power outages. Dam failure could also affect fueling stations, as well as electric car charging stations.
- **Communications** – An influx of service calls to dispatch centers for reporting of flooding, power outages, and rescues or other issues can occur resulting in communication networks going down for extended periods of time. Messaging systems need to be deployed during these events to let the public know about road closures, washouts, debris on roads, or lane closures. Calls to and from family and friends during a hazard event can further overwhelm communication systems such as cell towers and other infrastructure. Demand may exceed the capacity of these systems to remain operational during response efforts.
- **Transportation** – Highways and local roads may see extensive flooding. Bridges can be damaged or destroyed. This can cause lane closures or road closures and limit available routes altogether. These closures can affect response personnel (EMS, Fire, Police) as well as cause additional traffic issues for residents. Evacuation efforts may be difficult and further put people at risk of death or injury.
- **Hazardous Material** – Hazardous material facilities can be affected by flooding. Releases during these events can contribute to the dangers of floodwaters and cause contamination of potable water sources, as well as additional exposure to the environment.
- **Water Systems** – Any water (or wastewater) system located in a dam inundation area may be affected by dam failure flooding. The Planning Area's stormwater drainage system and facilities may also be affected.

Streambank erosion leading to a large levee failure event could overwhelm many community lifelines in the Colusa County Planning Area. As shown on the maps and tables above, there are multiple levees that would affect large swaths of the Planning Area. A failure of many of these levees could, at least temporarily, overwhelm the community lifelines in place in affected areas of the Planning Area.

Natural, Historic, and Cultural Resources

Streambank erosion could have a minor effect on those resources that are near areas where streambank erosion occurs. The greater risk is from streambank erosion that could cause levee failure flooding. Large flood events can affect natural, historic, and cultural resources. There are a number of ways floodwaters can impact natural resources and the environment: Wildlife habitats can be destroyed by floodwaters. Contaminated floodwater can pollute rivers and habitats. Silt and sediment can destroy natural areas. Riverbanks and natural levées can be eliminated as rivers reach bankfull capacity. Rivers can be widened, and deposition can increase downstream. Trees can be uprooted by high-velocity water flow. Plants that survive the initial flood may die due to being inundated with water. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to structures within the flooded areas, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged and lost during extreme flood events. Any of these resources that fall in the flood zones would be vulnerable.

Economic Assets and Community Activities of Value

Streambank erosion could have a minor effect on those assets that are near areas where streambank erosion occurs. Activities of value are thought to be minimally affected. The greater risk is from streambank erosion that could cause levee failure flooding. Major flood events could affect any economic asset that lies in the floodplain and can have long lasting effects. This could cause those businesses and economic assets within these areas to close or relocate. This could cause temporary or permanent loss of sales tax revenue. This is also true if agricultural areas are flooded in the County (discussed in greater detail in Section 4.3.6). These events can also affect those economic assets outside of the floodplain, at least in the short term until the Planning Area has sufficiently recovered. Community activities of value can also be disrupted by floods, though many of these events take place in the summer months, which are less likely to flood. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Impacts from Streambank Erosion

The 2023 California State Hazard Mitigation Plan noted that riverine flooding causes bank erosion, especially in the upper courses of rivers with steep gradients, where floodwaters can pass quickly without much flooding but scour the banks, edging properties closer to the floodplain or causing them to fall in. Other impacts from stream bank erosion include greater levee maintenance and increased risk of levee failure. Should the levees fail, the area protected by the levees would be flooded.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future streambank erosion conditions and associated impacts and vulnerability of the County to levee failures.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. Additional population growth would likely bring continued diversity to the County. Vulnerable population groups could face disproportionate effects from streambank erosion (and resultant levee failure) and should be planned for. Changes in population and population patterns will likely not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. A degrading streambed results in higher and often unstable, eroding banks. When land use changes occur in a watershed, such as clearing land for agriculture or development, runoff increases. With this increase in runoff the stream channel will adjust to accommodate the additional flow, increasing streambank erosion. Addressing the problem of streambank erosion requires land use planning, enforcing regulatory requirements, and an understanding of both stream dynamics and the management of streamside vegetation. Depending on the location of new development and adherence to protective building codes, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Determining the cause of accelerated streambank erosion is the first step in solving the problem. When a stream is straightened or widened, streambank erosion increases. Accelerated streambank erosion is part of the process as the stream seeks to re-establish a stable size and pattern. Damaging or removing streamside vegetation to the point where it no longer provides for bank stability can cause a dramatic increase in bank erosion.

Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can make for a more resilient community. Planned developments should take erosion risk areas into account during the construction of new homes and commercial properties.

4.3.16. Subsidence

Hazard Profile

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

Hazard/Problem Description

Land subsidence is defined as the sinking of the land over man-made or natural underground voids. Subsidence can result in serious structural damage to buildings, roads, irrigation ditches, underground utilities, and pipelines. It can disrupt and alter the flow of surface or underground water. Weight, including surface developments such as roads, reservoirs, and buildings and manmade vibrations from such activities as blasting or heavy truck or train traffic can accelerate the natural processes of subsidence. In Colusa County, there are generally two types of subsidence of concern: subsidence from groundwater pumping and the settling of the ground over abandoned mine workings (i.e., the creation of sinkholes).

Groundwater Pumping

Severe groundwater overdraft may lead to subsidence, a permanent lowering of the ground surface due to consolidation of sediments. According to the HMPC, groundwater pumping is the primary contributor to subsidence; however, this pumping has only a small effect on the County. Water is a necessity for ranchers raising beef cattle, growing vineyards and orchard crops or farmers growing annual truck crops. Livestock must be supplied with water and crops must be irrigated.

Fluctuations in the level of underground water caused by pumping or by injecting fluids into the earth can initiate sinking to fill the empty space previously occupied by water or soluble minerals. The consequences of improper use of land subject to ground subsidence can be excessive economic losses, including the high costs of repair and maintenance for buildings, irrigation works, highways, utilities, and other structures. This results in direct economic losses to citizens as well as indirect economic losses through increased taxes and decreased property values.

Location and Extent

Subsidence has been documented in some areas of the Sacramento Valley. Minimal subsidence locations in the County have been reported. According to the HMPC, any groundwater pumping areas in the eastern portion of the County may be at risk to subsidence. The HMPC noted that the Arbuckle area of the County is an area subject to subsidence associated with the drawdown of the water table. This is also where 5 wells went dry during the most recent drought.

There is no scientific scale or measurement system of subsidence. Changing elevations and groundwater tables can be measured over time, if areas are suspected of being affected by subsidence. The speed of onset of subsidence is slow, making it hard to determine with certainty that subsidence has occurred.

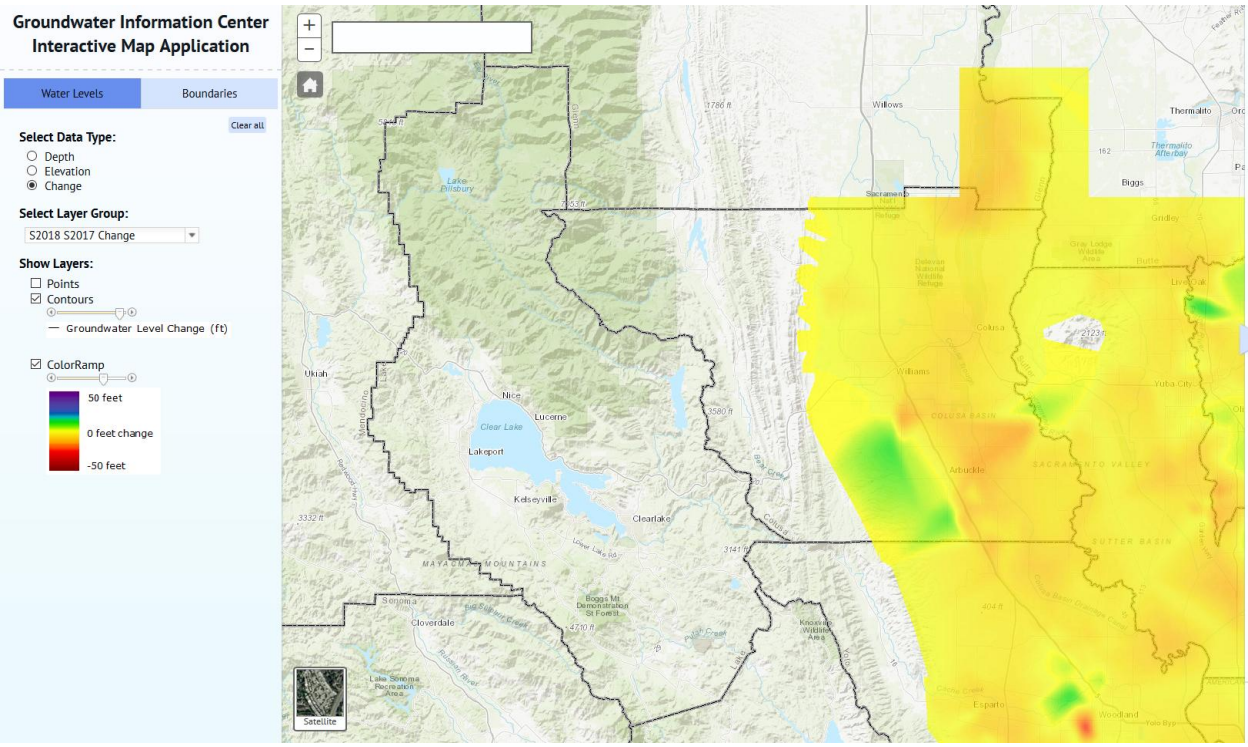
The California Department of Water Resources has created an interactive map that shows geospatially referenced groundwater levels, groundwater table elevation, and subsidence in California. The map includes:

- Groundwater depth below ground surface
- Groundwater elevation
- Groundwater change in elevation from year to year
- Subsidence trends as measured by extensometers and at GPS stations
- Cumulative subsidence at GPS stations

- Changes in groundwater levels from long-term monitoring wells
- Estimated potential for future subsidence in each groundwater basin

The groundwater subsidence map for Colusa County is shown in Figure 4-96.

Figure 4-96 Colusa County – Subsidence from Groundwater Pumping



Source: Cal DWR Groundwater Information Center. Verified on 3/22/2024.

Abandoned Mines

Given the mining history in Colusa County, subsidence due to past mining operations (i.e., the settling of ground over abandoned mine workings) is a concern in the Planning Area. Past mining activities have created surface subsidence in some areas and have created the potential for subsidence in other areas. Colusa County is home to many abandoned mines.

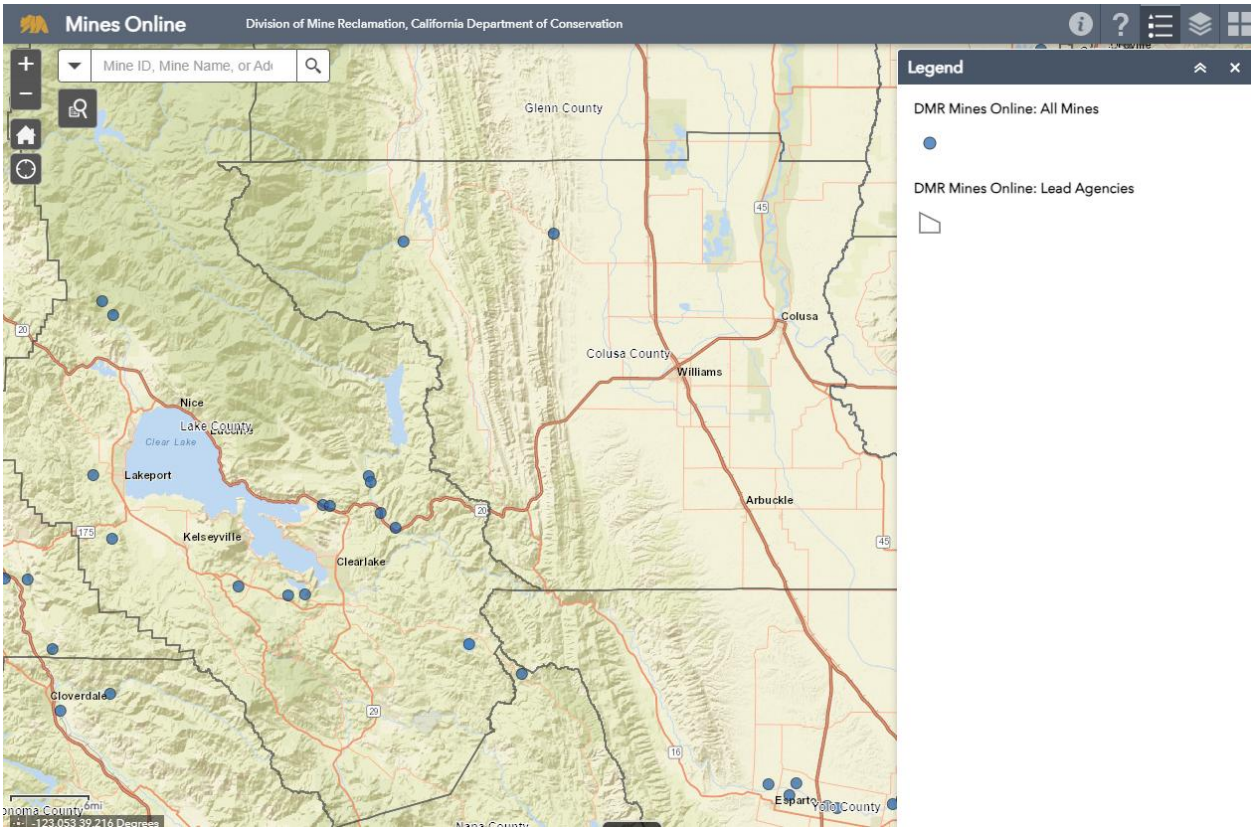
The susceptibility of mine shafts to subsidence or cave-ins depends on a number of factors, particularly water content of the soil above and the depth and physical condition of the shaft (often due to heavy rains). The Division of Mines and Geology believes that septic systems contribute to subsidence by keeping otherwise dry soil overburden wet and heavy, thus triggering collapses that might otherwise not occur.

The greatest problem regarding mine-related surface hazards is the absence of information about the locations and physical characteristics of abandoned tunnel entrances and shafts. Some are known, cataloged and marked, while others are not. Most are on privately owned property. Without current, comprehensive information, it is difficult to assess the magnitude of the problem or to devise remedial programs.

Location and Extent

Mines and mining, always dangerous while in operation, posed new dangers when abandoned. Airshafts were left exposed or covered by a few boards. They are typically holes of 4 to 10 feet in diameter on the surface, extending hundreds of feet down to the mine tunnels below. Access shafts were often covered hurriedly by closing off the mine mouth (entrance) with logs, then backfilling with rock and earth. In time, the forgotten but reclaimed site sprouted vegetation, hiding a large hole lurking perhaps as little as 8 to 10 feet below the surface. Abandoned mines in Colusa County are shown on Figure 4-97. It should be noted that this list of locations may be incomplete, as many mine areas have gone unreported.

Figure 4-97 Colusa County – Location of Abandoned Mines



Source: California Department of Conservation. Retrieved 3/22/2024.

There is no scientific scale or measurement system of subsidence from abandoned mines. Changing elevations or sinkholes can be measured over time, if areas are suspected of being affected by subsidence. The speed of onset of subsidence is variable and can be long (as slow settling occurs) or short (if a shaft collapses).

Past Occurrences

Disaster Declaration History

There have been no disaster declarations related to subsidence in Colusa County, as shown in Table 4-4.

NCDC Events

The NCDC database does not track past occurrences of subsidence.

EOC Activations

The County maintains a list of EOC activations by hazard. EOC activations from subsidence from 2008 to 2024 are shown in Table 4-108.

Table 4-108 Colusa County – EOC Activations from Subsidence 2008-2024

Disaster Type	EOC Activations	
	Count	Date
Subsidence	1	4/2014

Source: Colusa County OES

Hazard Mitigation Planning Committee Events

2014 - The HMPC noted that a sinkhole was reported to OES on the Victoria Farms property, a private drive off of Maxwell Colusa Road west of Highway 45. Located northeast of shop area near well pad adjacent to concrete ditch. Approximately 75' in diameter, it has deepened about 6" recently. The sinkhole is encroaching on ditch which will cause it to become unusable. Advised to keep marked for safety purposes and if filled, should use natural materials such as rip rap, rocks, and clayey soil.

Since 2014, subsidence has occurred to a large degree within the Arbuckle area. This affects County Roads and Interstate 5. It is believed that this is caused by the removal of groundwater. Groundwater recharge could help the issue to some degree, however a permanent solution has not been developed yet. The California Department of Water Resources has been working to determine the cause and to develop a solution.

While the HMPC knows that subsidence currently may occur in the County, few other specific events where damages were caused could be recalled. The HMPC further noted that subsidence of the groundwater table is a larger, regional and State of California issue.

Likelihood of Future Occurrence

Likely— California's land subsidence is tied to prolonged droughts and simultaneous record-breaking heat. When the state endures prolonged periods of drought, surface water stores are depleted, and the reliance on groundwater for water supply is increased. Groundwater pumping has historically occurred in the history of Colusa County, especially during times of drought. Given the likelihood of drought and the need for water for agricultural purposes, future occurrences are considered likely.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and extreme heat can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Subsidence

Climate change may cause additional subsidence in the County during times of drought and additional groundwater pumping. Data is showing that the groundwater table is lowering causing subsidence in California which can be compounded by the changes in precipitation and periods of drought.

Vulnerability Assessment

Vulnerability—Low

California's land subsidence is often tied to prolonged droughts and simultaneous record-breaking heat. When the state endures prolonged periods of drought, surface water stores are depleted, and the reliance on groundwater for water supply is increased.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has certain specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

In Colusa County, there are generally two types of subsidence of concern: subsidence from groundwater pumping and the settling of the ground over abandoned mine workings (i.e., the creation of sinkholes). There are few mines in the County, though members of the HMPC noted old mine sites west of Cortina Rancheria may be causing water quality concerns due to the tailing. Karst may also happen in the County, but it is of lesser concern.

The 2010 General Plan Background report noted that a document titled *Ground Water Levels in the Sacramento Valley Groundwater Basin – Colusa County* (DWR, 1994) summarized hydrographs dating to the 1920s, from 114 groundwater wells in Colusa County. Water management and delivery practices appear to have rectified declining ground water levels that were documented into the 1960s. The application of surface water, which coincided with the abandonment of large-scale groundwater extraction, also appears to have stabilized annual fluctuations in groundwater levels that were experienced prior to the late 1960s.

Since 2014, subsidence has occurred to a large degree within the Arbuckle area. This affects County Roads and Interstate 5. It is believed that this is caused by the removal of groundwater. Groundwater recharge could help the issue to some degree, however a permanent solution has not been developed yet. The California Department of Water Resources has been working to determine the cause and to develop a solution.

The County noted that other issues with subsidence is the displacement of the roads with vertical shifting as well as how this vertical displacement affects all infrastructure and private property.

Local concerns for each of the jurisdictions can be found under the Local Concerns heading in each respective jurisdictional annex to this LHMP Update.

Assets at Risk

Assets at risk from subsidence include people and populations; structures; critical facilities and infrastructure and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

People and Populations

Since subsidence generally happens over a long period of time, there is only a minimal risk to people and populations, including vulnerable populations. Areas in the eastern portion of the Colusa County Planning Area have had groundwater levels lowered due to pumping; and subsidence has occurred. Since subsidence from groundwater pumping is a slowly occurring phenomenon, it is unlikely to affect populations in the short term. Given the lack of data on mines in the County, it is unknown whether people or populations will have any measurable risk to mine-related subsidence. Sinkholes happen more quickly than general subsidence and can affect people and populations, depending on where the sinkhole occurs.

Structures

Certain structures in the Colusa County Planning Area bear some measure of risk to subsidence. Subsidence could cause damages as building footings become unstable. However, as noted above, area groundwater levels have been lowered due to pumping, and no related subsidence has resulted. A sinkhole from an abandoned mine location could affect a structure.

Critical Facilities and Infrastructure and Community Lifelines

Critical facilities in the Colusa County Planning Area bear some measure of risk to subsidence. Gradual sinking could cause foundation damage. If a sinkhole were to open as a result of subsidence, there could be damages to infrastructure and lifelines. A sinkhole from an abandoned mine location could affect critical facilities, infrastructure, or community lifelines.

Natural, Historic, and Cultural Resources

All natural, historic, and cultural resources in the Colusa County Planning Area bear some measure of risk to subsidence. A sinkhole from an abandoned mine location could affect a historic structure. Historic structures built when building codes were less restrictive may be at greater risk should a sinkhole occur.

Economic Assets and Community Activities of Value

Economic assets bear some measure of risk to subsidence. Subsidence could cause damages as building footings become unstable. Community activities of value are thought to have little to no risk from subsidence.

Impacts from Subsidence

Effects of land subsidence in California include increased flood risk in low-lying areas, damage to buildings and infrastructure, loss of groundwater aquifers, and damage to aquatic ecosystems. As the land sinks, it can experience increased flooding and adverse impacts on sewer lines, stormwater drainage systems, and other impacts to critical facilities and infrastructure. As subsidence progresses, areas protected by levees can be impacted. Compaction of the aquifer system due to subsidence may permanently decrease its capacity to store water. Other impacts of subsidence is the displacement of the roads with vertical shifting as well as how this vertical displacement affects infrastructure and private property.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future subsidence conditions for subsidence from groundwater pumping and associated impacts and vulnerability of the County to subsidence. Climate change impacts on old mine areas is unknown, but unlikely.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. Additional population growth would likely bring continued diversity to the County. Though unlikely, vulnerable population groups could face disproportionate effects from subsidence and should be planned for. Changes in population and population patterns will likely not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. Locating new development, structures and critical facilities and infrastructure within or near areas of subsidence may put additional development at risk. Additionally, County building codes are in effect to reduce this risk. Thus, depending on the location of new development and adherence to protective building codes, changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Many of the groundwater subsidence and mine areas in the County are known, but many still remain unknown and untracked. Knowing these

locations and choosing not to develop in those areas or mitigating against future issues will reduce future losses due to subsidence. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered, can make for a more resilient community.

4.3.17. Wildfire

Hazard Profile

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

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. Additional losses could occur if PG&E initiates a power shutdown during extreme fire weather conditions. This is discussed in greater detail at the beginning of Section 4.3.

Wildfire Smoke and Air Quality

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.

Wildfire smoke can have negative effects to those who live in or near a fire burn area. Smoke and air pollution from wildfires can be a severe health hazard. Significant wildfires occurring in nearby northern California communities since the 2018 LHMP Update have created significant air pollution affecting area residents. County residents have been affected by wildfire smoke and poor air quality, from fires both within the Planning Area and from those much further away. During 2018 during the Camp Fire in Butte

County, Colusa County experienced 13 days of the worst air quality previously experienced in the region. 2019 and 2020 saw air quality impacts from smoke as well. Purple air sensors in the County showed periods of very poor air quality in Colusa County. This was a concern especially during Covid. A document titled Smoke Impacts CA: 2020 Lessons – 2021 Actions that was published by the US Forest Service noted that wildfire smoke exposure could result in greater susceptibility to COVID-19 and other viruses/bacteria (decrease in local and systemic immune function).

Location and Extent

This section is broken down into two parts: a discussion on the wildland urban interface, and the Colusa County wildfire setting.

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 wildland urban interface 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 Colusa County consists of communities at risk (shown in in Section 4.3.17) 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.

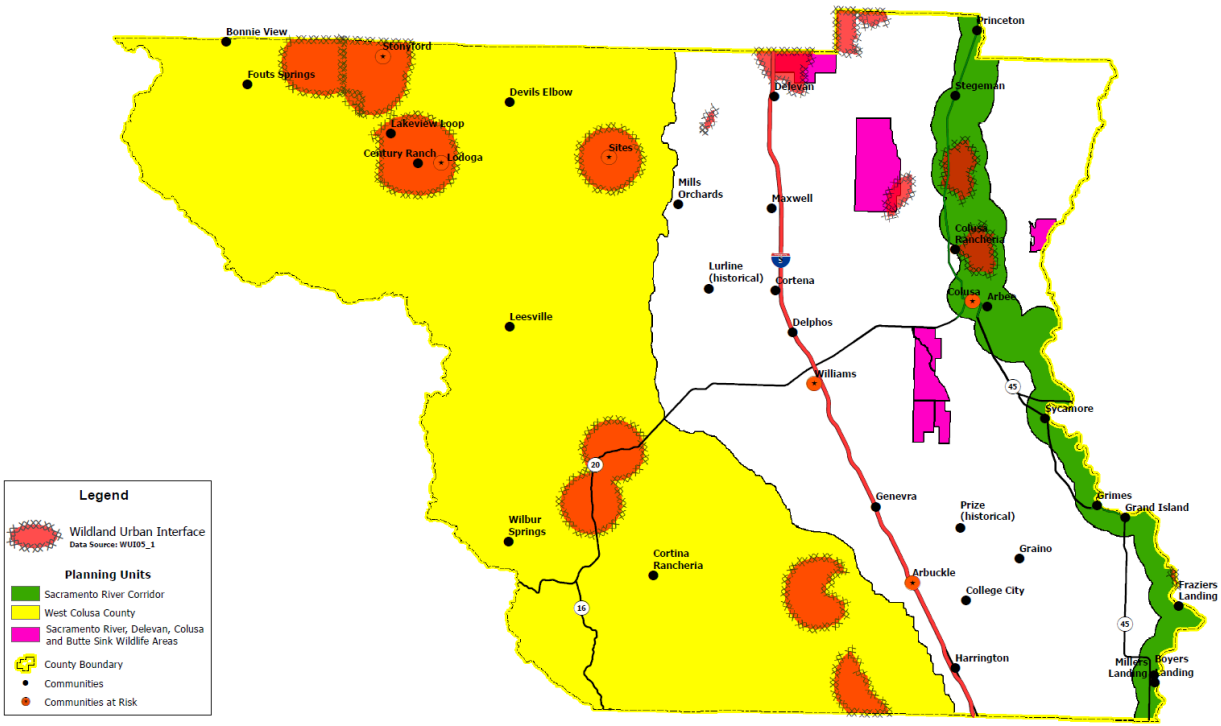
WUI fires are often the most damaging. WUI fires occur where the natural and urban development intersect. Even relatively small acreage fires may result in disastrous damages. WUI fires occur where the natural forested landscape and urban-built environment meet or intermix. The damages are primarily reported as damage to infrastructure, built environment, loss of socio-economic values and injuries to people.

The 2021 Colusa County Community Wildfire Protection Plan (CWPP) noted that within Colusa County, remote communities and residences at risk from fires originating within wildlands areas are primarily located within the County's grasslands and oak woodlands. These developed areas include Stonyford, Lodoga, the Cortina Rancheria, Century Ranch development and Sites developed area. Additional scattered development of individual homes and other domestic structures are found within or near the Mendocino National Forest such as Fouts Springs, Wilbur Springs and Leesville. In terms of wildfire threat, these areas

of rural development have been described as points where the fuel feeding a wildfire changes from natural (wildland) to manmade fuel, such as structures, crops, and urban debris.

Figure 4-98 shows these WUI areas in red with Colusa County in the center of the frame. This intermingling of wildland and manmade fuel has made the control of wildland fires more difficult and costly. It has also dramatically increased the danger and potential destruction caused by wildfire.

Figure 4-98 Colusa County – WUI Areas



Source: Colusa County 2021 CWPP

Colusa County Wildfire Setting

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 leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. The 2023 Fire Plan for the Sonoma-Lake-Napa Unit (which includes Colusa County) noted that there is a wide range of fuels in the County. Fuels range from agricultural farmland (wheat, safflower, cut stubble), annual grasses, oak woodland, 15–50 year old chaparral, large stands of decadent brush and timber in the higher elevations. Also to be considered as a fuel source are manmade structures, such as homes and

other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that is under human control.

- **Topography** – An area's terrain and land slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes. The 2023 Sonoma-Lake-Napa Fire Plan noted certain topographic elements in the County. Elevation within the East Division ranges from 250' to 3000' with slopes ranging from 0 – 80%. There is a dominant North/South orientated ridge running from Hwy 20 to central Colusa county. These main ridges keep the coastal influence weather from being a factor. Farmlands, ranches, rural and major roads along with other manmade features provide a network of barriers that will need to be connected to create an effective fire line.
- **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 fuels that feed wildfires, creating a situation where fuel will ignite more readily and burn more intensely. Thus, during periods of drought, the threat of wildfire increases. Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread and the more intense it will be. In addition to wind speed, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. Lightning also ignites wildfires, often in difficult to reach terrain for firefighters. The 2023 Fire Plan noted that the weather in the County is generally warm and dry during the day with a slight relative humidity recovery at night. If a critical weather pattern exists such as a Foehn North Wind, or a cold front passage, the daily diurnal weather variation will be subdued. If these critical weather patterns align with the topography, expect extreme rates of spread, especially along exposed ridges and through constricted areas. Peak summer day temperatures are generally 95°-105°F, cooling to 50°-60°F at night, with relative humidity ranging between 20% – 35% or less. Gradient winds are generally out of the N/NW 5-10 mph, strengthening in the afternoon with a 10-15 mph wind in the late afternoon diminishing by dark.
- **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.

The 2021 Colusa County CWPP noted that a large portion of Colusa County, like much of Northern California, is at very high risk of experiencing catastrophic wildfire. The Colusa County's westside area is largely rural or in the wildland/urban interface between urban development and those lands managed for ranching, timber production, open space, and watershed resources. Landscapes within various U.S. Fish and Wildlife Service (USFWS) refuges located in the County as well as those along and immediately adjacent to the Sacramento River remain in a more natural condition with abundant native vegetation and related wildland fuels. Over the past 90 years, many of the landscapes within western Colusa County have developed high levels of fuel loading due to aggressive fire suppression on both public and private lands. Lands within federal wildlife refuges and wildland areas along the Sacramento River can develop unnatural amounts of live and dead fuels unless managed in order to reduce fire risk and the impact of wildfire on adjacent developed areas. These high fuel loads can without management, increased the potential for large wildfires that could destroy an array of natural resources and cause millions of dollars in damage to public and private property. The problem of hazardous fuel conditions continues to grow each year as more people move into and utilize the area's grasslands, oak woodlands, chaparral and forestlands. Greater recreational

use of Mendocino National Forest (MNF), U.S. Bureau of Reclamation (BOR), and Bureau of Land Management (BLM) parcels located within western Colusa County has also contributed to an increase in the threat of wildfire on these public lands and on adjacent private parcels.

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. Wildfire can affect any area of the Planning Area; however, CAL FIRE has mapped areas in California that are at risk to wildfire. Methodologies for this analysis and maps showing the various Fire Hazard Severity Zones, which range from Urban-Unzoned to Very High, can be found in the Vulnerability Assessment below. Geographic extents of wildfire can be seen on Figure 4-99 and is detailed by jurisdiction in Table 4-109.

Figure 4-99 Colusa County Planning Area – CAL FIRE Fire Hazard Severity Zones

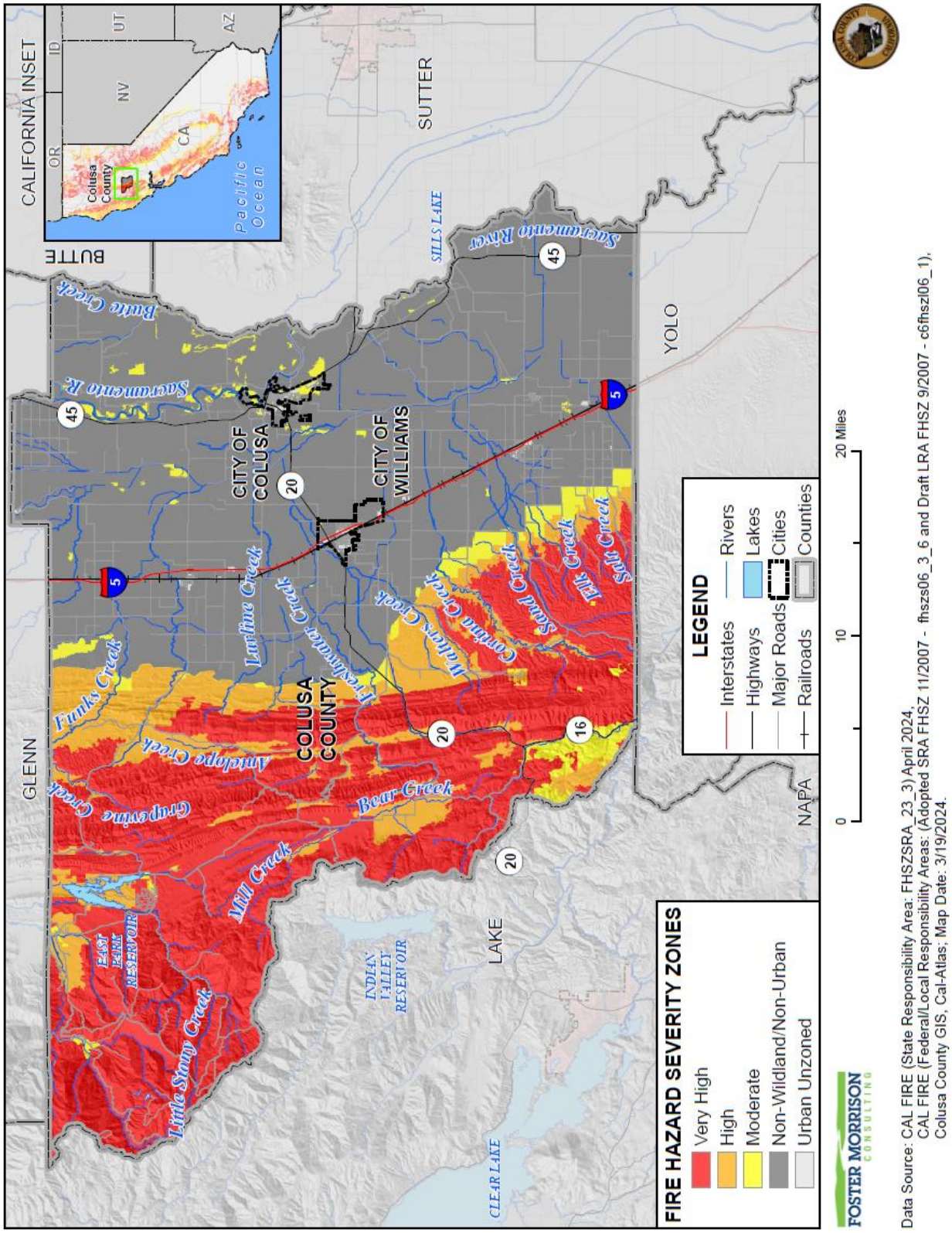


Table 4-109 Colusa County Planning Area – CAL FIRE Fire Hazard Severity Zones Geographical Extents by Jurisdiction

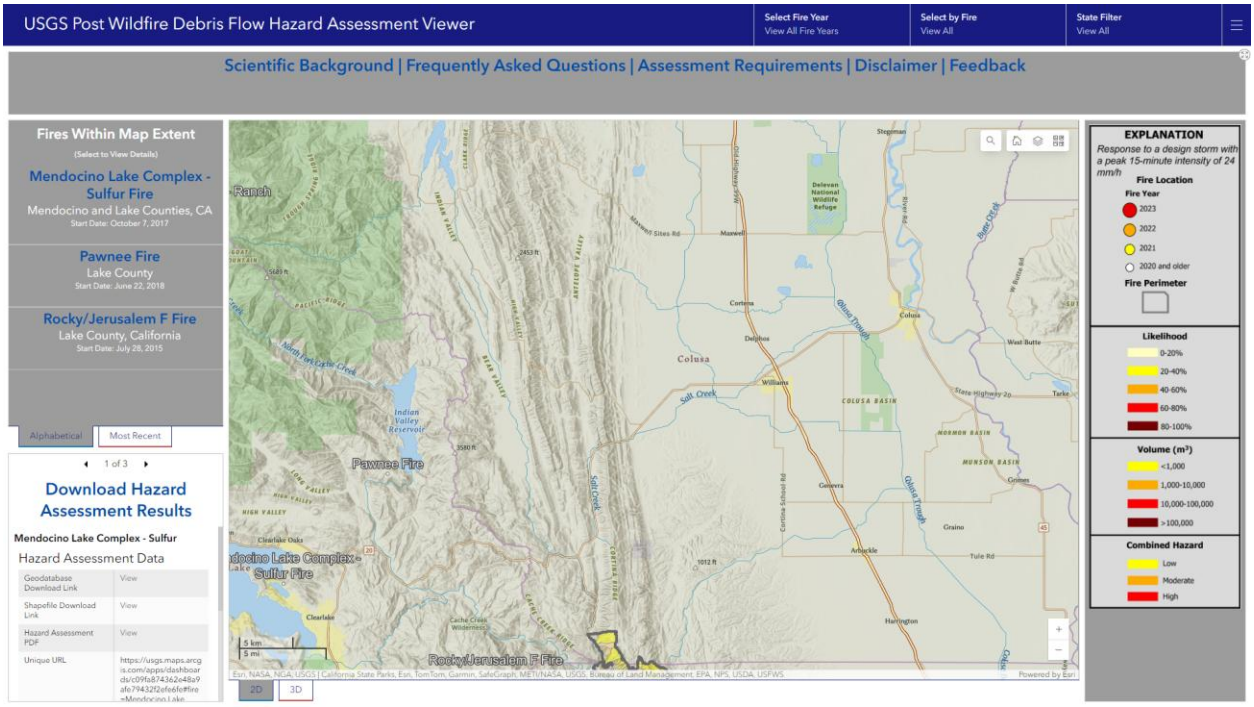
Jurisdiction / Fire Hazard Severity Zones	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
City of Colusa						
Very High	0	0.00%	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%	0	0.00%
Moderate	507	21.03%	168	12.13%	339	33.10%
Non-Wildland/Non-Urban	1,113	46.17%	544	39.18%	569	55.65%
Urban Unzoned	791	32.81%	676	48.69%	115	11.25%
City of Colusa Total	**2,412**	**100.00%**	**1,388**	**100.00%**	**1,023**	**100.00%**
City of Williams						
Very High	0	0.00%	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%	0	0.00%
Moderate	96	3.30%	27	2.55%	69	3.74%
Non-Wildland/Non-Urban	2,047	70.59%	603	56.76%	1,444	78.59%
Urban Unzoned	757	26.11%	432	40.69%	325	17.67%
City of Williams Total	**2,900**	**100.00%**	**1,062**	**100.00%**	**1,838**	**100.00%**
Unincorporated Colusa County						
Very High	267,535	36.95%	21,986	8.91%	245,549	51.45%
High	77,030	10.64%	25,282	10.24%	51,747	10.84%
Moderate	25,855	3.57%	9,844	3.99%	16,010	3.35%
Non-Wildland/Non-Urban	352,204	48.64%	188,727	76.46%	163,476	34.26%
Urban Unzoned	1,418	0.20%	979	0.40%	440	0.09%
Unincorporated Colusa County Total	724,041	100.00%	246,818	100.00%	477,223	100.00%
Grand Total	**729,353**	**100.00%**	**249,269**	**100.00%**	**480,084**	**100.00%**

Source: CAL FIRE (FHSZ SRA 2024, FRA & LPA 2007)

Post-Wildfire Landslides and Debris Flows

Post-wildfire landslides and debris flows are a concern in Colusa County, though the fires usually burn in areas that are less populated. Fires that burn in hilly areas, which comprise the western portion of Colusa County, 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 been ongoing on a case by case basis since 2012. A search of the USGS Emergency Assessment of Post-Fire Debris Flow Hazards showed only one event in Colusa County – a very small portion of the Rocky/Jerusalem Fire. This can be seen at the bottom center of Figure 4-100.

Figure 4-100 Colusa County – Post-Wildfire Debris Flow Areas



Source: USGS. Retrieved 3/22/2024.

Past Occurrences

Disaster Declaration History

A search of FEMA and Cal OES disaster declarations shows one federal and two state disaster declarations. These are shown in Table 4-110.

Table 4-110 Colusa County – Federal and State Disaster Declaration from Wildfire 1950-2024

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Fire	1	2018 (Ranch Fire)	2	1987 (Fouts Fire), 2018 (Ranch Fire)

Source: Cal OES, FEMA

NCDC Events

The NCDC has tracked wildfire events in the County dating back to 1993. The 13 events in Colusa County in the database are shown in Table 4-111.

*Table 4-111 NCDC Wildfire Events in Colusa County 1993 to 8/31/2023**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Wildfire	13	7	1	37	5	$0	$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 Colusa County were extracted and are listed in Table 4-112. There are 75 fires recorded in this database for Colusa County greater than 50 acres. Each of them was tracked by CAL FIRE. Many more small fires have occurred, but were not included in the analysis.

Figure 4-101 shows fire history for the Colusa County Planning Area, colored by the size of the acreage burned. This map contains fires from 1950 to 2023, while the detailed tables of wildfire shown in Table 4-112 contain fires from 1910 to 2023, though the first recorded wildfire in this database in Colusa County is from 1916.

Figure 4-101 Colusa County Wildfire History – CAL FIRE 1910 to 2023

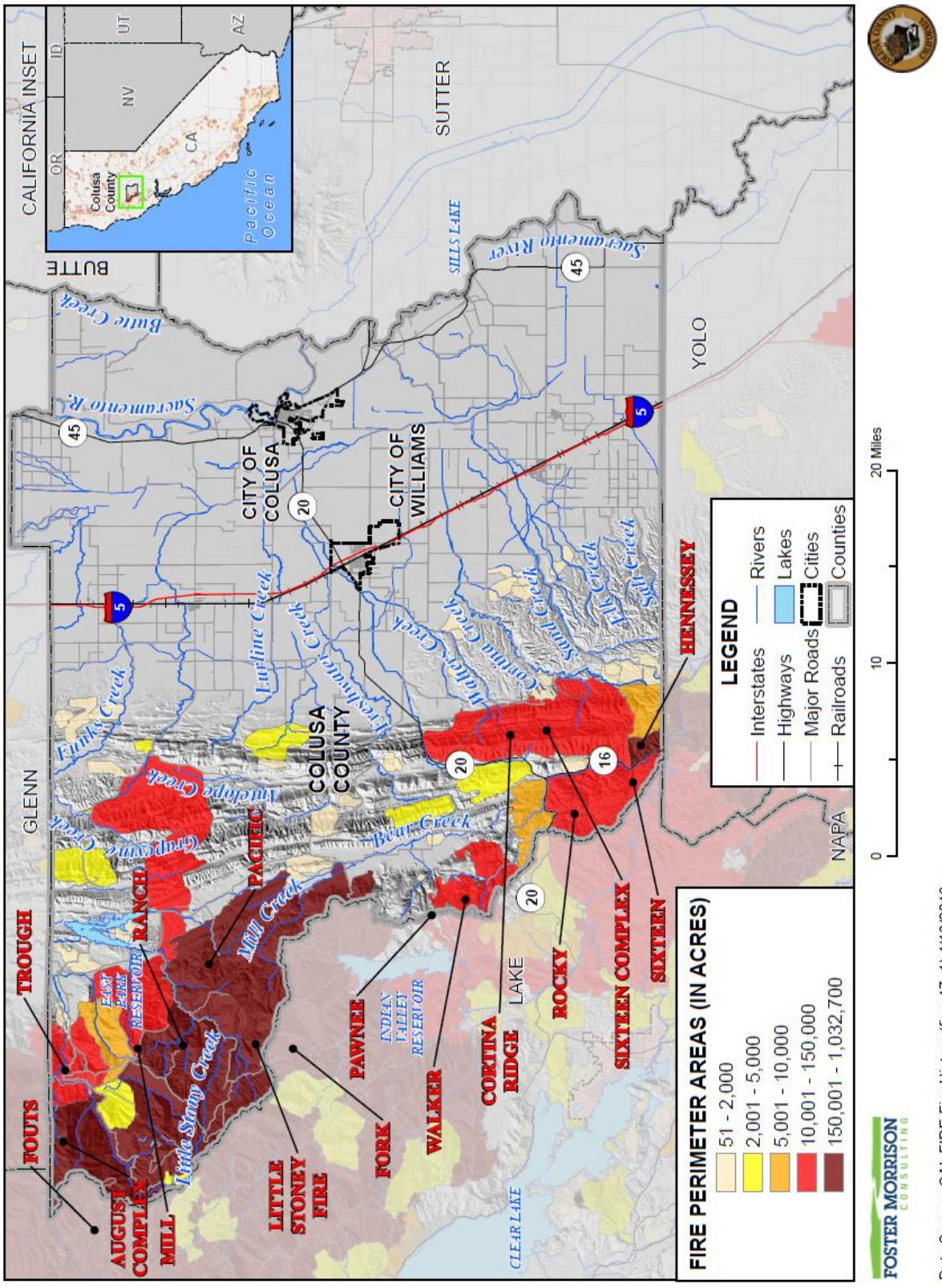


Table 4-112 Colusa County – CAL FIRE Wildfire History Summary 1910-2023

Wildfire Name	Year	Date	Cause Description	Total Wildfire Acres	Wildfire Acres Within County
40 FIRE	–	–	–	1,057	19
TROUGH SPRINGS	1916	–	Equipment Use	6,189	6,188
PACIFIC	1928	–	Equipment Use	15,610	15,607
SPANISH RANCH	1928	–	Miscellaneous	1,395	0
CRACKER BOX	1932	–	Unknown/Unidentified	1,853	1,853
DIGGER PINE CAMP	1939	–	Miscellaneous	3,982	1
FOUTS SPRING	1939	–	Miscellaneous	524	524
(blank)	1948	–	Unknown/Unidentified	12,222	12,220
(blank)	1949	–	Unknown/Unidentified	782	782
WALTER TINDELL	1950	–	Unknown/Unidentified	299	299
I.G. ZUMWALT	1950	8/6/1950	Unknown/Unidentified	345	345
LITTLE STONEY FIRE	1950	9/3/1950	Unknown/Unidentified	17,367	9,283
WENDELL PAYNE #3	1950	9/3/1950	Unknown/Unidentified	568	568
LANG	1951	8/9/1951	Unknown/Unidentified	1,202	1,202
LANG #3	1951	9/9/1951	Unknown/Unidentified	642	642
GABBERT	1952	19166	Unknown/Unidentified	1,390	1,390
JACKSON	1952	8/23/1952	Unknown/Unidentified	266	265
ZUMWALT	1952	8/5/1952	Unknown/Unidentified	1,252	1,252
W.H. JONES	1952	9/27/1952	Unknown/Unidentified	454	454
LEON ETCHEPARE	1953	–	Unknown/Unidentified	805	805
L.V. & J.D. MOSSMAN	1953	6/17/1953	Unknown/Unidentified	548	548
I. ZUMWALT	1954	7/22/1954	Unknown/Unidentified	1,643	1,149
LIGHTNING #5	1954	7/25/1954	Unknown/Unidentified	2,129	2,129
U.S. RECLAMATION	1954	8/7/1954	Unknown/Unidentified	516	516
ROADSIDE #2	1960	7/21/1960	Unknown/Unidentified	1,308	1,288
ROADSIDE #4	1961	–	Unknown/Unidentified	1,171	1,170
ROADSIDE #1	1961	6/14/1961	Unknown/Unidentified	3,621	3,620
A. W. WALDO	1961	7/24/1961	Unknown/Unidentified	470	470
ROADSIDE #3	1961	8/9/1961	Unknown/Unidentified	372	372
ROADSIDE #1	1962	–	Unknown/Unidentified	569	569
THREE SISTERS	1962	6/7/1962	Unknown/Unidentified	510	510
ROADSIDE #3	1962	9/8/1962	Unknown/Unidentified	446	446
CACHE CREEK	1964	7/11/1964	Unknown/Unidentified	375	375

Wildfire Name	Year	Date	Cause Description	Total Wildfire Acres	Wildfire Acres Within County
SOUTH JACKSON CANYON	1964	8/5/1964	Unknown/Unidentified	718	718
ZUMWALT	1966	24273	Unknown/Unidentified	544	544
DEBOLT	1966	6/11/1966	Unknown/Unidentified	812	812
CORTINA RIDGE FIRE	1966	6/12/1966	Unknown/Unidentified	16,323	16,320
DUMP #12	1966	6/26/1966	Unknown/Unidentified	78	78
PAULO	1967	7/6/1967	Unknown/Unidentified	437	437
BRUSH CREEK	1967	9/13/1967	Unknown/Unidentified	385	385
GRANT	1968	25097	Unknown/Unidentified	1,863	1,862
ELK CREEK	1968	7/18/1968	Unknown/Unidentified	724	724
JACKSON	1972	–	Unknown/Unidentified	1,958	1,958
ZUMWALT	1974	6/23/1974	Unknown/Unidentified	796	52
FOUTS	1975	–	Debris	2,546	2,546
KALFSBEER	1975	6/20/1975	Unknown/Unidentified	1,047	1,047
COOK FIRE	1976	–	Unknown/Unidentified	984	984
GRAVRLLY BUTTES	1976	6/23/1976	Unknown/Unidentified	1,199	1,198
(blank)	1977	–	Miscellaneous	98	79
SITES	1978	9/4/1978	Unknown/Unidentified	748	748
ROBINSON	1979	–	Unknown/Unidentified	731	731
FOUTS	1987	9/1/1987	Lightning	16,363	4,907
LETTS	1988	12/5/1988	Miscellaneous	3,312	606
COOK	1989	8/27/1989	Arson	973	973
TURKEY RUN	1991	–	Unknown/Unidentified	516	13
LIGHTENING FIRE	1992	–	Unknown/Unidentified	2,928	2,928
FORK	1996	8/11/1996	Arson	83,057	441
MIDDLE	1998	9/20/1998	Equipment Use	5,993	4,202
SIXTEEN	1999	10/16/1999	Arson	37,893	2,960
TROUGH	2001	8/8/2001	Miscellaneous	24,927	7,326
BEAR	2002	5/18/2002	Escaped Prescribed Burn	110	110
4-2	2003	9/3/2003	Equipment Use	304	55
SITES	2003	9/3/2003	Lightning	390	390
RUMSEY 2	2005	10/12/2005	Miscellaneous	392	1
SPRING	2006	7/8/2006	Vehicle	274	274
WALKER	2008	6/22/2008	Vehicle	11,173	6,314
RUMSEY	2009	6/29/2009	Equipment Use	677	262

Wildfire Name	Year	Date	Cause Description	Total Wildfire Acres	Wildfire Acres Within County
SUMMIT	2009	8/12/2009	Campfire	287	282
OASIS	2009	9/7/2009	Campfire	1,575	18
MILL	2012	–	Miscellaneous	29,526	29,521
SITES_COMPLEX	2012	7/8/2012	Arson	4,429	4,087
WALKER	2012	8/12/2012	Unknown/Unidentified	5,103	3,992
SIXTEEN_COMPLEX	2012	9/4/2012	Arson	17,942	17,688
ROCKY	2015	7/29/2015	Miscellaneous	69,438	10,453
SANDS	2017	7/17/2017	Unknown/Unidentified	53	53
PAWNEE	2018	6/23/2018	Miscellaneous	15,197	43
RANCH	2018	7/27/2018	Miscellaneous	410,202	73,721
AUGUST COMPLEX	2020	8/16/2020	Lightning	1,032,700	51
HENNESSEY	2020	8/17/2020	Lightning	305,352	1,465
Grand Total				**2,194,963**	**271,220**

Source: CAL FIRE Fire History (4/13/2018)

EOC Activations

The County maintains a list of EOC activations by hazard. EOC activations from wildfire from 2008 to 2024 are shown in Table 4-113.

Table 4-113 Colusa County – EOC Activations from Wildfire 2008-2024

Disaster Type	EOC Activations	
	Count	Date
Wildfire	3	8/2012, 7/2016, 8/2020, 6/2024

Source: Colusa County OES

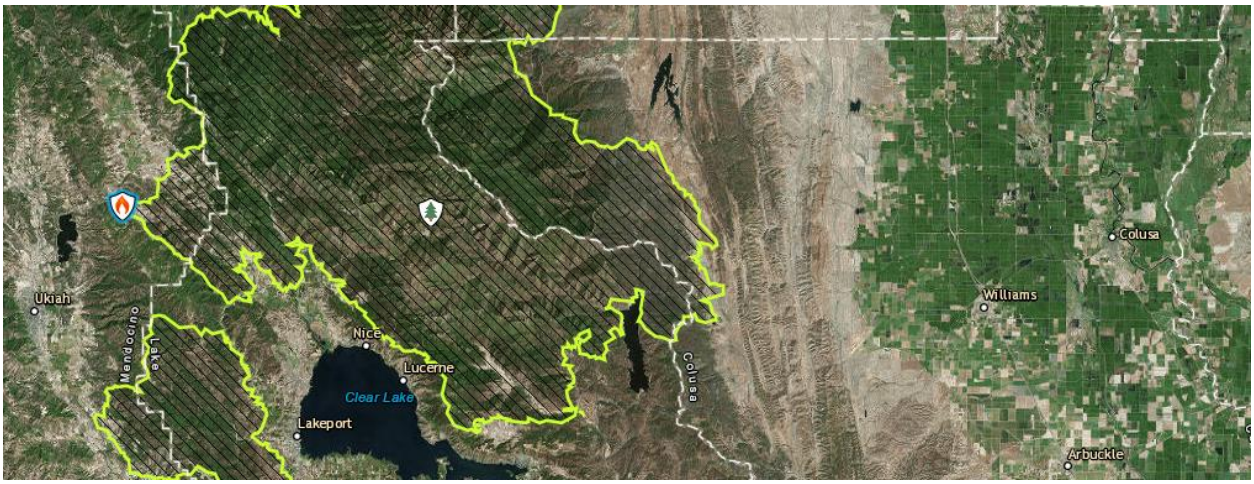
Hazard Mitigation Planning Committee Events

The HMPC noted that fire has played a significant historical role in Colusa County. The following includes some of the more significant named fires in Colusa County.

- **2018 Mendocino Complex Fire** – The Mendocino Complex Fire was the largest recorded fire complex in California history. It was a large complex of two wildfires, the River Fire and Ranch Fire, which burned in Mendocino, Lake, Colusa, and Glenn Counties in the U.S. State of California. First reported on July 27, 2018, both fires burned a combined total of 459,123 acres. Colusa County had burn areas in the unincorporated County. The entire western side of the County was on mandatory evacuations. The HMPC noted that a Red Cross shelter and a State Fire Camp and Federal Fire Camp was set up in the County. In the western part of the County in the communities of Stonyford, Lodoga and Fouts Sprints, many outbuilding and one residence was lost to the fire. Fortunately, no lives were lost. Many

acres of timberland were burned which will affect those who harvest the trees for woodcutting. No established businesses reported economic loss due to fire activity. The County experience damage to roads, and expended funds for many overtime activities during the firefight. A local emergency was proclaimed, and a USDA emergency was supportive for agricultural losses, however Colusa County was not named in the Gubernatorial or Federal Declaration. No public assistance support was received. Burn areas can be seen on Figure 4-102.

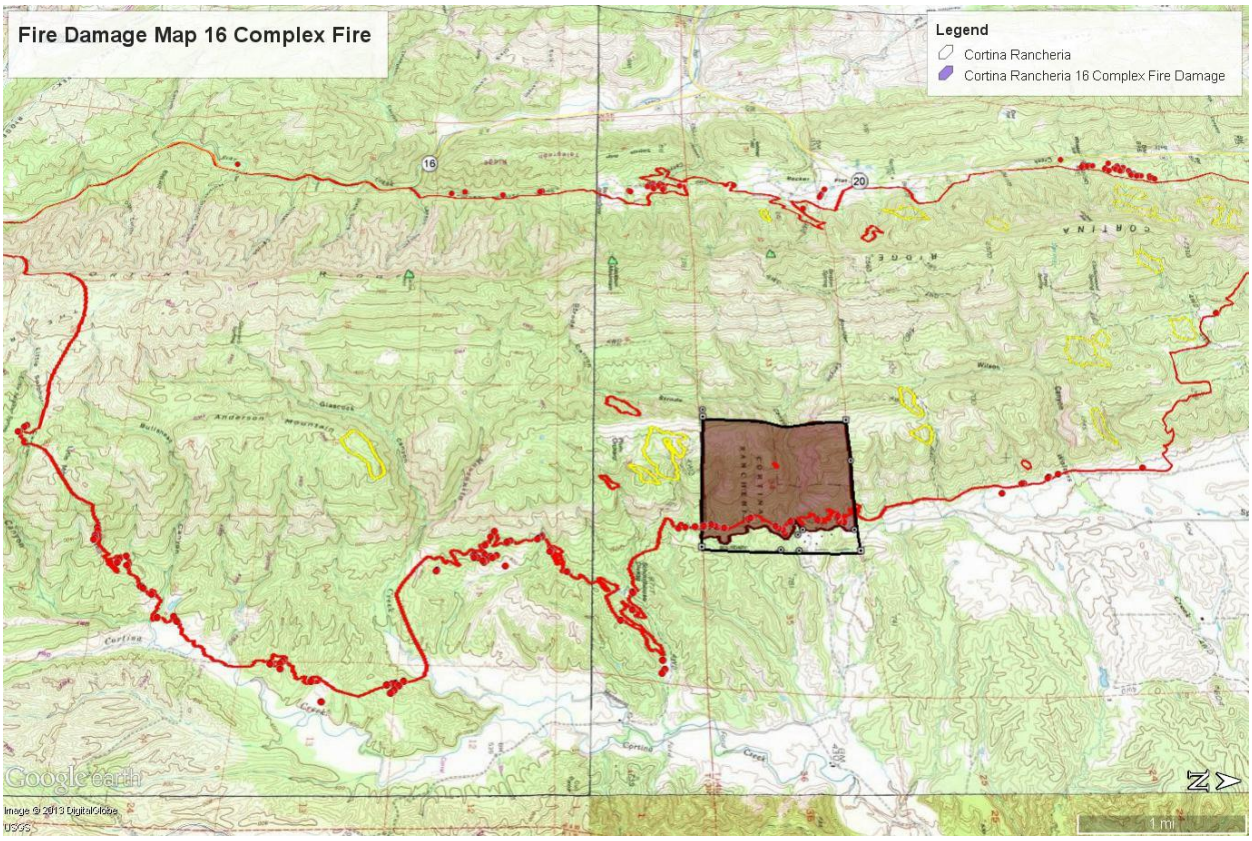
Figure 4-102 Mendocino Complex Burn Areas



Source: CAL FIRE

- **2012 Mill Fire** – The Mill Fire began sometime after midnight July 7, 2012, in the area near Mill Valley, Mill Creek and Letts Lake campgrounds. On July 7, the fire grew to one acre by 3 p.m. and expanded to about 150 acres by 8 p.m. according to the U.S. Forest Service. By July 8th the fire grew to 10,000 acres by 10 p.m. In total, the fire burned 29,502 acres.
- **2012 Wye Fire** – The Wye Fire burned 7,934 acres in Lake and Colusa counties. Challenging fire behavior, low reality humidity, very high temperatures, and erratic winds contributed to the spread of the fire. The fire burned an area around Highway 20 east of Highway 53 and in the Clearlake Oaks area. The smoke from the fires could be seen for miles. It could be seen from Napa County from the south and Butte County from the north. The fire destroyed two structures and one outbuilding. In addition, two other structures were damaged. 3 injuries were attributed to this fire. At its peak, more than 1,250 fire personnel from multiple agencies were involved in the fire fight. Multiple evacuation orders were put out. The Wye Fire resulted in a federal disaster declaration (FM-5004).
- **2012 Complex 16 Fire** – A wildfire burned in Colusa County, which caused damages to both the County and the Cortina Rancheria. Cultural items lost included multiple oak trees. The wildfire exacerbated future erosion in the burn scar areas, and has caused some recurring problems with hydrophobic soils. No homes were lost, but the fire occurred very close to site of 6 homes and cultural center. An acorn crop was lost due to the fire. Spring Valley Rd. was closed due to down power lines and residents were trapped due to no other road to use for ingress and egress. $75,000 in damages was reported on the Cortina Rancheria. Figure 4-103 shows the wildfire perimeter and the location of the Cortina Rancheria.

Figure 4-103 16 Complex Fire Burn Perimeter and Cortina Rancheria Area



Source: Cortina Rancheria

- **2001 Trough Fire** – The Trough Fire was one that challenged firefighter forces for over a week and required the combined forces of over 1,583 personnel. Fire suppression efforts were hampered by steep wilderness terrain, high temperatures, and access to areas of the Snow Mountain Wilderness area by air insertion only. The fire started on August 8, 2001, in an area just west of the community of Stonyford, California. By the time containment was achieved the fire had burned into three counties; Colusa County, Glenn County and Lake County respectively. Property losses included 10 residential structures, 20 outbuildings, 7 vehicles, and 2 other designated properties. Some damages can be seen on Figure 4-104. Property saved included 27 residential structures, 70 other miscellaneous outbuildings, and 1 commercial property. Notable saves include; the California Youth Authority's Fouts Springs Youth Facility which houses 162 youths on a compound of approx. 20 structures, the community of Stonyford with a population of 250, and many historical structures throughout the region.

Figure 4-104 Trough Fire – One of Three Vintage Outbuildings and Bus Destroyed on CYA Youth Compound

Source: Colusa County OES

Likelihood of Future Occurrence

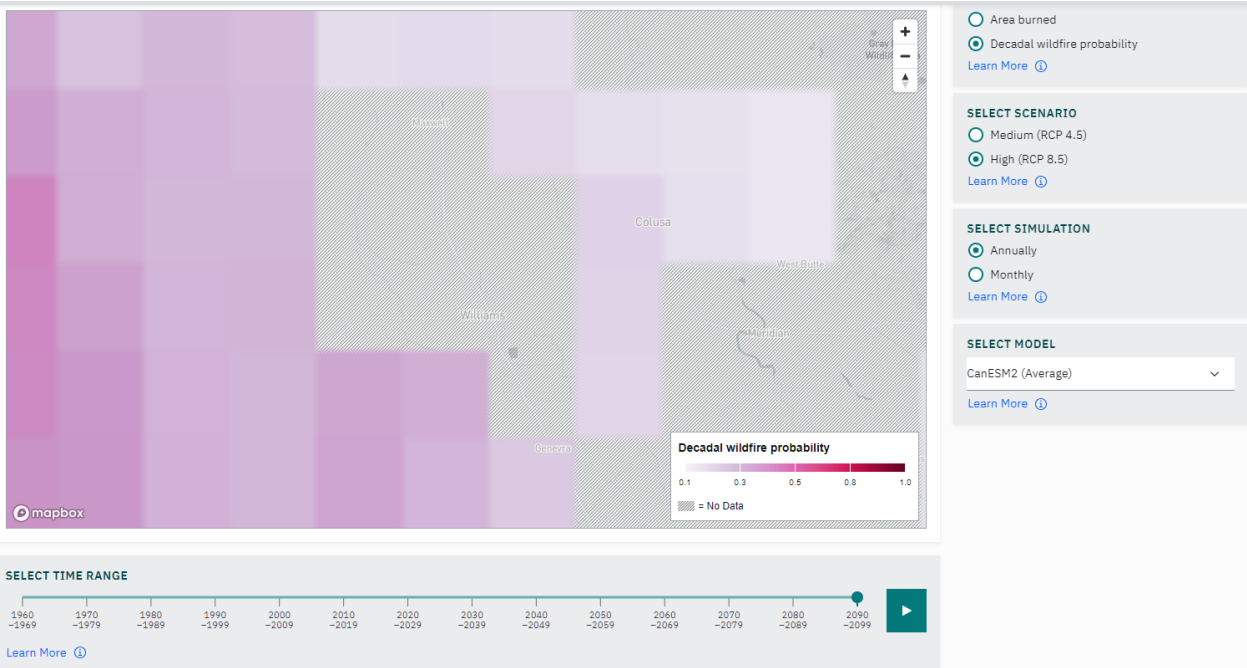
Highly Likely —Colusa County faces a serious wildland fire threat every year. While generally limited to the sparsely populated, forested areas in the western portion of the County, fires will continue to occur on an annual basis in the Colusa County Planning Area. The threat of wildfire and potential 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, portions of Colusa County continue to be at risk from wildfire. However, most of the fires remain occur in more remote areas of the County with limited structures and people at risk.

It is likely that climate change will increase the chance of future occurrence as well as future impacts. More information on climate change and wildfire can be found in the next section. More information on future impacts can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

Climate Change and Wildfire

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 2090-2099, as compared to recent (2010) conditions. This is shown in Figure 4-105. Based on this model, Cal-Adapt predicts that wildfire risk in Colusa County will increase moderately at the end of the 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 the Colusa County Planning Area, precipitation patterns, high levels of heat, topography, and fuel load will determine the frequency and intensity of future wildfire.

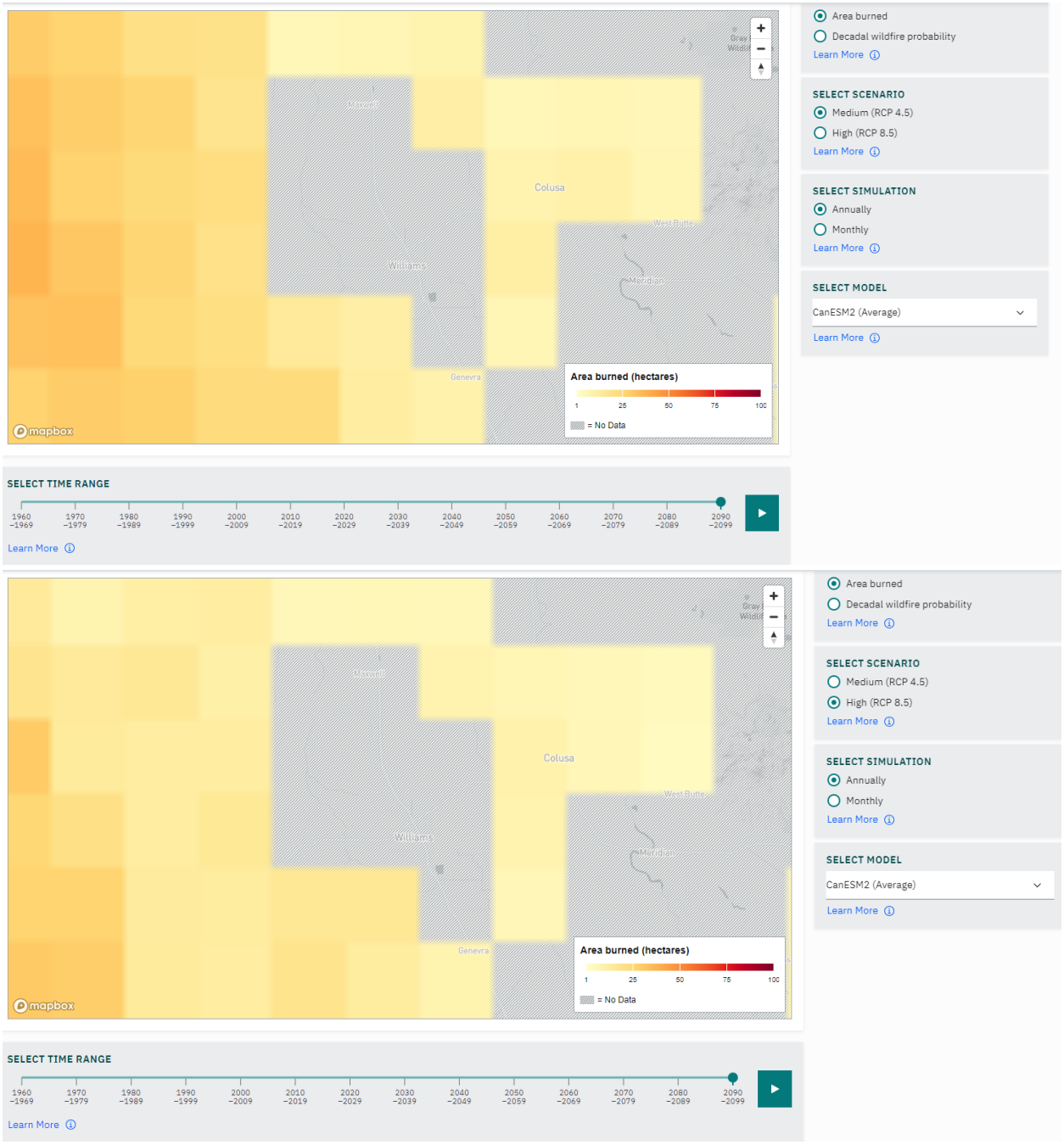
Figure 4-105 Colusa County Planning Area – Projected Increase in Wildfire Burn Areas



Source: Cal-Adapt. Retrieved 3/22/2024.

Wildfire scenario projections were done by Cal-Adapt, based on statistical modeling from historical data of climate, vegetation, population density, and fire history. The fire modeling ran simulations on five variables on a monthly time step - Large fire presence/absence, Number of fires given presence, Area burned in a grid cell given a fire, High severity burned area given a fire and emissions. These are shown on Figure 4-106. The upper chart shows modeled annual averages of area burned for the Planning Area under the RCP 4.5 scenario, while the lower chart shows modeled annual averages of area burned for the Planning Area under the RCP 8.5 scenario.

Figure 4-106 Colusa County Planning area – Future Annual Averages of Acres Burned under RCP 4.5 and 8.5 Scenarios



Source: Cal-Adapt. Retrieved 3/22/2024.

Vulnerability Assessment

Vulnerability—High

Risk and vulnerability to the County from wildfire is of concern. Wildfires that occur in the County occur from a variety of both natural and manmade causes. The County can be affected both by fires that start on

or near County lands as well as those that start elsewhere and move into the County. In addition to burning large areas of land, air quality can be affected in the County by fires occurring inside the County as well as those from many miles away. As growth continues and populations increase in the County, the potential for wildfires will also increase.

An assessment of a community's vulnerability to this hazard begins with an understanding of local exposure to unincorporated Colusa County. This is included in the Local Concerns section below. After that, vulnerability is discussed in multiple sections that detail how this hazard can affect both the entire Colusa County Planning Area as well as the unincorporated portions of Colusa County. How the hazard affects the jurisdictions can be found in their respective annexes to this LHMP Update. These sections below include assets at risk, impacts, and how future development can be affected by this hazard.

Local Concerns (unincorporated Colusa County)

The unincorporated County has specific concerns regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce vulnerabilities to this hazard.

A section of National Forest crosses through the western area of Colusa County. The United States Forest Service patrols the areas during wildfire season. Past planning processes have determined that wildfires are a minor threat to the Colusa County Planning Area, based on land use listed in the County General Plan and historical data of previous declarations, and input from area fire departments. This is changing in the County. Secondary homes within the forest boundaries which could place residents in jeopardy of death or injury during a rapidly moving wildfire. Adjacent to the National Forest are areas of rolling hills and brush areas. This land is part of the State Responsibility Area, which means that wildfire protection is under the jurisdiction of CAL FIRE. This area has limited population, but has moderate fire risk. Historically, wildfire has been of limited concern in the County as the WUI areas and other fire prone areas of the County are found in the western side of the County where limited population exists

The 2021 Colusa County CWPP noted, however, that throughout Colusa County and in California as a whole, communities adjacent to and within the state's wildlands have experienced growth and an increase in public access and use. Development in these areas has taken a number of forms. Remote residences and areas of development are often created without many of the infrastructure components and fire safety features that are integral to fire protection. Significant among these deficiencies are insufficient access on two lane roads for ingress and egress of firefighting equipment, roads that dead end reducing escape opportunities, inadequate water supply systems, and the presence of mobile homes as residences on small rural parcels. Considering that mobile homes are often installed with insufficient vegetation removal and control, this type of residence is at an increased risk from fast moving wildland fires.

In addition to the fire threats facing WUI areas within Colusa County, several other significant wildfire issues confront County residents. Among these are highly flammable invasive fuels (Arundo donax and Tamarisk) within a number of streams located on the valley floor. The potential for fire within this dense, often desiccated vegetation threatens developed sites, ranchlands and farms. In addition, high vegetative fuel levels are found along the Sacramento River corridor and within U.S. Fish and Wildlife Service National Wildlife Refuge lands located throughout portions of Colusa County on the valley floor.

Local concerns for each of the jurisdictions can be found under the Local Concerns heading in each respective jurisdictional annex to this LHMP Update.

Assets at Risk

Assets at risk from wildfire include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections for the Colusa County Planning Area and unincorporated Colusa County.

Methodology

As part of the Fire and Resource Assessment Program (FRAP), the State Fire Marshall was mandated to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors, including areas where winds have been identified as a major cause of wildfire spread. These zones, referred to as Fire Hazard Severity Zones (FHSZs), include moderate, high, and very high FHSZs. The FHSZ map evaluates hazard, not risk. Hazard is based on the physical conditions that create a likelihood and expected fire behavior over a 30-50 year period without considering mitigation measures such as home hardening, recent wildfire, or fuel reduction efforts. Risk is the potential damage a fire can do to an area under existing conditions, accounting for any modification such as fuel reduction projects, defensible space, and ignition resistant building construction.

Effective April 1, 2024, CAL FIRE updated its Fire Hazard Severity Zone (FHSZ) maps for the State Responsibility Area (SRA) to provide updated map zones based on new science in local climate data and improved fire assessment modeling. The FHSZ model for wildland fire has two key elements: probability of an area burning and expected fire behavior under extreme fuel and weather conditions. The factors considered in determining fire hazard within wildland areas are fire history, flame length, terrain, local weather, and the potential fuel over a 50-year period. Outside of wildlands, the model considers factors that might lead to buildings being threatened, including terrain, weather, urban vegetation cover, blowing embers, proximity to wildland, fire history and fire hazard in nearby wildlands. FHSZs are not a structure loss model, as key information regarding structure ignition (such as roof type, etc.) is not included.

The new FHSZ mapping will create more accurate zone designations that can direct the implementation of mitigation strategies in areas where hazards warrant these investments. The FHSZ mapping program is still ongoing with new mapping in Local Responsibility Areas (LRA) in process.

For the Colusa County Planning Area, the following datasets were utilized for the analysis and contained all FHSZ hazard classes from Very High to Urban Unzoned: CAL FIRE State Responsibility Area (FHSZSRA_23_3) April 2024 and CAL FIRE Federal/Local Responsibility Areas: (Adopted SRA FHSZ 11/2007 - fhszs06_3_6 and Draft LRA FHSZ 9/2007 - c6fhszl06_1). Since it is possible for any given parcel to intersect with multiple categories for purposes of this analysis, the parcel centroid was used to determine which FHSZ 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 parcel layer. Based on this approach, the FHSZs for the Planning Area were determined and further broken out by property use and included information on both land and improved values.

This methodology is used below for the FHSZ analysis of people and populations, structures, and critical facilities at risk as well as with respect to future development areas.

People and Populations

All populations are at some vulnerability to wildfire. Certain vulnerable populations are at greater risk to the effects of wildfire as well as smoke and air quality issues that wildfires bring. Vulnerable populations include:

- Unhoused
- Infants and children under age five and their caregivers
- Elderly (65 and older)
- Individuals with disabilities
- Individuals' dependent on medical equipment
- Individuals who exercise or recreate outdoors
- Individuals who work outdoors
- Individuals with impaired mobility

Colusa County Planning Area residents that live in CAL FIRE FHSZs are often the most vulnerable. Not only are the residents at risk, but their homes and contents are all at risk, compounding the impacts associated with significant hazard events. To further evaluate the impact to the residential population within the Planning Area, CAL FIRE's wildfire hazard layers were overlayed on the parcel layer and linked to the Assessor data. Those residential parcel centroids that intersect the mapped layers were counted and multiplied by the 2020 Census Bureau average household factors for each jurisdiction. These are shown by jurisdiction in Table 4-114.

Table 4-114 Colusa County Planning Area – Improved Residential Parcels and Population by CAL FIRE Fire Hazard Severity Zone by Jurisdiction

Jurisdiction	Very High		High		Moderate	
	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk
City of Colusa	0	0	0	0	175	508
City of Williams	0	0	0	0	3	8
Unincorporated County	232	673	82	209	72	258

Source: CAL FIRE, 2023 Colusa County Parcel/Assessor's Data, 2020 US Census Bureau Average Household Size– City of Colusa (2.90); City of Williams (2.55); Unincorporated Colusa County (3.58).

These numbers reflect low end estimates as the property use categories based on the Assessor data utilized for this LHMP Update assumes all residential properties are single family residences. However, some of the residential parcels actually include multi-family units, including apartments, condominiums and well as duplexes and triplexes. These variations in residential property use were not accounted for in the analysis, which skews populations results to be lower.

Structures

This section is presented in two sections: Fire Responsibility Area Analysis and Fire Hazard Severity Zone Analysis.

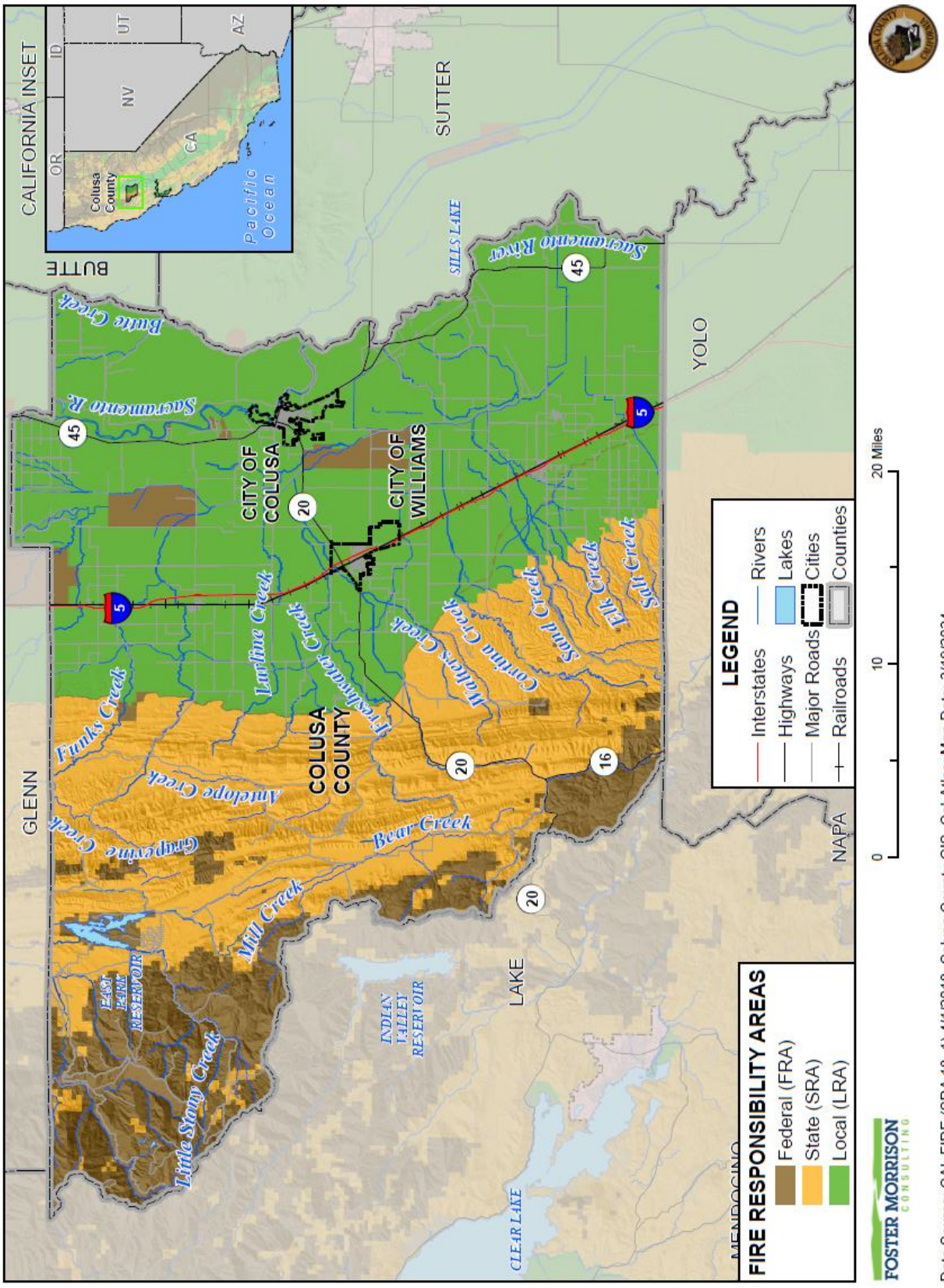
Fire Responsibility Area Analysis

There are various wildland fire protection agencies that have responsibility within the California Counties. 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 federal and state 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. 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 Colusa 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 Colusa 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 4-107.

Figure 4-107 Colusa County Planning Area – Fire Responsibility Areas in FRA, SRA, and LRA



Colusa County is relatively equally divided (in terms of land area) between the FRA, SRA, and LRA as shown in the figure above. However, most of the structures in the County fall in the LRA. 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 4-115 for the entire Colusa County Planning Area.

Table 4-115 Colusa County Planning Area – Count and Value of Parcels by Local, State, and Federal Responsibility Areas by Jurisdiction

Jurisdiction / Fire Responsibility Area	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Total Value
City of Colusa						
LRA	2,334	2,077	$144,303,544	$443,767,787	$49,228,543	$637,299,874
City of Colusa Total	**2,334**	**2,077**	**$144,303,544**	**$443,767,787**	**$49,228,543**	**$637,299,874**
City of Williams						
LRA	1,755	1,477	$110,173,986	$349,462,550	$126,901,961	$586,538,497
City of Williams Total	**1,755**	**1,477**	**$110,173,986**	**$349,462,550**	**$126,901,961**	**$586,538,497**
Unincorporated Colusa County						
LRA	7,709	4,997	$1,431,126,141	$851,585,243	$195,516,311	$2,478,227,695
SRA	2,686	586	$95,150,150	$62,943,153	$3,831,071	$161,924,374
FRA	487	15	$39,393,861	$4,044,867		$43,438,728
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$2,683,590,797**
Grand Total	**14,971**	**9,152**	**$1,820,147,682**	**$1,711,803,600**	**$375,477,886**	**$3,907,429,168**

Source: CAL FIRE (FHSZ SRA 2024, FRA & LPA 2007), 2023 Colusa County Parcel/Assessor's Data

Fire Hazard Severity Zone Analysis

All structures in the Colusa County Planning Area have some risk to wildfire. GIS was used to determine the possible impacts of wildfire within the Planning Area. Summary analysis results for each jurisdiction in the Planning Area are shown in Table 4-116, which summarizes total parcel counts, improved parcel counts and their structure values by fire hazard severity zone. Breakouts of this FHSZ analysis by property use for the unincorporated County is shown in Table 4-117. Details specific to property uses in the incorporated jurisdictions in the County are shown in their respective annexes to this Plan Update.

Table 4-116 Colusa County Planning Area – Count and Value of Parcels (and Structures) by CAL FIRE Fire Hazard Severity Zone by Jurisdiction

Jurisdiction / Fire Hazard Severity Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
City of Colusa							
Moderate	271	205	$26,303,908	$100,956,400	$20,126,336	$78,616,901	$226,003,545
Non-Wildland/Non-Urban	109	66	$21,782,513	$18,275,854	$7,091,405	$15,337,734	$62,487,506
Urban Unzoned	1,954	1,806	$96,217,123	$324,535,533	$22,010,802	$215,541,328	$658,304,786
City of Colusa Total	**2,334**	**2,077**	**$144,303,544**	**$443,767,787**	**$49,228,543**	**$309,495,963**	**$946,795,837**
City of Williams							
Moderate	14	7	$1,213,560	$1,877,618	$333,680	$1,624,053	$5,048,911
Non-Wildland/Non-Urban	624	533	$50,157,946	$156,354,180	$39,433,510	$99,958,385	$345,904,021
Urban Unzoned	1,117	937	$58,802,480	$191,230,752	$87,134,771	$152,617,402	$489,785,405
City of Williams Total	**1,755**	**1,477**	**$110,173,986**	**$349,462,550**	**$126,901,961**	**$254,199,840**	**$840,738,337**
Unincorporated Colusa County							
Very High	2,239	335	$61,918,918	$38,071,019	$1,119,547	$28,058,865	$129,168,349
High	557	206	$37,653,475	$20,687,067	$2,008,318	$16,512,900	$76,861,760
Moderate	556	264	$44,579,599	$36,709,787	$9,516,826	$31,522,348	$122,328,560
Non-Wildland/Non-Urban	5,583	3,199	$1,346,694,088	$606,061,874	$174,717,679	$542,099,435	$2,669,573,076
Urban Unzoned	1,947	1,594	$74,824,072	$217,043,516	$11,985,012	$140,270,583	$444,123,183
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$758,464,131**	**$3,442,054,928**
Grand Total	**14,971**	**9,152**	**$1,820,147,682**	**$1,711,803,600**	**$375,477,886**	**$1,322,159,934**	**$5,229,589,102**

Source: CAL FIRE (FHSZ SRA 2024, FRA & LPA 2007), 2023 Colusa County Parcel/Assessor Data

Table 4-117 Unincorporated Colusa County– Count and Value of Parcels (and Structures) by CAL FIRE Fire Hazard Severity Zone and by Property Use

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Very High							
Agricultural	842	96	$43,888,662	$17,256,564	$517,385	$17,256,564	$78,919,175

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Commercial	4	4	$267,832	$404,735	$8,130	$404,735	$1,085,432
Government	30	1	$914,151	$39,764	$0	$39,764	$993,679
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	1	1	$27,716	$294,198	$321,914	$294,198	$938,026
Miscellaneous	209	1	$6,272,606	$51,447	$0	$51,447	$6,375,500
Residential	1,153	232	$10,547,951	$20,024,311	$272,118	$10,012,157	$40,856,537
Very High Total	**2,239**	**335**	**$61,918,918**	**$38,071,019**	**$1,119,547**	**$28,058,865**	**$129,168,349**
High							
Agricultural	329	118	$32,655,450	$11,825,999	$1,387,345	$11,825,999	$57,694,793
Commercial	2	2	$42,891	$300,496	$0	$300,496	$643,883
Government	12	1	$1,056,601	$40,537	$0	$40,537	$1,137,675
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	3	2	$4,282	$86,072	$90,354	$86,072	$266,780
Miscellaneous	14	1	$534,111	$85,631	$0	$85,631	$705,373
Residential	197	82	$3,360,140	$8,348,332	$530,619	$4,174,165	$16,413,256
High Total	**557**	**206**	**$37,653,475**	**$20,687,067**	**$2,008,318**	**$16,512,900**	**$76,861,760**
Moderate							
Agricultural	234	160	$30,954,976	$16,403,724	$3,816,001	$16,403,724	$67,578,425
Commercial	27	24	$1,460,372	$6,006,314	$3,388,815	$6,006,314	$16,861,815
Government	109	2	$4,011,954	$3,490,763	$0	$3,490,763	$10,993,480
Industrial	0	0	$0	$0	$0	$0	$0
Institutional	6	4	$386,407	$260,512	$404,302	$260,512	$1,311,733
Miscellaneous	16	2	$2,282,512	$173,599	$1,761,003	$173,599	$4,390,713
Residential	164	72	$5,483,378	$10,374,875	$146,705	$5,187,436	$21,192,394
Moderate Total	**556**	**264**	**$44,579,599**	**$36,709,787**	**$9,516,826**	**$31,522,348**	**$122,328,560**
Non-Wildland/Non-Urban							
Agricultural	4,054	2,285	$1,216,344,410	$316,276,836	$107,606,265	$316,276,836	$1,956,504,347
Commercial	64	38	$8,055,110	$42,292,303	$24,041,083	$42,292,303	$116,680,799
Government	229	9	$25,203,187	$515,401	$0	$515,401	$26,233,989
Industrial	31	19	$6,057,680	$57,506,560	$38,488,991	$86,259,843	$188,313,074
Institutional	18	1	$593,137	$2,691,992	$0	$2,691,992	$5,977,121
Miscellaneous	241	19	$26,257,343	$1,347,357	$90,670	$1,347,357	$29,042,727
Residential	946	828	$64,183,221	$185,431,425	$4,490,670	$92,715,703	$346,821,019
Non-Wildland/Non-Urban Total	**5,583**	**3,199**	**$1,346,694,088**	**$606,061,874**	**$174,717,679**	**$542,099,435**	**$2,669,573,076**

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Other Value	Estimated Contents Value	Total Value
Urban Unzoned							
Agricultural	31	19	$1,113,077	$1,488,002	$230,309	$1,488,002	$4,319,390
Commercial	163	111	$11,143,054	$22,533,217	$4,585,616	$22,533,217	$60,795,104
Government	46	26	$771,916	$3,442,721	$37,449	$3,442,721	$7,694,807
Industrial	20	11	$3,930,710	$13,999,889	$3,195,588	$20,999,833	$42,126,020
Institutional	27	18	$295,426	$4,594,388	$2,633,182	$4,594,388	$12,117,384
Miscellaneous	52	6	$1,565,490	$3,439,535	$0	$3,439,535	$8,444,560
Residential	1,608	1,403	$56,004,399	$167,545,764	$1,302,868	$83,772,887	$308,625,918
Urban Unzoned Total	**1,947**	**1,594**	**$74,824,072**	**$217,043,516**	**$11,985,012**	**$140,270,583**	**$444,123,183**
Unincorporated Colusa County Total	**10,882**	**5,598**	**$1,565,670,152**	**$918,573,263**	**$199,347,382**	**$758,464,131**	**$3,442,054,928**

Source: CAL FIRE (FHSZ SRA 2024, FRA & LPA 2007), 2023 Colusa County Parcel/Assessor Data

Critical Facilities and Infrastructure

Wildfire presents a threat to critical facilities and infrastructure. The following analysis identifies critical facilities and infrastructure at risk to wildfire. A separate analysis was performed on the critical facility inventory in Colusa County and all jurisdictions to determine critical facilities in FHSZs. Using GIS, the FHSZ areas were overlayed on the critical facility GIS layer. Figure 4-92 shows critical facilities, as well as the FHSZs. Table 4-105 details critical facilities by FHSZ by facility type and count for the Planning Area. Details of critical facility definition, type, name and address by FHSZ are listed in Appendix F.

Figure 4-108 Colusa County Planning Area – Critical Facilities in CAL FIRE FHSZs

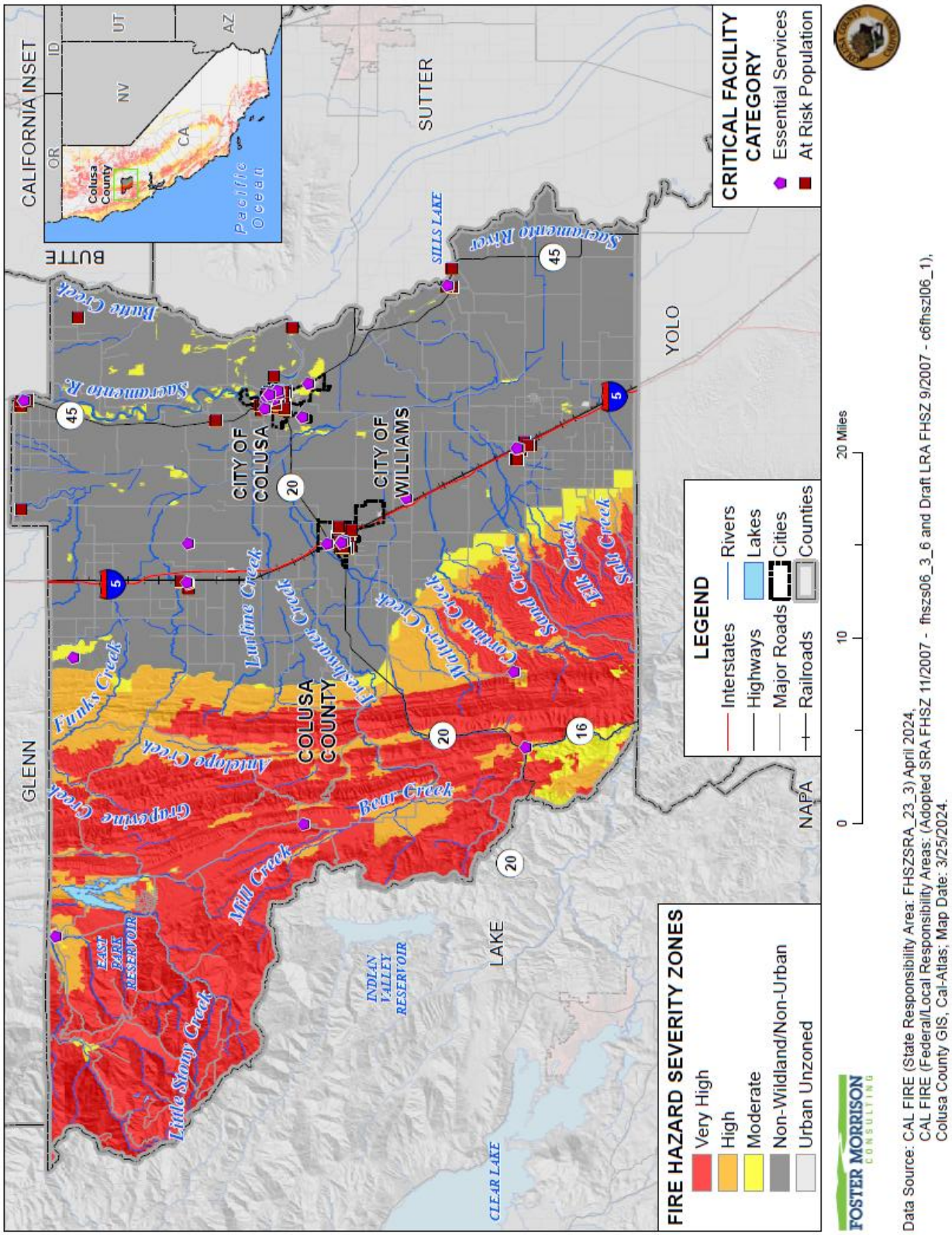


Table 4-118 Colusa County Planning Area – Critical Facilities in CAL FIRE FHSZs by Category, Type, and Jurisdiction

Jurisdiction/ Fire Hazard Severity Zone	Critical Facility Category	Facility Type	Facility Count
City of Colusa			
Moderate	Essential Services Facilities	Public Services	1
		Total	**1**
	At Risk Population Facilities	Apartment Complex	2
		Mobile Home Park	1
		Total	**3**
Moderate Total			**4**
Non-Wildland/Non-Urban	Essential Services Facilities	Utility Facility	1
		Total	**1**
	At Risk Population Facilities	Apartment Complex	1
		Mobile Home Park	1
		Total	**2**
Non-Wildland/Non-Urban Total			**3**
Urban Unzoned	Essential Services Facilities	Emergency Response	1
		Fire Station	2
		Medical	1
		Police Station	1
		Public Services	2
		Utility Facility	1
		Total	**8**
	At Risk Population Facilities	Apartment Complex	19
		Assisted-Living	1
		Hotel or Motel	2
		Jail	1
		Mobile Home Park	3
		School	8
		Senior Living Facility	1
		Total	**35**
Urban Unzoned Total			**43**
City of Colusa Total			**50**
City of Williams			
Non-Wildland/Non-Urban	At Risk Population Facilities	Mobile Home Park	1
		Senior Living Facility	1
		Total	**2**

Jurisdiction/ Fire Hazard Severity Zone	Critical Facility Category	Facility Type	Facility Count
Non-Wildland/Non-Urban Total			**2**
Urban Unzoned	Essential Services Facilities	Emergency Response	2
		Fire Station	1
		Public Services	1
		Utility Facility	1
		Total	**5**
	At Risk Population Facilities	Apartment Complex	4
		Hotel or Motel	8
		Migrant Housing	1
		Mobile Home Park	1
		School	4
		Senior Living Facility	2
		Total	**20**
Urban Unzoned Total			**25**
City of Williams Total			**27**
Unincorporated Colusa County			
Very High	Essential Services Facilities	Fire Station	2
		Total	**2**
Very High Total			**2**
High	Essential Services Facilities	Fire Station	1
		Total	1
High Total			**1**
Moderate	Essential Services Facilities	Native American Reservation	1
		Total	1
	At Risk Population Facilities	Mobile Home Park	1
		Total	1
Moderate Total			2
Non-Wildland/Non-Urban	Essential Services Facilities	Utility Facility	2
		Total	**2**
	At Risk Population Facilities	Apartment Complex	1
		Casino	1
		Hotel or Motel	1
		Mobile Home Park	4
		Total	**7**
Non-Wildland/Non-Urban Total			**9**
Urban Unzoned	Essential Services Facilities	Fire Station	4

Jurisdiction/ Fire Hazard Severity Zone	Critical Facility Category	Facility Type	Facility Count
		Utility Facility	3
		Total	**7**
	At Risk Population Facilities	Apartment Complex	4
		Mobile Home Park	4
		School	9
		Total	**17**
Urban Unzoned Total			**24**
Unincorporated Colusa County Total			**38**
Grand Total			**115**

Source: CAL FIRE (FHSZ SRA 2024, FRA & LPA 2007), Colusa County GIS

Community Lifelines

Wildfire presents a threat to life and property, including to community lifelines in the Colusa County Planning Area. Community lifelines that would be vulnerable to wildfire include:

- **Safety and Security** –Police, Fire, and EMS personnel are often called on to respond during fire emergencies. This would be especially true if a wildfire occurred in or near the Planning Area. Emergency resources may be stretched during a large event.
- **Food, Hydration, Shelter** – Shelters may need to be opened to handle those displaced by a wildfire. Food and water would need to be provided.
- **Health and Medical** – There may be injuries and deaths from wildfire. Patient movement from accident scenes by EMS may have to be rerouted due to fire or smoke issues. Hospitals could see an influx of injured. Public health can be at risk from air quality issues from smoke.
- **Energy** – Wildfires could impact large areas of above ground electric infrastructure, causing widespread power outages. Even the threat of wildfire can cause power outages when fire weather conditions lead to PSPS events. Fire may cause fuel transportation to be delayed, causing local shortages.
- **Communications** – Communication systems can be damaged during a wildfire. An influx of service calls to dispatch centers for reporting of wildfire, power outages, or other issues can occur. Calls to and from family and friends during a wildfire can further overwhelm communication systems such as cell towers and other infrastructure. Demand may exceed the capacity of these systems to remain operational during response efforts. Messaging systems need to be deployed during these times to let the public know about road closures or evacuation routes.
- **Transportation** – Highways and local roads may see closures. These closures can affect response personnel (EMS, Fire, Police) as well as cause additional traffic issues for residents. Evacuation routes may be affected and overwhelmed during a large event.
- **Hazardous Material** – hazardous material facilities can be affected by wildfire. A release during these times can cause additional risk to responders, as well as additional exposure to the environment.
- **Water Systems** – Water systems may be taxed during wildfires. Access to water for firefighting can also be a challenge if power outages occur in affected areas. Wastewater systems can also be affected by an increase in silt, debris ash, and other materials entering the systems.

A large wildfire event could temporarily overwhelm many facilities and community lifelines in the Colusa County Planning Area.

Natural, Historic, and Cultural Resources

Natural, historic, and cultural resources located within areas at risk to wildfire would be vulnerable. Should a wildfire occur in the Planning Area, the impacts to natural, historic, and cultural resources could be extensive and include air pollution, contamination from water runoff containing toxic products, and other environmental discharges or releases from burned materials affecting soils, habitat areas, wildlife, and aquatic resources. Historic and cultural resources can be affected and are often more vulnerable due to their older age, construction type, and lack of fire prevention infrastructure such as sprinklers.

Economic Assets and Community Activities of Value

Wildfires in the Colusa County Planning Area can cause direct damage to economic assets such as businesses and commercial centers located in affected areas. If a fire occurs during a dry period, agricultural crops may also be affected. During extreme events, the economy may slow while recovery efforts are prioritized. Business revenue may be reduced during extended events. Community activities and events in areas affected by wildfire (and smoke and air quality issues) may be cancelled or rescheduled. This includes the County Fair, Farm Show, rodeos, craft fairs, and hunting and fishing seasons.

Impacts from Wildfire

Potential impacts from wildfire include loss of life and injuries; damage to structures (commercial, industrial, and residential) and other improvements, natural and cultural resources, croplands, and timber; and loss of recreational opportunities. Wildfires can cause short-term and long-term disruption to the Colusa County Planning Area. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the Planning Area by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Fires can also affect air quality in the Planning Area; smoke and air pollution from wildfires can be a severe health hazard. Smoke impacts may come from wildfires outside the Planning Area, as well as from within.

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. 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. Schools and businesses can be forced to close for extended periods of time. Recently, the threat of wildfire, combined with the potential for high winds, heat, and low humidity, has caused PG&E to initiate a PSPS which can also significantly impact a community through loss of services, business closures, and other impacts associated with loss of power for an extended period. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

The impacts of a fire are felt long after the fire is extinguished. In addition to the loss of property in fires, the loss in vegetation and changes in surface soils alters the environment. When supporting vegetation is

burned, hillsides become destabilized and prone to erosion. The burnt surface soils are harder and absorb less water. When winter rains come, this leads to increased runoff, erosion, and landslides in hilly areas.

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

Wildfire smoke can also have negative effects to those who live in or near a fire burn area. Smoke and air pollution from wildfires can be a severe health hazard. Significant wildfires occurring in nearby northern California communities since the previous LHMP Update have created significant air pollution affecting area residents. Planning Area residents have been affected by wildfire smoke and poor air quality, from fires both within the County and from those much further away.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the County may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for Colusa County include the following:

- Climate change is likely to exacerbate future wildfire conditions and associated impacts and vulnerability of the County to wildfire.
- Future population growth should be considered, as having more or less people in a community affects the overall hazard vulnerability to the County. Population growth in Colusa County has recently slowed. Additional growth within the WUI and other high fire hazard areas of the County would place additional populations at risk to wildfire. Additional population growth would likely bring continued diversity to the County. Vulnerable population groups could face disproportionate effects from wildfire and should be planned for. Changes in population and population patterns may or may not increase the impacts and vulnerability of the County to this hazard depending on the location and nature of growth and continued planning for future hazard conditions.
- Land use planning should be proactive to address future hazard conditions. Locating new development, structures and critical facilities and infrastructure within or near areas of wildfire risk may put additional development at risk. However, County building codes are in effect to reduce this risk and should be updated as necessary to continue to address future wildfire conditions. It should be noted that most of the growth in the County is occurring in areas outside the moderate or higher fire hazard severity zones. Thus, depending on the location of new development and adherence to protective building codes,

changes in land use and development may or may not increase the impacts and associated vulnerabilities of the County to this hazard.

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes, are followed, and varying needs for different demographic groups with intersecting identities that reside within the County are considered can help to make for a more resilient community.

GIS Analysis

Colusa County provided 53 future development areas which were used as the basis for the inventory of future development for the unincorporated County. These were mapped in GIS. Where multiple parcels are listed, the parcels are merged to form one polygon, and the hazards assigned are based on the centroid of the polygon. Figure 4-109 show the locations of the future development areas and FHSZs. Table 4-119 shows the details of the future development areas that are located in each FHSZ.

Figure 4-109 Unincorporated Colusa County – Future Development in FHSZs

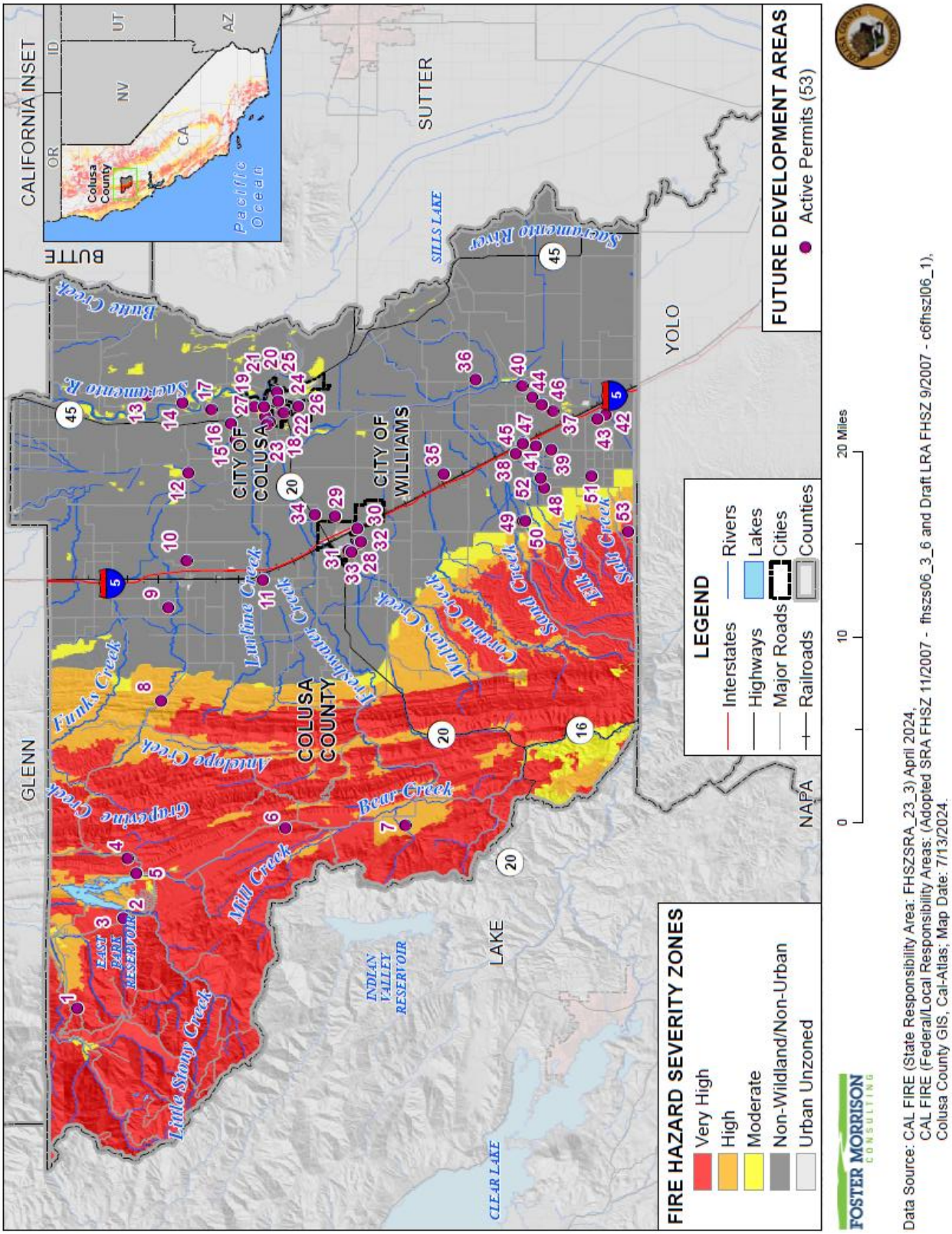


Table 4-119 Unincorporated Colusa County – Future Development in FHSZs with Parcel Counts and Acreages

Fire Hazard Severity Zone	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
Very High	1	010-200-001-000	1	161.29
	2	4564 LODOGA STONYFORD RD	1	2.49
	3	4564 LODOGA STONYFORD RD	1	2.49
	4	010-280-079-000	1	13.90
	5	4481 SITES LODOGA RD	1	86.68
	6	014-250-019-000	1	219.76
	53	5875 SILLS RD	1	618.41
	Very High Total		**7**	**1,105.00**
High	7	2001 BEAR VALLEY RD	1	637.09
	8	011-200-012-000	1	282.12
	High Total		**2**	**919.21**
Non-Wildland/Non-Urban	9	4105 RIORDAN RD	1	76.26
	10	5603 MAXWELL RD	1	30.89
	11	5498 LURLINE AVE	1	12.18
	12	6458 MAXWELL RD	1	319.89
	13	4374 RIVER RD	1	402.44
	14	4073 RIVER RD	1	10.32
	15	015-060-091-000	1	497.11
	16	6892 HARBISON RD	1	11.00
	17	015-030-094-000	1	17.03
	18	3258 MCCOY RD	1	6.01
	19	015-310-050-000	1	11.97
	23	3286 RANCH RD	1	1.85
	26	015-380-019-000	1	1.00
	27	1773 LURLINE AVE	1	3.40
	28	016-230-101-000	1	2.49
	29	2668 HUSTED RD	1	10.00

Fire Hazard Severity Zone	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
	30	2461 OLD HIGHWAY 99W	1	8.53
	32	016-230-065-000	1	1.45
	33	016-220-099-000	1	1.37
	34	017-010-045-000	1	56.35
	35	1707 LONE STAR RD	1	121.30
	36	019-090-058-000	1	10.00
	37	7020 FRIEL RD	1	9.92
	39	758 WILDWOOD RD	1	25.08
	40	7251 TULE RD	1	2.64
	41	887 WILDWOOD RD	1	1.89
	42	021-290-070-000	1	30.47
	43	6901 HARRINGTON AVE	1	15.16
	46	7072 PERKINS RD	1	9.29
	48	821 WYER RD	1	10.79
	49	6031 HILLGATE RD	1	9.65
	50	6011 HILLGATE RD	1	9.72
	51	6439 MARINE AVE	1	27.77
	52	853 JENSEN AVE	1	9.92
	Non-Wildland/Non-Urban Total		**34**	**1,775.14**
Urban Unzoned	20	022-200-066-000	1	0.45
	21	022-200-066-000	1	0.45
	22	3145 WILL S GREEN RD	1	7.48
	24	1232 FIFTH ST	1	0.60
	25	002-101-004-000	1	4.48
	31	2533 VENICE AVE	1	2.06
	38	805 GAIL AVE	1	0.38
	44	507 MAIN ST	1	0.47
	45	707 FIRST ST	1	0.13
	47	720 FIFTH ST	1	0.55
	Urban Unzoned Total		**10**	**17.05**

Fire Hazard Severity Zone	Future Development Site Number	Future Development Name	Total Parcel Count	Total Acres
Grand Total			**53**	**3,816.40**

Source: CAL FIRE, Colusa County

4.4 Capability Assessment

Thus far, the planning process has identified the natural hazards posing a threat to the Colusa 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 capability assessment. Combining the risk assessment with the capability assessment provides an overview of the County's net vulnerability to disasters, and more accurately focuses the goals, objectives, and proposed actions of this Plan.

A two-step approach is used to conduct the Capability Assessment for each participating jurisdiction to this LHMP Update. 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 unincorporated 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.

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; and mitigation education, outreach, and partnerships are discussed in Section 4.4.4.

4.4.1. Colusa County's Regulatory Mitigation Capabilities

Table 4-120 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in unincorporated Colusa County. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Table 4-120 Colusa County Regulatory Mitigation Capabilities

Plans	In Place Y/N	Does the plan address hazards? Can the plan be used to carry out mitigation actions? When was it last updated??
Capital Improvements Plan	2012	
Climate Change Adaptation Plan		

Community Wildfire Protection Plan	Y	Plan addresses wildfire hazard and has mitigation actions. It was updated in 2021.
Comprehensive/Master Plan	2012/2014	County 2030 General Plan. Yes the General Plan primarily through its Safety Element implements mitigation policies and actions.
Continuity of Operations Plan	2017	
Economic Development Plan	2012	
Land Use Plan	Y	As part of General Plan.
Local Emergency Operations Plan	2016	
Stormwater Management Plan		
Transportation Plan		
Other (describe)		

Land Use Planning and Ordinances	Y/N	Is the ordinance an effective way to reduce hazard impacts? Is the ordinance adequately administered and enforced?
Acquisition of land for open space and public recreation use	N	N/A
Building code	Y	Y
Flood insurance rate maps	Y	Y
Floodplain ordinance	Y	Y
Natural hazard-specific ordinance (stormwater, steep slope, wildfire)	N	N/A
Subdivision ordinance	Y	Y
Zoning ordinance	Y	Y
Other	Y	Erosion program through building code.

How can these capabilities be expanded and improved to reduce risk?
Erosion control measures could be enhanced through the adoption of County specific performance standards. The EOP will be updated soon, which would also help reduce risk. An update of the Safety Element is needed. This is especially poignant as the levee decertifications have put more of the County in the 1% annual floodplain.

As indicated in the tables above, Colusa County has several plans and programs that guide the County's mitigation of development of hazard-prone areas. Starting with the Colusa 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.

Colusa County General Plan (2012)

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 hazards and hazard mitigation from the General Plan include the following:

Circulation Element

Goal CIRC-3	Provide a Circulation System that Supports Public Safety
Objective CIRC-3A:	Minimize Inconveniences and Safety Hazards Caused by Road Flooding, Washouts, and Emergency Conditions

Conservation Element

Goal CON-1	Conserve and protect Colusa County's ecosystem.
Policy CON 1-11:	Protect wetlands and riparian habitat areas from encroachment by development to the greatest extent feasible.
Policy CON 1-15:	Require that impacts to wetlands and riparian habitat protected by State or Federal regulations be avoided to the greatest extent feasible. If avoidance is not possible, fully mitigate impacts consistent with applicable local, state, and federal requirements.
Policy CON 1-16	Require new development projects to incorporate measures that eliminate or avoid direct impacts to lakes, reservoirs, rivers, creeks, streams, wetlands, and other waterways to the greatest extent feasible. Measures may include, but are not limited to, appropriate setbacks or the implementation of best management practices approved by the Department of Planning and Building.
Policy CON 1-29:	Support water development, treatment, and storage projects that are needed to meet existing and future local and regional demand.
Policy CON 1-30	Ensure that regional, state, and federal water projects, including proposed Sites Reservoir, protect local water rights and areas of origin.
Policy CON 1-31	Encourage municipal water purveyors to install water meters and abandon flat---fee water use rate structures where feasible.
Policy CON 1-32	Demonstrate leadership in water conservation by including water---efficient plumbing and landscaping at all new County facilities, and by reducing the County's own water use to the extent possible.
Policy CON 1-33	Require new development and expansion of existing uses to incorporate best management practices for water use and include water conservation measures.
Policy CON 1-34	Encourage the use of water conservation measures for agriculture and in existing residences and businesses.
Policy CON 1-35	Encourage the use of water conservation measures, including low flow plumbing; reclaimed wastewater for non---potable uses; dual plumbing that allows grey water from showers, sinks, and washers to be reused for landscape irrigation in new developments; and native and drought---tolerant landscaping.

Land Use Element

GOAL LU-1	Maintain the efficient and harmonious use of land in the county, promoting a well organized and orderly development pattern, avoiding random, haphazard growth, protecting public health and safety, and accommodating the orderly and sustainable growth of employment and population.
Policy LU 1-4	Locate lands designated for future development based on constraints associated with natural features, such as soil, slope, and drainage, preservation of the County's resources, including agriculture, open space, and scenic views, and by public service availability, such as sewer and water capability; policies and actions related to these requirements are set forth in more detail in the Safety, Conservation, and Public Facilities and Services Elements.

Open Space and Recreation Element

Goal OSR-1:	Preserve and Protect the Natural Resources and Scenic Beauty of the County
Policy OSR 1-5	New development should be designed and constructed to preserve open space features such as scenic corridors, wetlands, riparian vegetation, native vegetation, trees and natural resource areas where feasible and appropriate.
Policy OSR 1-9:	Maintain open space for future water and drainage projects.

Goal PSF-1	Ensure that adequate water and wastewater services are available to serve existing land uses and areas of planned growth, as identified in the General Plan Land Use Map.
Policy PSF 1-1	Encourage and support the expansion of municipal water systems to areas identified for current or future development and growth on the General Plan land use map.
Policy PSF 12	Prior to the approval of development, infrastructure, Specific Plans, or other projects that would result in increased demand for public water conveyance and treatment, projects must demonstrate proof of adequate water supply (e.g., that existing services are adequate to accommodate the increased demand, or improvements to the capacity of the system to meet increased demand will be made prior to project implementation), and that potential cumulative impacts to water users and the environment will be addressed.
Policy PSF 1-3	Coordinate with water providers throughout the County to manage water supplies in a way that ensures adequate supplies for existing residents, agricultural uses, and businesses, and for projected growth, and avoids groundwater overdraft, water quality degradation and other adverse environmental impacts.

Safety Element

Goal SA-1	Ensure the safety of County residents, businesses, and visitors from hazardous conditions, including natural catastrophes and human-caused emergencies.
Objective SA 1-A	Ensure that Colusa County is Prepared to Provide an Organized Response to Natural and Human-Caused Emergencies.

Goal SA-1	Ensure the safety of County residents, businesses, and visitors from hazardous conditions, including natural catastrophes and human-caused emergencies.
Objective SA 1-B	Ensure that Planning and Development Procedures Identify and Mitigate Potential Hazards
Objective SA 1-C	Reduce Risks to Human Life and Property from Seismic and Geological Hazards
Objective SA 1-D	Take Appropriate Steps to Reduce the Risks to Life, Property, and Public Services Associated with Flooding.
Objective SA 1-E	Strive to Maintain an Adequate System of Levees that Provide Flood Protection to Areas Throughout the County.
Objective SA 1-F	Reduce Risks to Life and Property from Dam Inundation
Objective SA 1-G	Minimize Risks to Human Life and Property from Fire in both Developed and Undeveloped Areas of the County
Objective SA 1-H	Minimize Risks to Residents and the Environment from Hazardous Materials and Waste

Other Colusa County Plans/Studies/Programs

Colusa County Emergency Operations Plan (2016)

The County of Colusa Emergency Operations Plan (EOP) addresses the County's planned response to extraordinary emergency situations associated with natural disasters, technological incidents and national security emergencies in or affecting the County of Colusa. This plan does not apply to normal day-to-day emergencies or the established departmental procedures used to cope with such emergencies. Rather, this plan focuses on operational concepts and would be implemented relative to large-scale disasters, which can pose major threats to life, property and the environment requiring unusual emergency responses.

This plan accomplishes the following:

- Establishes the emergency management organization required to mitigate any significant emergency or disaster affecting the County of Colusa.
- Identifies the roles and responsibilities required to protect the health and safety of Colusa residents, public and private property and the environmental effects of natural and technological emergencies and disasters.
- Establishes the operational concepts associated with a field response to emergencies, the County of Colusa Emergency Operations Center (EOC) activities and the recovery process.

Colusa County Threat and Hazard Risk Assessment (2014)

The Colusa Operational Area has compiled this Threat and Hazard Identification and Risk Assessment (THIRA) as a standard process for identifying community-specific threats and hazards and setting capability targets for each core capability identified in the National Preparedness Goal as required in Presidential Policy Directive (PPD) 8, and follows guidance from the Comprehensive Preparedness Guide (CPG) 201. New guidance for 2013 expands the THIRA process to include estimation of resources needed to meet the capability targets.

This THIRA will be reviewed on an annual basis and updated as necessary to acknowledge changing threats within the Operational Area to ensure planning processes include any changes or new threats.

Colusa County Wildfire Protection Plan (2021)

The Colusa County Community Wildfire Protection Plan was developed as a means of describing current fire and fuels conditions within various portions of Colusa County, identifying public and private assets at risk from wildfire, assessing currently in-place infrastructure that have been developed in order to protect these assets and to design efforts that improve current conditions. The planning document also provides background information necessary for local organizations to obtain grants and secure funding for future fuel reduction projects and other mitigation measures.

Throughout Colusa County and in California as a whole, communities adjacent to and within the state's wildlands have experienced growth and an increase in public access and use. Development in these areas has taken a number of forms. Remote residences and areas of development are often created without many of the infrastructure components and fire safety features that are integral to fire protection. Significant among these deficiencies are insufficient access on two lane roads for ingress and egress of firefighting equipment, roads that dead end reducing escape opportunities, inadequate water supply systems, and the presence of mobile homes as residences on small rural parcels. Considering that mobile homes are often installed with insufficient vegetation removal and control, this type of residence is at an increased risk from fast moving wildland fires.

Strategic Fire Plan Sonoma-Lake-Napa Unit (2023)

The California Department of Forestry and Fire Protection (CAL FIRE), Sonoma-Lake-Napa Unit (LNU) serves the counties of Sonoma, Lake, Napa, Solano, Yolo, and Colusa.

The LNU Fire Management Plan is a product of the implementation of the State Fire Plan. The State Fire Plan provides an analysis procedure to assess fire fuel hazards and risks in order to design and implement mitigating activities. The LNU Fire Management Plan provides background information, fuels and fire data, proposed projects, and individual Battalion reports outlining mitigating activities commonly carried out each year. This Plan is a local road map for the fire service and the public to create and maintain defensible landscapes to protect those assets vital to the state and its citizens.

The LNU Fire Plan outlines a comprehensive program designed to reduce total government costs and citizen losses from wildland fire in the Unit. It also strives to assist the public with assistance and education to create fire adapted communities that can more safely withstand a wildland fire.

Colusa 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.

Covid-19 Continuity of Operations Plan (2020)

The Colusa County Department of Health and Human Services put together a Continuity of Operations Plan (COOP) to deal with the Covid-19 pandemic. The goal of this plan was to continue all Colusa County services, as well as to mitigate the impact of staffing shortages. As the CDC guidance came out regarding social distancing and reducing face to face contact, the Colusa County Department of Health and Human Services made efforts to adapt to changes in how to deliver services. This included the following:

- To enforce the social distancing requirements set by CDC, and temporarily alleviate some of the workload due to staffing shortages, all non-emergency contact will be conducted by telephone or mail.
- All interviews can be conducted by telephone. Documents will be mailed to applicants where a signature is required.
- Workers are available by telephone Monday – Friday, 8:00 AM – 4:30 PM at (530) 458-0250 locally. Workers will be making extra effort to answer all incoming calls immediately, and return missed calls within one business day, as we anticipated increased phone traffic and prompt response times will reduce attempted in-office visits.
- EBT cards will be mailed, with the exception of qualified emergency applications or emergency replacements where the customer desires pick-up.
- The lobby will be open Monday – Friday, 8:00 AM – 4:30 PM for emergency services only. Emergency services available in lobby include accepting emergency applications, printing Passport-to-Services, printing emergency Beneficiary Identification Cards (BIC) and issuing emergency EBT cards. Applications for emergency services do not need to be filed in person, and can be made by any of the methods listed above.
- The public who choose to visit our lobby will be advised to maintain 6 feet or more social distancing during all face-to-face contact. Frequently touched surfaces in our lobby will be disinfected often. Our waiting area will have chairs placed 6 feet apart.

Colusa Basin Watershed Management Plan (2012)

The Colusa Basin Watershed is located in Northern California and lies mainly in Colusa County, with portions of the watershed spanning areas of Glenn and Yolo Counties. The watershed extends from the Stony Creek Watershed in the north to the Cache Creek Watershed in the south and from the Sacramento River westward to the ridge crest of the Inner Coast Range foothills. The watershed covers approximately 1,045,445 acres (1,634 square miles) and drains into the Sacramento River at Knights Landing via the Colusa Basin Drain. The landscape is dominated by agricultural and rangeland activities, with less than 1% of the land being urbanized.

The Colusa County Resource Conservation District's (CCRCD) Watershed Coordinator, working under a Watershed Coordinator grant from the California Department of Conservation, has prepared this Colusa Basin Watershed Management Plan (Plan) as part of an ongoing effort by the CCRCD to address natural resource concerns in the Colusa Basin Watershed. This Plan is a non-regulatory, community-driven guide which addresses the concerns of a variety of stakeholders. This Plan is meant to be a user-friendly, living document with a clear set of management goals, objectives and achievable programs and projects to sustain and enhance watershed functions.

Groundwater Sustainability Plan (2021)

Sustainable management of groundwater is defined under SGMA as the "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results" (California Water Code [CWC] Section 10721(v)). Undesirable results are associated with each of six sustainability indicators, including chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface water. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the subbasin. Sea water intrusion, while a SGMA-defined sustainability indicator, was determined to be inapplicable to the Subbasin due to the distances between the Subbasin and the Pacific Ocean, bays, deltas, or inlets ranging from about 30 to 60 miles.

The purpose of this GSP is to characterize groundwater conditions in the Subbasin, evaluate and report on existing conditions relating to the six sustainability indicators, describe existing monitoring, management programs and policies relating to groundwater resource use, document public outreach and communication, establish sustainability goals, and describe projects and management actions (PMAs) the GSAs will implement to achieve sustainable groundwater management within 20 years of implementing the GSP (CCRs Title 23, Section 350.4 (f)).

Integrated Water Management Plan (2014)

The purpose of this Integrated Regional Water Management Plan (IRWMP) is to document the regional water resource management conditions, needs and strategies; to describe the process and projects that will improve regional water resources management in the IRWM region; and, to comply with the Final California Department of Water Resources (DWR) Integrated Regional Water Management (IRWM) Grant Program Guidelines.

The IRWMP was developed in three phases: Phase 1 centered on developing the goals and objectives for the region; Phase 2 focused on developing and prioritizing projects; and Phase 3 focused on drafting, and public review of, the IRWMP.

Colusa County Ordinances

Building Code (Chapter 5)

This chapter shall be known and may be referred to in all proceedings as the "Colusa County Building Code." The purpose of this chapter is to enact regulations relating to buildings and structures, imposing restrictions thereon and to provide for their enforcement. The provisions of this chapter shall apply to all of the unincorporated territory of Colusa County. (Ord. No. 744, § 2 (part); Ord. No. 763 § 1 (part): Ord. No. 781 § 1 (part): Ord. No. 805, § 1.) The following codes are adopted:

- The 2016 Edition of the California Building Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 2, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.
- The 2016 Edition of the California Mechanical Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 4, of the California Code of Regulations, is adopted by Colusa County with the same force and effect as if fully set forth herein.
- The 2016 Edition of the California Electrical Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 3, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.
- The 2016 Edition of the California Plumbing Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 5, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.
- The 2016 Edition of the California Fire Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 9, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.
- The 2016 Edition of the California Residential Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 2.5, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.
- The 2016 Edition of the California Energy Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 6, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.
- The 2016 California Green Building Standards Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 11, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.
- The 2016 California Referenced Standards Code, including all its appendices, as adopted by the state of California and incorporated in Title 24, Part 12, of the California Code of Regulations, is adopted with the same force and effect as if fully set forth herein.

Emergency Services (Chapter 6)

The declared purposes of this chapter are to provide for the preparation and carrying out of plans for the protection of persons and property within this county in the event of an emergency; the direction of the emergency organization; and the coordination of the emergency functions of this county with all other public agencies, corporations, organizations, and affected private persons. (Ord. No. 450, § 2 (part).)

t shall be the duty of the county disaster council, and it is hereby empowered, to develop and recommend for adoption by the board of supervisors, emergency and mutual aid plans and agreements and such ordinances and resolutions and rules and regulations as are necessary to implement such plans and agreements. The disaster council shall meet upon call of the chairman or, in his absence from the county or inability to call such meeting, upon call of the vice-chairman.

All officers and employees of this county, together with those volunteer forces enrolled to aid them during an emergency, and all groups, organizations, and persons who may by agreement or operation of law, including persons impressed into service under the provisions of section 6-6(a)(6)(c) of this chapter, be charged with duties incident to the protection of life and property in this county during such emergency, shall constitute the emergency organization of the county of Colusa. (Ord. No. 450, § 2 (part).)

The Colusa County disaster council shall be responsible for the development of the county of Colusa emergency plan, which plan shall provide for the effective mobilization of all of the resources of this county, both public and private, to meet any condition constituting a local emergency, state of emergency, or state of war emergency; and shall provide for the organization, powers and duties, services, and staff of the emergency organization. Such plan shall take effect upon adoption by resolution of the board of supervisors.

Fire Prevention (Chapter 7)

There is hereby adopted by the board of supervisors, county of Colusa, for the purpose of prescribing regulations governing conditions hazardous to life and property from fire or explosion, that certain code known as the Uniform Fire Code, recommended by the Western Fire Chiefs Association and the International Conference of Building Officials, being particularly the 1982 edition thereof and the whole thereof, save and except such portions as are hereinafter deleted, modified or amended by Sections 7-3 through 7-3.17 of this chapter, of which code not less than three copies have been and are now filed in the office of the clerk of the county of Colusa, and the ex officio clerk to the board of supervisors, and the same are hereby adopted and incorporated as fully as if set out at length herein and from the date on which this article shall take effect, the provisions thereof shall be controlling within the limits of the unincorporated areas of the county of Colusa. (Ord. No. 397, § 1; Ord. No. 432, § 1.)

Weed Abatement (Chapter 7A)

The purpose of this chapter is to provide for the removal of weeds from around the exterior of improvements situated in the unincorporated areas of the county so as to reduce the potential for fire, exposure to potential for fire, exposure to poisons and noxious substances and to promote the public health, safety and welfare of the community.

The board of supervisors finds that on many lots or parcels of land located in the unincorporated areas of the county, the growth and accumulation of weeds during the summer and fall months of the year poses a severe fire and safety hazard, both to persons and property; that the growth and accumulation of weeds presents difficult conditions for fire suppression efforts; that the growth and accumulation of weeds is allowed to occur by significant numbers of property owners, many of whom live out of the county and/or the state.

Based upon these findings, the board of supervisors declares that the existence of weeds in the unincorporated areas of the county constitutes a nuisance of a seasonal and recurring nature and that the weeds in these areas should be removed by the owners of the respective lots or parcels and, in the absence of such voluntary removal, that the weeds may be abated and removed by the county fire districts as set forth in this chapter. (Ord. No. 437, § 2 (part).)

Land Grading and Leveling (Chapter 9)

The board of supervisors finds that the regulations contained in this chapter governing the grading and levelling of land, the obstruction of or change in the natural drainage, and the control of irrigation and drainage water resulting therefrom are necessary for the protection of roads, highways, and other public properties and improvements pertaining to public health, safety, convenience and general welfare. (Ord. No. 414, § 2 (part).)

No person shall grade or level, cause to be graded or levelled, or commence grading or levelling operations upon any land area of five or more acres, or move, excavate, remove, dredge, pile or stockpile earth or other material so as to change, or cause to be changed, the natural course of any channel or waterway without first having complied with the provisions of this chapter.

Flood Damage Prevention (Chapter 33)

The flood hazard areas of Colusa County are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety, and general welfare. These flood losses are caused by uses that are inadequately elevated, floodproofed, or protected from flood damage. The cumulative effect of obstructions in areas of special flood hazards which increase flood heights and velocities also contribute to the flood loss. (Ord. No. 822, Exh. A.)

It is the purpose of this chapter to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains; electric, telephone and sewer lines; and streets and bridges located in areas of special flood hazard;
- Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future blighted areas caused by flood damage;
- Ensure that potential buyers are notified that property is in an area of special flood hazard; and
- Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

In order to accomplish its purposes, this chapter includes methods and provisions to:

- Restrict or prohibit uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or flood heights or velocities;
- Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters;
- Control filling, grading, dredging, and other development which may increase flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas.

This chapter shall apply to all areas of special flood hazards within the jurisdiction of Colusa County, commonly designated as zone(s) A or AE.

A development permit shall be obtained before any construction or other development begins within any area of special flood hazard established in section 33-3.2. Application for a development permit shall be made on forms furnished by the floodplain administrator and may include, but not be limited to: plans in duplicate drawn to scale showing the nature, location, dimensions, and elevation of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities; and the location of the foregoing.

Groundwater Management (Chapter 43)

It is the long-standing policy of the county of Colusa to conserve and encourage agricultural operations within the county. The county general plan establishes the preservation and promotion of agriculture in its various forms as being the highest priority goal in the county planning process. Other legislative acts of the county board of supervisors, including but not limited to the adoption of the "right to farm" ordinance, are further evidence of the existing policy.

It is essential for the protection of the health, welfare, and safety of the residents of the county and the public benefit of the state, that county groundwater resources be protected from harm resulting from the extraction of groundwater for use on lands outside the county and its groundwater basins unless and until such time as needed additional surface water supplies are obtained for use on county lands and over-development of groundwater resources is addressed to the satisfaction of the board. (Ord. No. 615, (part): Ord. No. 770, § 1 (Exh. A) (part).)

Zoning Code (Chapter 44)

The zoning code carries out the policies of the Colusa County General Plan by classifying and regulating the uses of land and structures, consistent with the General Plan. This zoning code is adopted to protect and promote the public health, safety, comfort, convenience, prosperity, and general welfare of residents, and businesses in the unincorporated County. More specifically, the purpose of this zoning code is to:

- Provide standards and guidelines for the continuing orderly growth and development that will assist in encouraging economic growth, protecting the rural and agricultural character, and providing property owners the ability to develop and optimize the use of their land;
- Promote the County's agricultural character and open spaces, including view sheds, cultural and historic resources, forests, hills, and waterways;

- Promote proposed development and new land uses that conserve energy and natural resources;
- Create a comprehensive and stable pattern of land uses upon which to plan transportation, water supply, waste water, energy, and other public facilities and utilities;
- Promote proposed development within established communities that is designed to contribute to the character of the community, through compatible building types and appearance, attractive streetscapes, and appealing pedestrian spaces; and
- Promote compatibility between different types of development and land uses.

It is unlawful and a violation of this zoning code for any person to establish, construct, reconstruct, alter, or replace any use of land or structure, except in compliance with the requirements of this zoning code. No planning permit, building permit, or grading permit shall be issued by the County unless the proposed development complies with all applicable provisions of this zoning code. (Ord. No. 765 § 2 (Exh. A) (part))

Any subdivision of land proposed after the effective date of this zoning code shall be consistent with the minimum lot size requirements of Article 44-2 (Zoning Classifications, Allowed Uses, and Development Standards) and Colusa County Code Appendix IV (Subdivisions), and all applicable requirements of this zoning code. (Ord. No. 765 § 2 (Exh. A) (part))

The provisions of this zoning code shall be minimum requirements for the promotion of the public health, safety, and general welfare. When this zoning code provides for discretion or common sense interpretation on the part of a County official or body, that discretion or interpretation may be exercised to require more stringent measures than set forth in this zoning code, in order to promote orderly land use and development, agricultural resource protection, and the other purposes of this zoning code.

4.4.2. Colusa County's Administrative/Technical Mitigation Capabilities

Table 4-121 identifies the County personnel responsible for activities related to mitigation and loss prevention in the County.

Table 4-121 Colusa County Administrative/Technical Mitigation Capabilities

Administration	In Place Y/N	Describe capability Is coordination effective?
Staff		**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Y/FT	Y
Civil Engineer, including dam and levee safety	N	
Community Planner	Y/FT	Limited training on hazards and mitigation of such hazards
Emergency Manager	Y/FT	Does not have a designation to enforce any codes
Floodplain Administrator	Y/FT	As part of the FT department head's duties and not a separate position
GIS Coordinator	N	

Planning Commission	Y	Reviewing entity for changes to local ordinances including ordinances designed to address hazards
Other		
Technical	**Y/N**	**Has capability been used to assess/mitigate risk in the past?**
Grant writing	N	
Hazard data and information	Y	FT staff in various departments uses analysis to do so
GIS analysis	N	
Mutual aid agreements	N	
Other	Y	Local capability to perform mitigation duties like tree trimming and drain maintenance is effective, however some drains are privately owned and some do not take responsibility for maintenance.
How can these capabilities be expanded and improved to reduce risk?		
Only if more positions are added to various departments. Many County staff currently fill more than one role, making expansion difficult with current staffing levels. Increased grant funding could allow additional staff to be hired.		

4.4.3. Colusa County's Fiscal Mitigation Capabilities

Table 4-122 identifies financial tools or resources that the County could potentially use to help fund mitigation activities.

Table 4-122 Colusa County Fiscal Mitigation Capabilities

Funding Resource	In Place 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		
Community Development Block Grant	Y	The County does have access to CDBG funding
Federal funding programs (non-FEMA)		
Fees for water, sewer, gas, or electric services		
Impact fees for new development	Y	Development Impact Fees have been utilized for specific improvements
State funding programs	Y	CA DWR Grants and Cal OES grants. Other grant sources have been used.
Stormwater utility fee	N	
Other		

Funding Resource	In Place 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?
How can these capabilities be expanded and improved to reduce risk?		
Look for grant or other funding opportunities, both from stated and federal grants. Increased staff would be needed to both apply for and manage any future grant opportunities. Many County staff currently fill more than one role, making expansion difficult with current staffing levels.		

4.4.4. Colusa County Mitigation Education, Outreach, and Partnerships

Table 4-123 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 4-123 Colusa County Mitigation Education, Outreach, and Partnerships

Program/Organization	In Place Y/N	How widespread are each of these in your community?
Community newsletters	Y	Limited for hazard information
Hazard awareness campaigns (such as Firewise, Storm Ready, Severe Weather Awareness Week, school programs, public events)	Y	OES provides some public outreach and education. Education always helps mitigation activities.
Local news		
Organizations that interact with underserved and vulnerable communities	Y	This has recently been expanded.
Social media	Y	Instagram and Facebook
Other		
How can these capabilities be expanded and improved to reduce risk?		
Additional hazard info can be placed in community newsletters. The County has recently done increased outreach to underserved communities. That will be continued, and the County will seek to increase this. Seek to increase public/private partnerships. Current County funding makes this difficult.		

4.5 Natural Hazards Summary

As detailed in the hazard identification section, those hazards identified as a high or medium significance in Table 4-124 are considered priority hazards for mitigation planning. Those hazards that occur infrequently or have little or no impact on each jurisdiction in the Colusa County 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, natural and cultural resources, and economic damage. The ability of a jurisdiction 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 Planning Committee to

prioritize those hazards of greatest significance to each jurisdiction in the Colusa County Planning Area, enabling the jurisdictions to focus resources where they are most needed. ***Note***: originally landslide and subsidence were priority hazards for Colusa County. After review of the hazards, possible mitigation actions, and the County's current capabilities, these hazards were moved to low priority hazards for mitigation planning for this LHMP Update.

Table 4-124 Hazard Identification and Initial Determination of Priority Hazards

Hazard	Likelihood of Future Occurrence	Priority Hazard
Ag Hazards: Severe Weather/Invasive Species	Highly Likely	Y
Climate Change	Highly Likely	Y
Dam Failure	Occasional	Y
Drought & Water shortage	Likely	Y
Earthquake	Likely /Unlikely	Y
Floods: 1%/0.5%/0.2% annual chance	Occasional / Unlikely	Y
Floods: Localized Stormwater	Highly Likely	Y
Landslide, Mudslide, and Debris Flow	Likely	N
Levee Failure	Occasional	Y
Severe Weather: Extreme Cold and Freeze	Highly Likely	Y
Severe Weather: Extreme Heat	Highly Likely	Y
Severe Weather: Heavy Rain and Storms (Wind, Hail, Lightning)	Highly Likely	Y
Severe Weather: High Winds and Tornados	Highly Likely / Occasional	Y
Stream Bank Erosion	Highly Likely	Y
Subsidence	Likely	N
Wildfire	Highly Likely	Y