Tehama County

MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN
2018 PLAN UPDATE



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Tehama County

Multi-Jurisdictional Hazard Mitigation Plan

Volume 1

Planning-Area-Wide Elements

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Acknowledgments

Project Manager

Ryan Teubert, CFM
Flood Control/Water Resources Manager
Tehama County Flood Control and Water Conservation District
9380 San Benito Avenue
Gerber, CA 96035
Phone: 530-385-1462
Email: rteubert@tcpw.ca.gov

Other Tehama County Staff

Dennis Garton, Tehama County Board of Supervisors
Bill Goodwin, Tehama County Administration
Julie Sisneros, Tehama County Administration
Rick Gurrola, Tehama County Agriculture
David Stoffel, Tehama County Agriculture
John Stover, Tehama County Building and Safety
Tim Potanovic, Tehama County Environmental Health
David Brower, Tehama County Environmental Health
Lauri Dilworth, Tehama County Environmental Health
Randy Rapp, Tehama County Fire/CAL FIRE
Matt Chamblin, Tehama County Fire/CAL FIRE
Brian DeSmet, Tehama County Fire/CAL FIRE
Kristen Maze, Tehama County Planning
Gary Antone, Tehama County Public Works
Tim McSorley, Tehama County Public Works
Steve Mackey, Tehama County Public Works
Rod Daugherty, Tehama County Sheriff's Office

Steering Committee

Ryan Teubert, Tehama County
Rod Daugherty, Tehama County
Randy Rapp, Tehama County Fire/CAL Fire
Dawn Grine, City of Corning
Robin Kampmann, City of Red Bluff
Scott Miller, City of Red Bluff
Carolyn Steffan, City of Tehama

Consultants

Ethan Mobley, AICP, Project Manager, Dynamic Planning + Science
Brian Greer, Data Visualization Manager, Dynamic Planning + Science
Tammy Kulpa, Planner, Dynamic Planning + Science
Alex Krebs, GIS Associate, Dynamic Planning + Science
French Wetmore, French & Associates

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EXECUTIVE SUMMARY

Tehama County

MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

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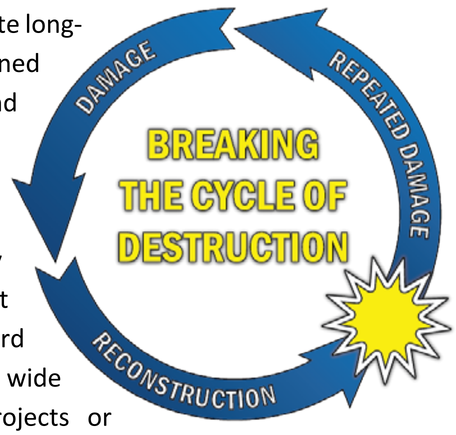
Executive Summary

Tehama County prepared this hazard mitigation plan to guide County and City Officials to protect the people and property of the County from the effects of natural disasters and hazard events. This plan demonstrates Tehama County's commitment to reducing risks from hazards through mitigation and serves as a tool to direct County resources to achieve optimum results with available administrative, technical and financial resources.

The term **"hazard mitigation"** refers to actions or strategies that can reduce or eliminate long-term risks caused by natural disasters. Mitigation activities can be developed, planned and executed before a disaster occurs or after. Oftentimes after disasters, repairs and reconstruction are completed in such a way as to simply restore damaged property to pre-disaster conditions. These efforts may return property and infrastructure to "the norm", but the replication of pre-disaster conditions may result in a repetitive cycle of damage and reconstruction. Hazard mitigation planning in Tehama County can break this repetitive cycle by producing less vulnerable conditions through smart construction, proper planning of future development and critical infrastructure. Hazard mitigation activities can also reduce risk around residents and infrastructure through a wide variety of mitigation strategies like construction of regional flood control projects or implementing fuel reduction around buildings within high wildfire risk areas.



What is a hazard mitigation plan?

This hazard mitigation plan provides an explanation of prevalent hazards within the County and how hazards may affect population and property differently across the County. The plan also contains information on natural hazard threats within Tehama County which identifies risks to vulnerable assets (people and property). Most importantly the mitigation strategy presented in this plan responds to the particular vulnerabilities and provides prescriptions or actions to achieve the greatest reduction of vulnerability, which results in saved lives, reduced injuries, reduced property damage, and protection for the environment in the event of a natural hazard. This plan provides information for the following natural hazard threats:

Dam Failure

Drought

Earthquake

Flooding

Slope Failure

Severe Weather

Wildfire

Why have a hazard mitigation plan?

The purpose of the plan is twofold. First, it provides the County and participating jurisdictions continued access to grant funding from the Federal Emergency Management Agency (FEMA) to conduct hazard mitigation activities for County and City owned facilities. Secondly, it provides resources (fiscal and technical) for residents wishing to conduct hazard mitigation efforts. The passage of the Disaster Mitigation Act in 2000 (DMA 2000) requires proactive pre-disaster planning as a condition of receiving certain financial assistance under the Robert T. Stafford Act. DMA 2000 encourages state and local authorities to work together on pre-disaster planning to assist local governments to accurately assess mitigation needs, resulting in faster allocation of funding and more cost-effective risk reduction projects.

Why is the plan updated so often?

As a DMA 2000 requirement, the plan must be updated every five (5) years to remain in compliance with federal mitigation grant conditions. Federal regulations require hazard mitigation plans to include a plan for monitoring, evaluating, and updating the hazard mitigation plan. An update process provides an opportunity to reevaluate recommendations, monitor the impacts of actions that have been accomplished, and determine if there is a need to change the focus of mitigation strategies over time. Grant compliance is contingent on meeting the plan update requirements that are contained in the code of federal regulations (44 CFR §201.6.). Jurisdictions that allow a plan to expire are not able to pursue funding under the Robert T. Stafford Act for which a current hazard mitigation plan is a prerequisite.

Participating Jurisdictions

The Tehama County Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers the entire area within Tehama County's jurisdictional boundaries (hereinafter referred to as the planning area). A planning partnership was formed to develop and steer content in this plan. This partnership consists of Tehama County and local government planning partners who worked together to create the goals, objectives, mitigation strategies and implementation methods to reduce risk. Any jurisdiction or organization may participate in the planning process. However, to obtain FEMA approval, each of the local jurisdictions must meet all requirements of 44 CFR §201.6. The following jurisdictions have elected to become participating jurisdictions as part of this plan update:

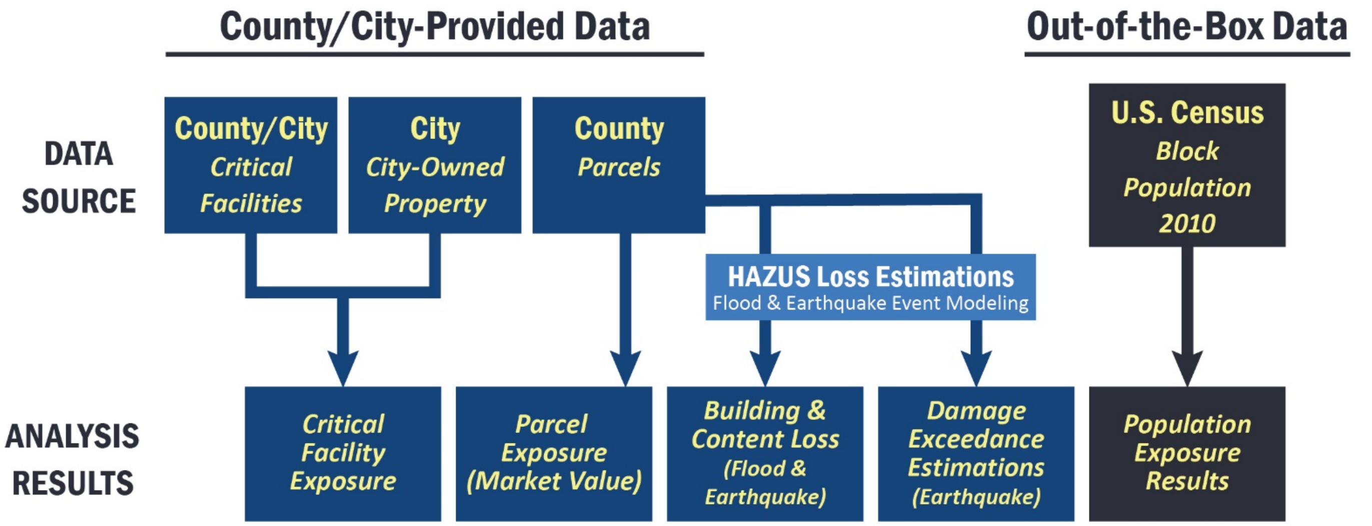
Tehama County	**Umbrella Plan:** **VOLUME 1**
City of Corning	**Participating Jurisdictions:** **Volume 2**
City of Red Bluff	
City of Tehama	

2018 Plan Development and Update Methodology

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. This plan documents the hazard mitigation planning process and identifies relevant hazards and vulnerabilities and strategies the County and participating jurisdictions will use to decrease vulnerability and increase resiliency and sustainability in the community. Tehama County followed a six phase process to develop this 2018 update. This included a re-organization of planning partners, development of a new risk assessment, revaluation of goals and objectives, development of new mitigation actions, new enhancements for implementing mitigation actions, updates to all sections of the 2012 plan, and a new website for stakeholder involvement and public information.

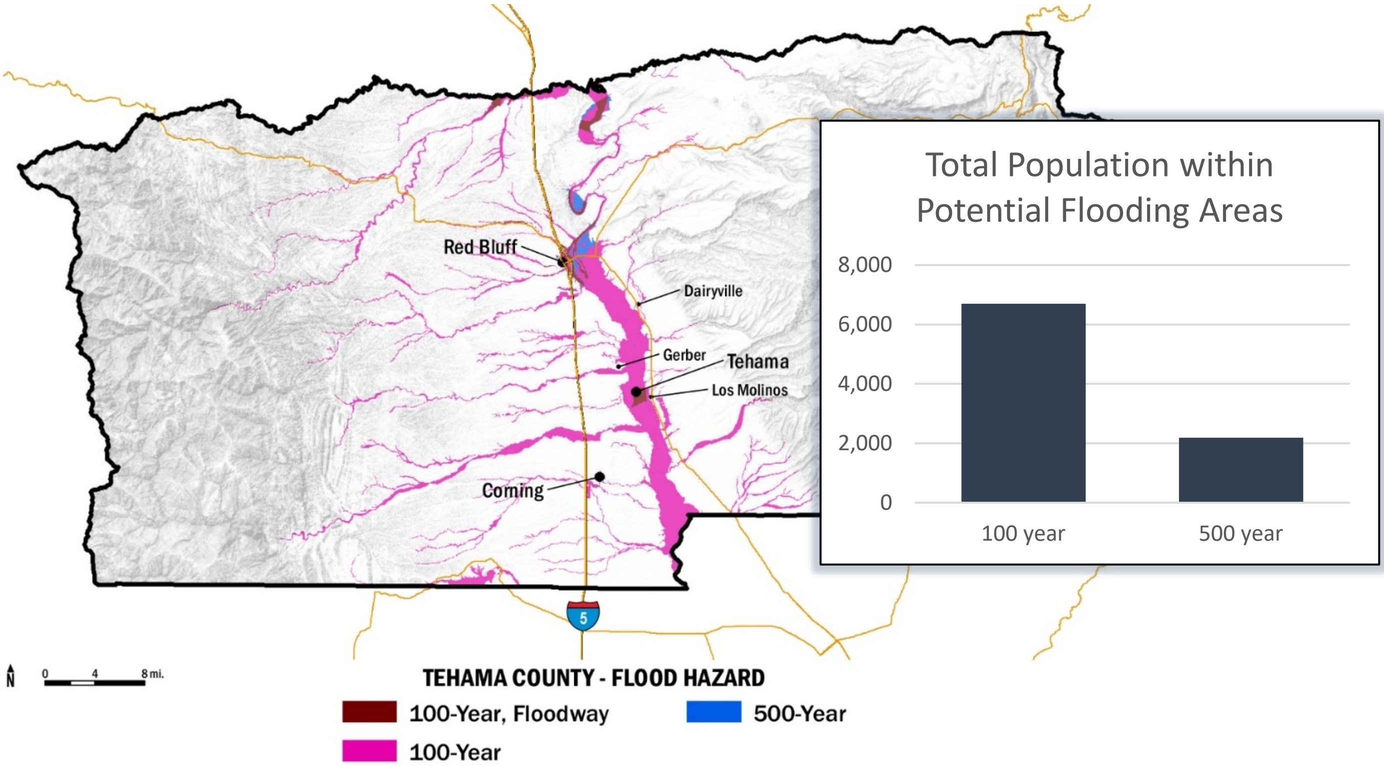
2018 Risk Assessment

A new risk assessment was conducted for each of the identified priority hazards. Geospatial data is essential in determining population and assets exposed to particular hazards. Geospatial analysis can be conducted if a natural hazard has a particular spatial footprint that can be overlaid against the locations of people and assets. In Tehama County earthquakes, flooding, slope failure, dam failure and wildfire have known geographic extents and corresponding spatial information about each hazard. The below graphic represents GIS data sources and analysis results for the 2018 risk assessment methodology.



Population and Asset Exposure

In order to describe vulnerability for each hazard, it is important to understand the "total" population and "total" assets at risk. The exposure for each hazard described in this section will refer to the percent of total population or percent of total assets. This provides the possible significance or vulnerability to people and assets for the natural hazard event and the estimated damage and losses expected during a "worst case scenario" event for each hazard. The sections below provide a description of the total population, critical facilities, and parcel exposure inputs.

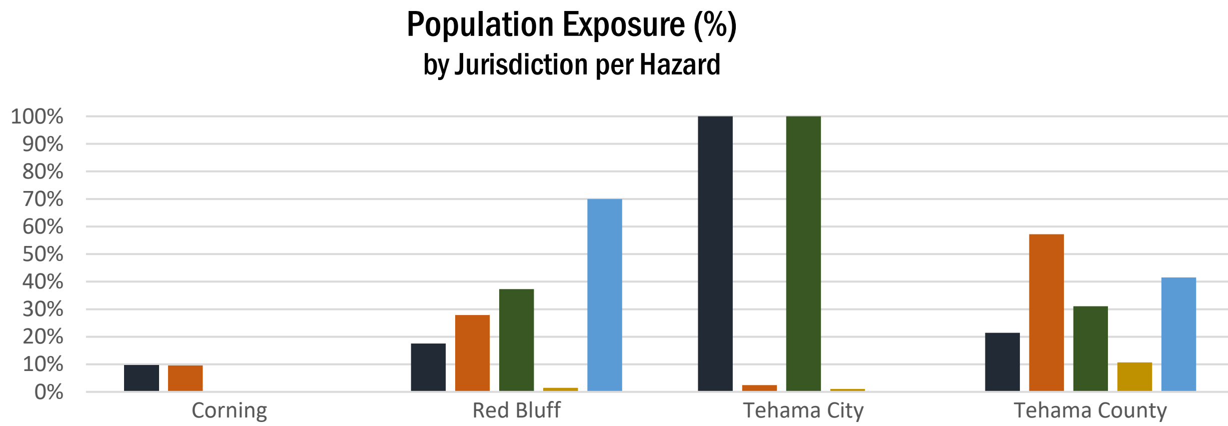


Summary of Vulnerable Assets (People, Value and Infrastructure)

Hazards with spatial boundaries can be evaluated to demonstrate the amount of population, critical infrastructure and parcel data within each hazard's footprint. At-risk populations, critical infrastructure, improved parcels, and loss results for each hazard category are provided in bar chart summary tables throughout this plan to evaluate the percentage of assets exposed to different types of hazards. The side-by- side comparison allows officials to evaluate the impacts of potential hazards to determine what hazards to direct energy and financial resource for mitigation activities. For detailed vulnerabilities assessment information see the individual hazard specific sections presented in the 2018 MJHMP.

Populations

Figure ES- 1 exhibits the percentage of total population of Tehama County residents by jurisdiction living within a known high hazard area such as flood zones, wildfire, dam failure, earthquake and potential areas of slope failure. Earthquake has the largest spatial footprint and could potentially affect more than people within the County and municipalities. However, casualties or injuries to the population is highly unlikely with the earthquake scenarios described in this plan. Potential for casualties is minimized due to date of building construction and type of structures within the County.

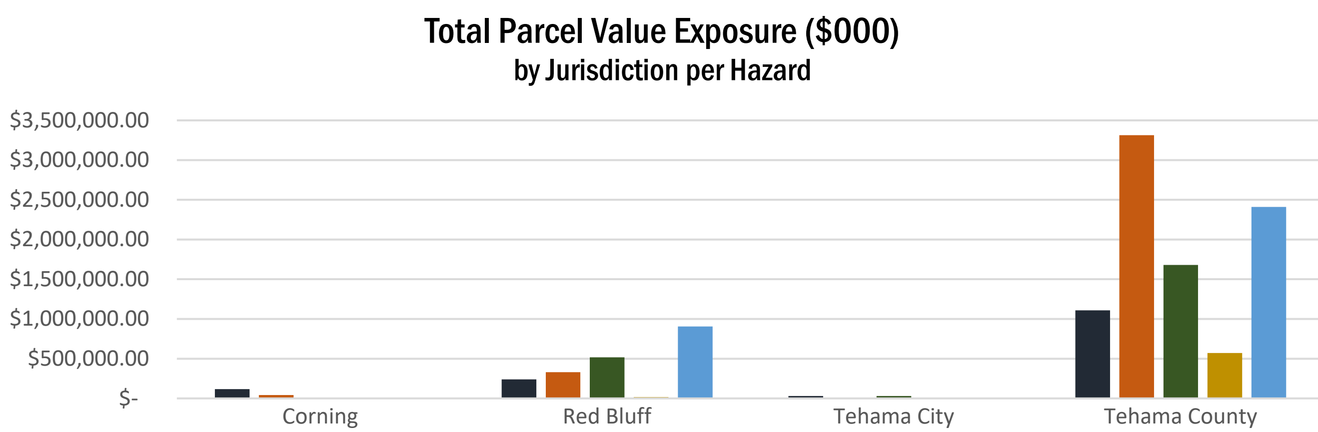


	Corning	Red Bluff	Tehama City	Tehama County
Flood	10%	18%	100%	21%
Wildfire	10%	28%	2%	57%
Dam	0%	37%	100%	31%
Slope Failure	0%	1%	1%	11%
Earthquake	0%	70%	0%	42%

Figure ES- 1: Population Exposure Summary Graphic

Improved Parcel Values at Risk

Parcel exposure by hazard comparison summaries are provided in Figure ES- 2 and Figure ES- 3. Figure ES- 2 provides total parcel values in areas within known hazard risk. Figure ES- 3 provides a percentage of total improved value within a known hazard based on the parcel information by hazard.



	Corning	Red Bluff	Tehama City	Tehama County
Flood	$116,773.81	$240,282.20	$30,459.26	$1,109,285.65
Wildfire	$43,059.82	$330,393.80	$891.52	$3,312,976.80
Dam	$-	$516,516.16	$30,459.26	$1,680,518.56
Slope Failure	$-	$16,253.86	$1,875.67	$572,494.88
Earthquake	$-	$905,560.00	$-	$2,410,983.56

Figure ES- 2: Total Parcel Values vs. Hazard Summary Graphic

Mitigation Guiding Principle, Goals and Objectives

The following guided the steering committee and the planning partnership in selecting the initiatives contained in this plan:

GUIDING PRINCIPLE

Through mitigation, reduce the vulnerability to natural hazards in order to protect the health, safety, welfare and economy of the residents and communities.

GOALS

GOAL #1
Enable residents to mitigate the impacts of hazards and disasters.

GOAL #2
Improve coordination of stakeholders to reduce risk through mitigation planning on a continual basis.

GOAL #3
Implement long-term, cost-effective, mitigation activities for the current and future built environment.

OBJECTIVES

1. Educate the public on the risk from natural hazards.
2. Support and encourage mitigation measures for homeowners in high-risk areas.
3. Maintain and make available maps of identified risk areas, and improve early warning emergency response systems.
4. Increase resilience of infrastructure and critical facilities.
5. Establish partnerships among government, businesses and communities to implement mitigation activities
6. Consider the impacts of natural hazards for future development.

Mitigation Strategy

The mitigation strategies and actions are the vital outcomes of a mitigation planning process. It is through the implementation of these initiatives that will enable Tehama County and participating communities to become disaster-resistant. Although one of the driving influences for preparing this plan was grant funding eligibility, its purpose is more than just access to federal funding. Some of the initiatives outlined in this plan are not geared toward grant eligibility under HMGP. Rather, the focus was the initiatives' effectiveness in achieving the goals of the plan and whether they are within each jurisdiction's capabilities. This planning process resulted in the identification of County and City specific mitigation actions to be targeted for implementation. Mitigation actions are located in the Documents here:

County Specific Mitigation Strategy: Volume 1, Section 5.5

City of Corning Mitigation Strategy: Volume 2, Section 1.5

City of Red Bluff Mitigation Strategy: Volume 2, Section 2.5

City of Tehama Mitigation Strategy: Volume 2, Section 3.5

Mitigation Action Implementation

Despite the County's efforts, no amount of planning or mitigation can prevent disasters from occurring or eliminate the risk and impacts of such events all together. Natural disasters will continue to occur; the County will take actions to reduce the risks and impacts these hazards pose to life, property, and economy. While this Hazard Mitigation Plan seeks to identify opportunities for reasonable mitigation actions, each individual has a responsibility to be aware of the potential hazards where they live and to minimize their own household's vulnerability.

The County's ability to carry out mitigation actions is limited to those facilities it has authority over. The County does not have direct authority over schools, fire, water and sanitation districts, private gas, electric and communication utilities, state and federal highways and facilities, private hospitals, neighboring cities and tribes. The County will focus on things it is empowered to do while still seeking to cooperatively work with other entities to address mutual areas of vulnerability and interdependence.

Full implementation of the recommendations of this plan will take time and resources. The measure of the plan's success will be the coordination and pooling of resources within the planning partnership. Keeping this coordination and communication intact will be the key to the successful implementation of this plan. Teaming together to seek financial assistance at the state and federal level will be a priority to initiate projects that are dependent on alternative funding sources. This plan was built upon the effective leadership of a multi-disciplined steering committee and a process that relied heavily on public input and support. The plan will succeed for the same reasons.

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Adoption Records

To comply with DMA 2000, the County Board of Supervisors has officially adopted the 2018 Tehama County Multi-Jurisdictional Hazard Mitigation Plan Volume 1 and Volume 2. The adoption of the 2018 MJHMP in its entirety recognizes the County's commitment to reducing the impacts of natural hazards within the Cities and County. See below record of Adoption.

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TEHAMA COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN 2018 UPDATE A RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF TEHAMA ADOPTING THOSE PORTIONS OF THE TEHAMA COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN 2018 UPDATE APPLICABLE TO THE COUNTY OF TEHAMA

RESOLUTION NO. 59-2018

WHEREAS, Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the federal Disaster Mitigation Act (DMA) of 2000 emphasizes the need for pre-disaster mitigation of potential natural hazards; and

WHEREAS, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple Federal Emergency Management Agency (FEMA) pre- and post-disaster mitigation grant programs; and

WHEREAS, Tehama County fully participated in the FEMA-prescribed mitigation planning process to prepare the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update; and

WHEREAS, the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update has been developed by the Tehama County Department of Public Works, Tehama County Flood Control and Water Conservation District, and Tehama County Sheriff's Office of Emergency Services in cooperation with other county departments, local officials, and the citizens of Tehama County, and

WHEREAS, the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update has been developed with assistance and cooperation by the participating jurisdictions of City of Corning, City of Red Bluff, and City of Tehama and officially recognizes these agencies as participating jurisdictions within the multi-jurisdictional planning process.

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update, and

WHEREAS, the California Office of Emergency Services and FEMA Region IX officials have reviewed the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update and approved it contingent upon adoption by the participating governing bodies; and

WHEREAS, the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update recommends mitigation activities that could reduce losses to life and property affected by both natural and human-made hazards that face the County and its municipal governments,

NOW, THEREFORE, BE IT RESOLVED AND ORDERED that Tehama County adopts the "Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 Update" as an official plan; and the respective officials and agencies identified in the implementation strategy of the plan are hereby encouraged to implement the recommended activities assigned to them.

BE IT FURTHER RESOLVED that the Tehama County Board of Supervisors hereby finds that the adoption of the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2018 is not subject to review under the California Environmental Quality Act (CEQA) pursuant to CEQA Guidelines sections 15060, subdivision (c)(2) (the activity will not result in a direct or reasonably foreseeable indirect physical change in the environment) and 15061, subdivision (b)(3) (there is no possibility the activity in question may have a significant effect on the environment). In addition to the foregoing general exemptions, the County of Tehama further finds that the Tehama County Multi -Jurisdictional Hazard Mitigation Plan is exempt from review under CEQA under CEQA Guidelines section 15262 (feasibility or planning studies)

BE IT FURTHER RESOLVED, Tehama County Department of Public Works will submit this Adoption Resolution to the California Office of Emergency Services and Federal Emergency Management Agency, Region IX officials to enable the Plan's final approval.

The foregoing resolution was offered on a motion by Supervisor Garton seconded by Supervisor Chamblin and carried by the following vote of the Board:

AYES: Supervisors Garton, Chamblin, Williams, Bundy and Carlson
NOES: None
ABSENT OR NOT VOTING: None

STATE OF CALIFORNIA)
) ss
COUNTY OF TEHAMA)

I, JENNIFER VISE, COUNTY Clerk and ex-officio Clerk of the Board of Supervisors of the County of Tehama, State of California hereby certify the above and foregoing to be a full, true and correct copy of a resolution adopted by said Board of Supervisors on this 26th day of June, 2018.

Dated: This 2nd day of July, 2018.

JENNIFER VISE, County Clerk and ex-officio Clerk of the Board of Supervisors of the County of Tehama, State of California

By ______________________
Deputy

VOLUME 1

Tehama County

MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

2018 PLAN UPDATE

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Section 1. Introduction

1.1 Participating Jurisdictions

The Tehama County Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers the entire area within Tehama County's jurisdictional boundaries (hereinafter referred to as the planning area). A planning partnership was formed to develop and steer content in this plan. This partnership consists of Tehama County and local government planning partners who worked together to create the goals, objectives, mitigation strategies and implementation methods to reduce risk. Any jurisdiction or organization may participate in the planning process. However, to obtain FEMA approval, each of the local jurisdictions must meet all requirements of 44 CFR §201.6. The following jurisdictions have elected to become participating jurisdictions as part of this plan update, as shown in Figure 1-1:

- **Tehama County**
- **City of Corning**
- **City of Red Bluff**
- **City of Tehama**

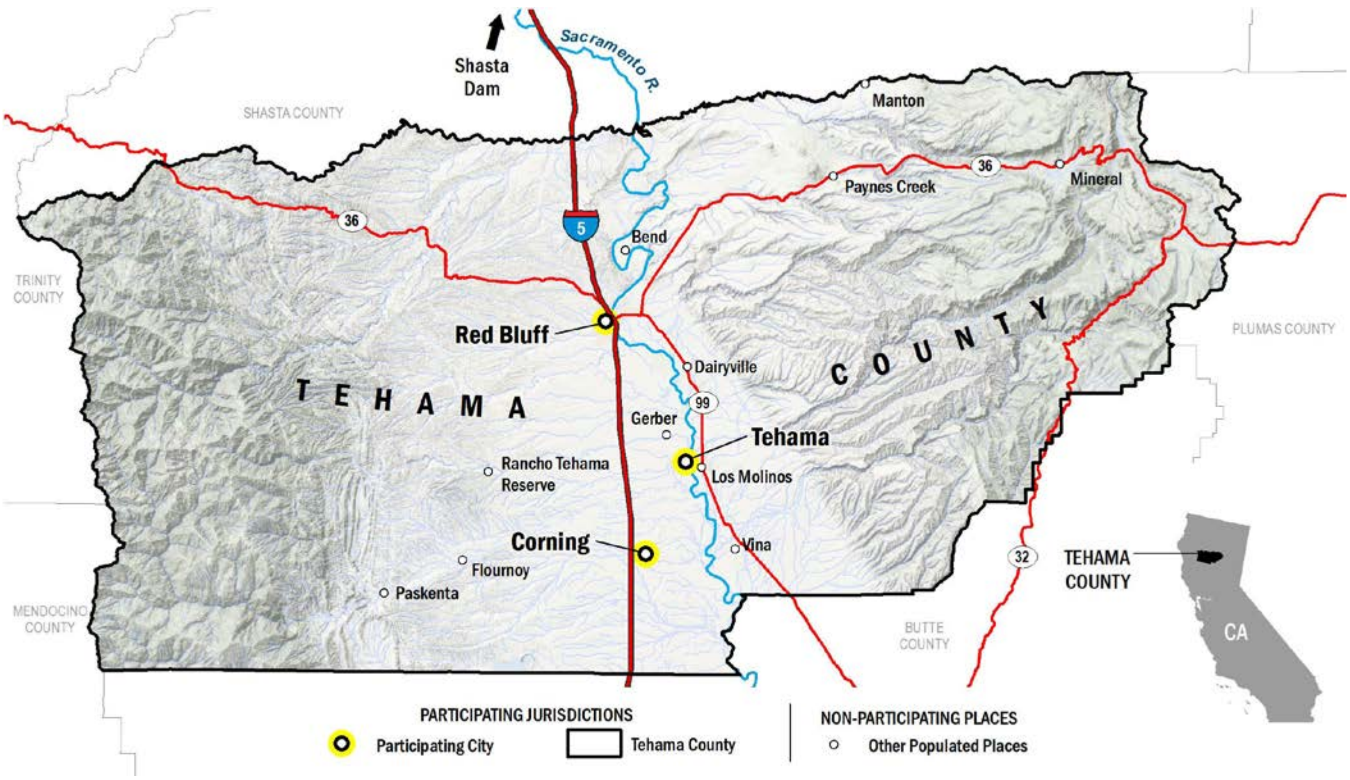

Figure 1-1: Participating Jurisdictions Map

1.2 Why Update This Plan?

Hazard mitigation is defined as a way to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster through long and short-term strategies. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many; including private property owners, business and industry and local, state and federal government.

The Federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) required state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. Prior to 2000, federal disaster funding focused on disaster relief and recovery, with limited funding for hazard mitigation planning. The DMA increased the emphasis on planning for disasters before they occur.

The DMA encourages state and local authorities to work together on pre-disaster planning, and it promotes sustainability for disaster resistance. Sustainable hazard mitigation includes the sound management of natural resources and the recognition that hazards and mitigation must be understood in the largest possible social and economic context. The enhanced planning network called for by the DMA helps local government articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects.

1.2.1 Purposes for Planning

This hazard mitigation plan identifies resources, information, and strategies for reducing risk from natural hazards. Several factors initiated this planning effort by Tehama County and the local jurisdictions that participated as planning partners:

- The Tehama County area has significant exposure to numerous natural hazards that have caused millions of dollars in past damage.
- The partners want to be proactive in preparedness for the probable impacts of natural hazards.
- Limited local resources make it difficult to implement proactive risk-reduction measures. Federal and State financial assistance is paramount to successful hazard mitigation in the area.

Elements and strategies in the plan were selected because they best meet the needs of the planning partners and their citizens. The plan was developed to meet the following objectives:

- Meet or exceed requirements of the DMA and SB 379
- Enable all planning partners to continue using federal grant funding to reduce risk through mitigation.
- Meet the needs of each planning partner as well as state and federal requirements.
- Create a risk assessment that focuses on Tehama County hazards of concern.

- Create a single planning document that integrates all planning partners into a framework that supports partnerships within the County, and puts all partners on the same planning cycle for future updates.
- Meet the planning requirements of FEMA's Community Rating System (CRS), allowing planning partners that participate in the CRS program to maintain or enhance their CRS classifications.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.

1.3 Who Will Benefit from This Plan?

One benefit of multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning under its guidance for the DMA. The plan will help guide and coordinate mitigation activities throughout Tehama County.

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

1.4 How to Use This Plan

This plan has been set up in two volumes so that elements that are jurisdiction-specific can easily be distinguished from those that apply to the whole planning area:

- **Volume 1**—Volume 1 includes all federally required elements of a hazard mitigation plan that apply to the entire planning area. This includes the description of the planning process, public involvement strategy, goals and objectives, countywide hazard risk assessment, countywide mitigation initiatives, and a plan maintenance strategy. Volume 1 includes the following appendices:
  - Appendix A—Mitigation Action Tracker (Short List)
  - Appendix B—Planning Process Documentation
- **Volume 2**—Volume 2 includes all federally required jurisdiction-specific elements, in annexes for each participating jurisdiction. It describes participation requirements established by the steering committee.. All planning partners have adopted Volume 1 in its entirety and each partner's jurisdiction-specific annex from Volume 2.

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Section 2. What's New

This section of the plan includes background information on the 2012 HMP and the 2018 MJHMP Updates. The 2012 Mitigation Actions were reviewed and have been changed, updated, and revised to reflect new priorities in the 2018 MJHMP. The sections below describe the background and planning process for 2018 changes and updates.

2.1 2012 HMP vs 2018 MJHMP Participating Jurisdictions

In October of 2012, the County met all approval requirements from DMA 2000 and officially adopted its first HMP as required. Eligibility status of the planning partnership was monitored by the Tehama County Point of Contact (POC) over the five year update process. The determination of whether a partner is meeting its participation requirements was based on the following parameters:

- Progress reports being submitted annually by the specified time frames.
- Partners notifying the POC of changes in designated points of contact.
- Partners supporting the Steering Committee by attending designated meetings or responding to needs identified by the committee.
- Partners continuing to be supportive as specified in the planning partner expectations package provided to them at the beginning of the process.

As a result of limited resources and personnel changes, the 2018 participating jurisdictions have changes since the 2012 adoption. Table 2-1 tracks 2012 and 2018 Participating Jurisdictions:

Table 2-1: Participating Jurisdiction Tracker

Jurisdiction Name	2012 Participating Jurisdiction	2018 Participating Jurisdiction
Municipalities		
City of Corning	Y	Y
City of Red Bluff	Y	Y
City of Tehama	Y	Y
Special Purpose Districts		
Capay Fire Protection District	Y	N
Red Bluff Joint Union High School District	Y	N

Important to note: It was decided by the Tehama County POC that the Special Purpose Districts would no longer participate as standalone entities and would participate as stakeholders instead for 2018 MJHMP process. This was decided as a result of participation requirements specified in the maintenance and implementation procedures specified under chapter 7 in Volume 1 of the 2012 plan.

2.2 Mitigation Actions

During the 2018 County MJHMP update process, each of the 2012 “County Wide” mitigation actions were examined for relevancy and the potential for future implementation and then evaluated for potential follow up effort. Some mitigation actions developed during the 2012 HMP effort were found to be inherent of the HMP update process or were not detailed enough for implementation at a local jurisdictional level. Due to lack of detail and current day mitigation practices, the County has made significant changes to the 2012 Mitigation Actions. Mitigation Actions previously developed under the 2012 HMP have been completely refreshed as a result of the newly completed risk assessment, planning process and implementation strategy. Table 2-2 provides a record of 2012 “County Wide” Mitigation Actions, the status, and additional notes for each action.

Table 2-2: MJHMP Mitigation Action Record of Revision Review

Tehama Unincorporated Area 2012 Mitigation Action Tracker				
Action No.	**Hazard Addressed**	**Initiative**	**Completed, Deleted or Deferred**	**Explanation**
CW-1	All Hazard	Continue to maintain a countywide hazard mitigation plan website to house the plan and plan updates, in order to provide the public an opportunity to monitor plan implementation and progress. Each planning partner may support the initiative by including an initiative in its action plan and creating a web link to the website.	**Completed**	**See Mitigatehazard.com/Tehama-HMP**
CW-2	All Hazard	Leverage public outreach partnering capabilities to inform and educate the public about hazard mitigation and preparedness.	**Delete / Removed**	**Inherent of mitigation plan implementation.**
CW-3	All Hazard	Coordinate all mitigation planning and project efforts, including grant application support, to maximize all resources available to the planning partnership.	**Delete / Removed**	**Inherent of mitigation plan implementation.**

Tehama Unincorporated Area 2012 Mitigation Action Tracker				
Action No.	**Hazard Addressed**	**Initiative**	**Completed, Deleted or Deferred**	**Explanation**
CW-4	All Hazard	Support the collection of improved data (hydrologic, geologic, topographic, volcanic, historical, etc.) to better assess risks and vulnerabilities.	**Delete / Removed**	**Inherent of mitigation plan implementation.**
CW-5	All Hazard	Provide coordination and technical assistance in grant application preparation that includes assistance in cost vs. benefit analysis for grant-eligible projects.	**Deleted / Removed**	**Inherent of mitigation plan implementation.**
CW-6	All Hazard	Where appropriate, support retrofitting, purchase, or relocation of structures or infrastructure located in hazard-prone areas to protect structures/ infrastructure from future damage, with repetitive loss and severe repetitive loss properties as priority when applicable.	**Edited for 2018**	**Added specific facilities for specific hazards. This was divided into separate mitigation actions for each hazard with more detail for each.**
CW-7	All Hazard	Continue to maintain the steering committee as a viable committee to monitor the progress of the hazard mitigation plan, provide technical assistance to planning partners and oversee the update of the plan as necessary.	**Deleted / Removed**	**Inherent of mitigation plan implementation.**

2.3 New Analysis and Risk Assessment Methodology

The County has taken this opportunity to strengthen the plan through the use of new research methods and information systems. Geographic Information Systems (GIS) mapping has provided the County with the tools to develop data sets which are much more comprehensive than featured in the 2012 HMP.

The 2018 MJHMP focuses on natural hazards; the human-caused hazards of hazardous materials and public health hazards identified in the 2012 HMP have been removed, as these issues are generally covered by other planning initiatives such as the County's newly developed EOP and other regional emergency operations plans. The 2018 MJHMP features new mitigation actions which focus on four different classifications. These classifications include:

- Local Plans and Regulations – intended to reduce the County's vulnerability to future hazard events through the implementation of codes and regulations.
- Structure and Infrastructure Projects – intended to protect existing structures by retrofitting, relocating, or modifying the structure to withstand a hazard event.
- Natural Systems – to reduce the effects of hazards on the natural resources within a region by preserving and/or restoring natural areas along with their mitigation functions.
- Public Information and Awareness – to advise residents, potential buyers, and visitors about hazards, potentially hazardous areas, and mitigation techniques.

Since the 2012 Tehama County Hazard Mitigation Plan was adopted, the County has allowed single family residential (SFR) units to be built in Zone A flood zones. At least one of these SFRs was built in a flood way after a hydrology study and report showed it could safely be completed with the proper mitigation. However, these changes did not impact the County's vulnerability to these or other hazards. These structures were built to the standards established by the National Flood Insurance Program (NFIP), Community Rating System (CRS) (in participating communities) and the Tehama County Floodplain Management Regulations (Code Chapter 15.52). These regulations are explained in detail in Section 4.7.1 of this plan.

2.4 Successful Mitigation Activities Since 2012

The 2012 Tehama County HMP guiding principle, goals, objectives and mitigation actions have been implemented through various on-going projects, plans and programs. With respect to the mitigation action items and strategies developed in 2012, Tehama County has been making improvements toward reducing natural hazard risks to life and property within the County. Significant risk reduction efforts have been made for floodplain management, flood damage prevention, and fire hazard abatement. These successful policies, programs, and projects are summarized below.

Figure 2-1: Los Molinos Drainage improvements

2.4.1 Los Molinos Drainage Improvements

Related 2012 HMP Objectives:

- *Increase resilience of (or protect and maintain) infrastructure and critical facilities.*

Flow emanating from the developed area of Los Molinos drains to Champlin Slough, along the east side of State Route 99E. During high flow periods, water would sheet flow over and along the west side of State Route 99E. The drainage improvement conducted in 2017 was completed to capture and convey the high peak flows from the developed area. Before project improvements, the combination of direct runoff and overflow was difficult to capture given the low gradients in the Town of Los Molinos and the high-water surface elevations in the Sacramento River during times of flooding. (Los Molinos Drainage Study, Existing Condition Flood Hydrology, 2007). In 2017, storm drain improvements were made to Grant Street using a Community Development Block Grant (CDBG) and Tehama County Flood Control and Water Conservation District funds. The project included intersection and mid-block storm drains, roadway repairs, and the addition of curb and gutters along Grant, Sherwood and Orange Streets near the Los Molinos High School.

2.4.2 Elder Creek Levee Improvements

Related 2012 HMP Objectives:

- *Increase resilience of (or protect and maintain) infrastructure and critical facilities.*
- *Encourage hazard mitigation measures that minimize adverse effect on the natural environment.*

Figure 2-2: Elder Creek Improvements looking upstream after temporary repair

During December 2014, a series of high flow events on Elder Creek caused significant erosion on an existing stream bank. The ongoing erosion degraded the berm and was encroaching into the levee prism compromising its integrity. A permitted temporary emergency repair was completed in December of 2015, this included moving gravel from the middle of the channel up against the eroded portion of the levee and then covering the gravel with 12-24" rip-rap.

The Elder Creek Levee improvements and repair returned the recently eroded stream embankment to its historic location and the project also added armoring (rip-rap) to protect the channel embankment from future erosion during high flow periods.

2.4.3 DWR Canal Capacity Improvements

Figure 2-3: DWR Channel Improvements

Related 2012 HMP Objectives:

- *Increase resilience of (or protect and maintain) infrastructure and critical facilities.*
- *Encourage hazard mitigation measures that minimize adverse effect on the natural environment.*

The main components of the project included vegetation removal and herbicide spot treatment, sediment removal, disposal and haul of removed materials, revegetation with native grass species, and erosion control. The vegetation removal was needed to meet the flow conveyance capacity requirements as well as to provide a project site that can continue to be maintained by the DWR staff.

All arundo has been removed from the project site. Arundo is a very invasive and hardy species that requires additional treatment to ensure re-growth does not occur from the root balls. The DWR staff has removed and/or treated the arundo stumps with herbicides in the spring and fall as needed to ensure they do not re-sprout.

2.4.4 Upgrades to Reverse 911 System (Tehama Alert)

Related 2012 HMP Objectives:

- *Develop or improve early warning emergency response systems and evacuation procedures.*

The Tehama County Sheriff's Office, Red Bluff Police Department and Corning Police Department intend to use Tehama Alert to notify residents of a potential fire, gas leak, flood or other natural or man-caused incident in local areas that would prompt an immediate evacuation or shelter in place protocols. In most of these instances, sufficient information should be provided for residents to act upon.

Tehama Alert may also be used to broadcast information regarding lost or missing children/adults or wanted and potentially dangerous people. A photo can actually be attached to the message. Tehama Alert is a free service and residents can sign up to receive alerts via cell phone by visiting the Tehama County Sheriff's Office website:

www.tehamaso.org/tehama-alert

As a result of this new system, residents of Tehama County will receive time-sensitive messages wherever specified; such as home, mobile or business phones, email address, text messages and more.

2.4.5 Cal Fire Mitigation Projects / Plans

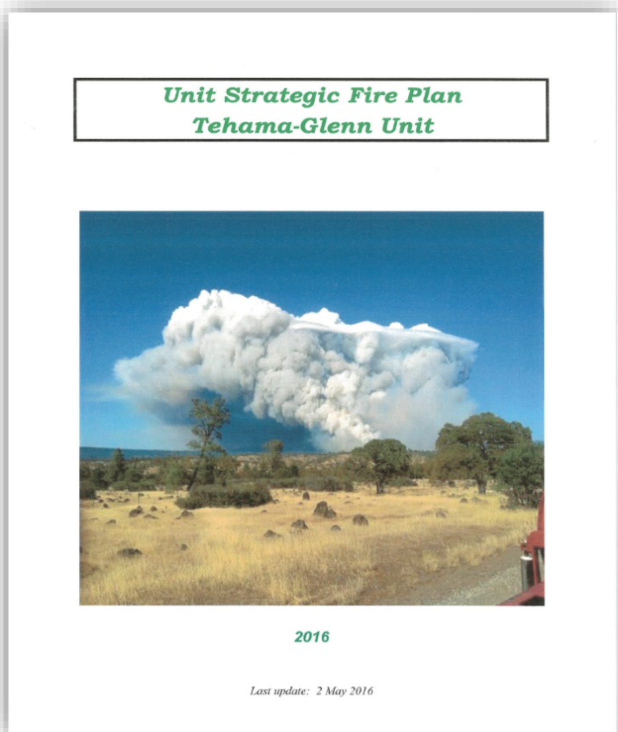

Figure 2-4: 2016 Tehama Glen Unit Strategic Fire Plan

2.4.5.1 Cal Fire Tehama-Glenn Unit Strategic Fire Plan

Related 2012 HMP Objectives:

- *Encourage coordination between participating jurisdictions and adjoining communities.*
- *Consider the impacts of natural hazards in all planning mechanisms that address current and future land uses within the planning area.*
- *Encourage hazard mitigation measures that minimize adverse effect on the natural environment.*

The Cal Fire Tehama-Glenn Unit Strategic Fire Plan is a cooperative effort between State and local stakeholders focused on fire and fuels management within Tehama and Glenn Counties. The Cal Fire Tehama-Glenn Unit's Pre-Fire Engineer is responsible for updating the multi-county plan through the incorporation of current fire policies at the State level and identification of new and in-progress project work which will impact fire hazards within the planning area and will advance the fire and fuels management agenda of the Tehama-Glenn Unit.

2.4.5.2 Cal Fire Wildland Fire Pre-Plan

Related 2012 HMP Objectives:

- *Maintain and make available maps of identified risk areas.*

In 2016, Cal Fire Tehama-Glenn Unit personnel completed preparation of Wildland Fire Pre-Plans for State Responsibility Area lands within Tehama County. These planning documents take the form of maps that display those features and fire/fuels management infrastructure that can affect the control and management of a wildfire event. Information contained on these maps includes water sources, equipment staging areas, heli-base sites, improvements related to fire control infrastructure, communications and other facilities, road and highway infrastructure, power lines, pipelines and other linear features, and fuel treatments that have been completed.

2.4.5.3 Cal Fire Vegetation Management Program and Related Vegetation Treatment Projects

Related 2012 HMP Objectives:

- *Establish partnerships among government, businesses and communities to improve and implement methods to protect property.*

The Cal Fire Vegetation Management Program (VMP) is an ongoing, cost-sharing initiative between private landowners and Cal Fire, which takes the role of project administrator. The program focuses on the use of prescribed burns along with manual and mechanical fuels reduction in order to reduce the presence of fire prone vegetation on State Responsibility Area (SRA) lands. Throughout the Tehama–Glenn Unit area, project work completed under this program has traditionally taken the form of prescribed burns for gross wildland fuels reduction. The VMP allows private landowners to enter into a contract with Cal Fire to use prescribed fire and other means to accomplish a combination of fire protection and resource management goals. Implementation of VMP projects is by local Cal Fire units who develop project related environmental impact assessment documents and who provide fire control equipment and ignition/containment crews along with a burn boss to oversee ignition control and mop up operations. Importantly, the VMP program provides indemnification to landowners in the event of fire escape. The fuels reduction projects that are completed first are those that are identified through the Cal Fire planning process and subsequently developed and prioritized in individual Community Wildfire Protection Plans. Completed, in progress, and planned VMP projects within the Tehama West Community Wildfire Protection Plan and Tehama East Community Wildfire Protection Plan area are listed in the 2017 Tehama East and Tehama West Community Wildfire Protection Plan Update. For more information see:

http://www.tehamacountyrcd.org/programs2.html

2.4.6 Resource Conservation District of Tehama County (RCDTC) Chipper Program

Related 2012 HMP Objectives:

- *Support and encourage mitigation measures for homeowners in high-risk areas.*
- *Establish partnerships among government, businesses and communities to improve and implement methods to protect property.*

Figure 2-5: RCDTC Chipper Program Equipment

In order to expedite completion of the project work developed in the Tehama East and Tehama West Community Wildfire Protection Plans, the RCDTC developed funding through the California Fire Safe Council for the purchase of a 116-horsepower chipper that would be suitable for processing vegetation up to 12 inches in diameter. These dollars were also used to fund the development of procedures and recordkeeping of the District's Vegetation Management Program through which the chipper, an operator/field technician, and related services are provided. In 2014, the RCDTC received funding from the McConnell Foundation of Redding to purchase a second chipper unit to expand the operation and provide backup equipment in order to assure project sponsors and landowners that project work can be completed in a timely, cost efficient manner according to originally proposed schedules. In addition to outside sources of funding, the RCDTC used internally developed dollars to purchase several heavy-duty pickups to pull the chipper units. Non-grant sources of funding have also been used to purchase an array of herbicide application and all-wheel drive transportation equipment through the use of overhead dollars along with those provided in connection with fee-for-service vegetation treatment projects. For more information see: http://www.tehamacountyrcd.org/services/chipperBrochure.pdf

2.4.7 Countywide Fire Plan Base Map

Related 2012 HMP Objectives:

- *Maintain and make available maps of identified risk areas.*
- *Support and encourage mitigation measures for homeowners in high-risk areas.*

In alignment with the 2012 HMP Mitigation Action CW-4, the Resource Conservation District of Tehama County created the Countywide Fire Plan Base Map which is a major component of the Tehama East/Tehama West Community Wildfire Protection Plan (CWPP) update which was completed in June of 2017. The map provides another means in addition to the CWPP of achieving improved project effectiveness and cost efficiency developed through the CWPP process. This planning map displays all completed, in process and proposed fire related projects described in the revised Tehama West and Tehama East CWPP along with the resources these efforts are intended to protect. The map allows public and private land managers, community groups, and government agencies to visually demonstrate the relationship between their proposed, in progress, and completed projects and the fire and fuels management efforts being conducted by other entities. This information is expected to help those conducting fuels reduction work to better demonstrate the value of their projects in relation to other fuels reduction efforts in the creation of landscape scale protection against catastrophic wildfire. Through this explanation and demonstration of the interconnectedness between individual projects, applications for permits or funding have a much greater chance of receiving approval. To accomplish this intention, the Countywide Fire Plan Base Map is considered to be a key component and outcome of this updating process.

2.4.8 Well Capping Enforcement Ordinance

Related 2012 HMP Objectives:

- *Encourage hazard mitigation measures that minimize adverse effect on the natural environment.*

In 2015, the Tehama County Board of Supervisors passed an ordinance to add a further layer of protection for the groundwater aquifers and water wells connected to it. Water wells not used to supply water for a residence on the same parcel within the past 90 days will be considered dormant and new small wells on vacant parcels will not be allowed without a permitted use. The fine for violation is $1,000 per day that groundwater is carried off-parcel in an unpermitted manner and a potential jail sentence if those involved are prosecuted criminally.

2.5 Incorporation into other Planning Mechanisms

Over the past 5 years, the 2012 Hazard Mitigation Plan was incorporated into other planning mechanisms as a demonstration of progress in local hazard mitigation effort. The HMP was referenced in the 2016 Tehama County Emergency Operations Plan put together by the Sherriff's Office. There were no other planning documents updated during this time period, but this 2017 update will be incorporated into updates to the County Flood Mitigation Plan, Groundwater Management Plan, Groundwater Sustainability Plan, General Plan, Wild Fire Protection Plan and a 6 County Integrated Regional Water Management (IRWM) Plan and the Mid and Upper Sacramento Regional Flood Management Plan in the future.

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Section 3. Planning Methodology

This section describes each stage of the planning process used to develop the 2018 MJHMP. The 2018 MJHMP planning process provides a framework for document development and follows the FEMA recommended steps. The 2018 MJHMP follows a prescribed series of planning steps which includes organizing resources, assessing risk, developing the mitigation plan, drafting the plan, reviewing and revising the plan, and adopting and submitting the plan for approval. Each is described in this section.

3.1 The Planning Process

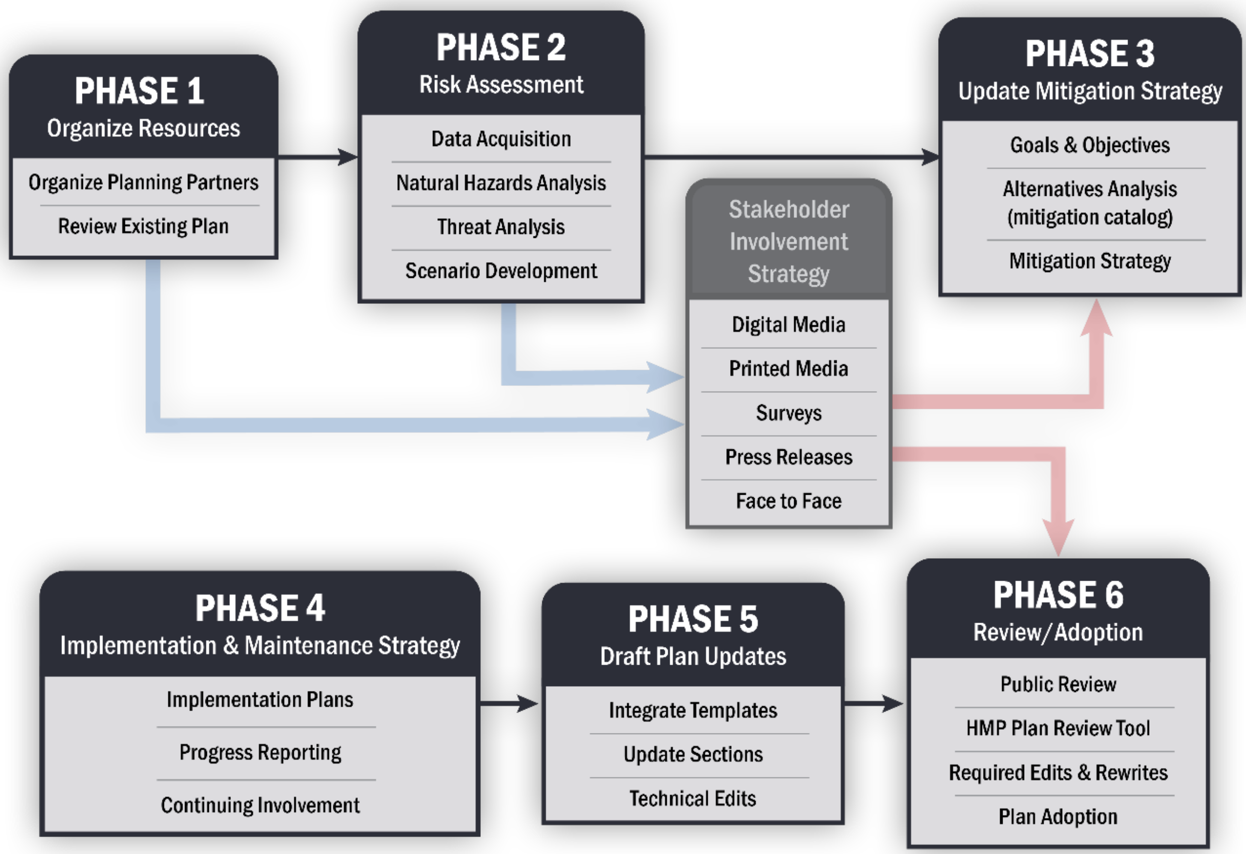
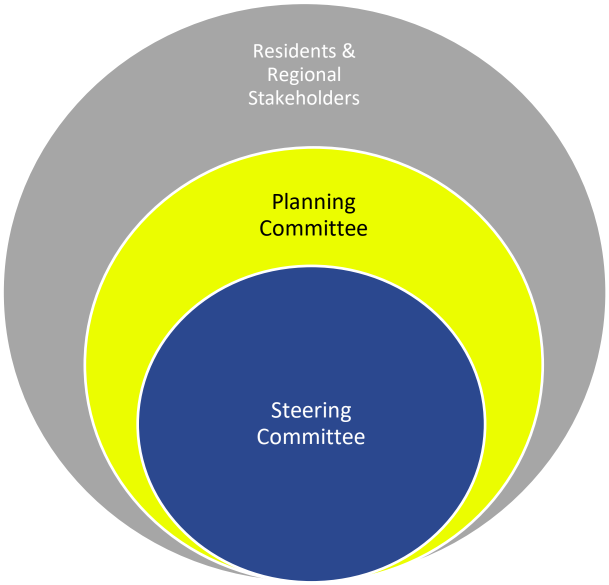


Figure 3-1: Tehama County Planning Process

3.2 Organize Resources

This section describes the first step of the 2018 MJHMP planning process - Organizing Resources. Organizing the resources consists of planning team development and document review tasks.



3.2.1 Building the Planning Team

The Planning Team, key to the back bone of the planning process, was critical for the development of the 2018 MJHMP. The Planning Team consisted of a Steering Committee, Planning Committee (engaged residents and regional stakeholders) and a HMP consultant used for plan development and facilitation.

3.2.1.1 Steering Committee

At the core of the 2018 MJHMP planning process is the Steering Committee. The Steering Committee was integral in ensuring the success of the planning process, its implementation, and future maintenance. To aid the Steering Committee the County developed a professional services agreement with a HMP consultant (Dynamic Planning + Science) to provide direction and support for the 2018 update. Members of the Steering Committee were also a part of the MJHMP Planning Committee discussed below and in the individual annexes in Volume 2. Table 3-1 lists the Steering Committee Members and Table 3-2 lists the Planning Committee Members.

Table 3-1: 2018 MJHMP Steering Committee

Jurisdiction	Point of Contact	Title
Tehama County	Ryan Teubert	Flood Control and Water Resources Manager
City of Corning	Dawn Grine	Director of Public Works
City of Red Bluff	R. Scott Miller	Assistant Public Works Director
City of Tehama	Carolyn Steffan	City Clerk/ Administrator
Tehama County Sheriff's Office	Rod Daugherty	Sergeant / OES Manager
DP+S (HMP Consultant)	Ethan Mobley	Project Manager
DP+S (HMP Consultant)	Brian Greer	GIS / Risk Assessment Lead / Data Visualization
DP+S (HMP Consultant)	Tammy Kulpa	Plan Writing

3.2.1.2 Planning Committee

Table 3-2: 2018 MJHMP Planning Committee

Name	Title	Jurisdiction/ Agency	CRS Floodplain Management Category	Representing	Role
Randy Rapp	Deputy Chief, Operations	**Cal Fire, Tehama-Glen Unit**	Preventative Measures	Planning Partner	Technical Advisory
Matt Chamblin	Administrative Officer	Cal Fire, Tehama-Glen Unit	Preventative Measures	Planning Partner	Technical Advisory
Steve Mackey	Operations Superintendent	Tehama County Public Works	Structural Projects	Planning Partner	Technical Advisory
Kristen Maze	Director of Planning	Tehama County Planning Department	Preventative Measures	Planning Partner	Technical Advisory
John Stover	Building Official / Floodplain Administrator	Tehama County Building Department	Property Protection	Planning Partner	Technical Advisory
Mark Dutro	Citizen Advisor	Citizen Advisor	Public Information	Stakeholder	Citizen Advisor
Mike Murphy	Citizen Advisor	Citizen Advisor	Public Information	Stakeholder	Citizen Advisor
Gary Antone	Director of Public Works	Tehama County Public Works	Structural Projects	Planning Partner	Technical Advisory
Rick Gurrola	Agricultural Commissioner	Tehama County Agriculture Department	Natural Resource Protection	Stakeholder	Technical Advisory
David Stoffel	Agricultural Biologist/Weights & Measures Specialist	Tehama County Agriculture Department	Natural Resource Protection	Stakeholder	Technical Advisory
Brian DeSmet	Fire Marshal	Tehama County Fire	Emergency Services	Stakeholder	Technical Advisory
Bill Goodwin	Chief Administrator	Tehama County Administration	Public Information	Stakeholder	Technical Advisory
Julie Sisneros	Purchasing Agent	Tehama County Administration	Public Information	Stakeholder	Technical Advisory
Tim Potonovic	Director of Environmental Health	Tehama County Environmental Health	Natural Resource Protection	Stakeholder	Technical Advisory
Lauri Dilworth	REHS II	Tehama County Environmental Health	Natural Resource Protection	Stakeholder	Technical Advisory
David Brower	REHS III	Tehama County Environmental Health	Natural Resource Protection	Stakeholder	Technical Advisory
Dennis Garton	Supervisor- District 3	Tehama County Board of Supervisors	Public Information	Stakeholder	Technical Advisory
Ian Turnbull	Fire Chief	Capay Fire District	Emergency Services	Stakeholder	Technical Advisory
Jeremy Strait		Bureau of Land Management	Natural Resource Protection	Stakeholder	Technical Advisory
David LeBlanc		Bureau of Reclamation	Natural Resource Protection	Stakeholder	Technical Advisory

Name	Title	Jurisdiction/ Agency	CRS Floodplain Management Category	Representing	Role
Michael Ward	Water Resources Engineer	California Department of Water Resources	Natural Resource Protection	Stakeholder	Technical Advisory
Todd Hillaire	Flood and Watershed Section Chief	California Department of Water Resources	Natural Resource Protection	Stakeholder	Technical Advisory
Jud Pray	Director	Tehama County Farm Bureau	Natural Resource Protection	Stakeholder	Technical Advisory
Rob Riana	Project Manager	Resource Conservation District of Tehama County	Natural Resource Protection	Stakeholder	Technical Advisory
Steven Larson	Pre-Disaster and Flood Mitigation Division	Cal OES		Stakeholder	Technical Advisory
Klye Nodderer	Senior Emergency Services Coordinator	Cal OES		Stakeholder	Technical Advisory
Robert Goyeneche	Emergency Services Coordinator	Cal OES		Stakeholder	Technical Advisory
Nicholas Dawson	Assistant Chief	Plumas County Sheriff's Office	Emergency Services	Neighboring Jurisdiction	Technical Review
Amy Travis	Deputy Director	Glenn County Sheriff's Office	Emergency Services	Neighboring Jurisdiction	Technical Review
Cindi Dunsmoor	Emergency Services Officer	Butte County OEM	Emergency Services	Neighboring Jurisdiction	Technical Review
Anthony Bertain	Lieutenant	Shasta County Sheriff's Office	Emergency Services	Neighboring Jurisdiction	Technical Review
Rick Ehlert	Emergency Services Coordinator	Mendocino County Sheriff's Office	Emergency Services	Neighboring Jurisdiction	Technical Review
Letty Garza	Director of Health and Human Services	Trinity County Sheriff's Office	Emergency Services	Neighboring Jurisdiction	Technical Review

To provide assistance to the Planning Committee, the County enlisted Dynamic Planning + Science (DP+S) due to its expertise in assisting public sector entities with developing hazard mitigation plans and strategies for particular hazard prone areas. Dynamic Planning + Science supported the County through facilitation of the planning process, data collection, and meeting material and document development. The MJHMP Consultant Team, as shown in Table 3-3, consists of a variety of hazard mitigation and certified urban planning professionals.

Table 3-3: 2018 MJHMP Update Consultant Team

HMP Update Project Team	HMP Update Project Team Role
Ethan Mobley, AICP	Project Manager
Brian Greer	GIS Specialist/Spatial Analyst
Tammy Kulpa	Hazard Mitigation Planner
Alex Krebs	GIS Associate

3.2.2 Planning Committee Meetings

The MJHMP Planning Committee met throughout the development of the updated MJHMP document. Table 3-4 provides a summary of the meetings conducted throughout the planning process, including meeting date, type, and topics discussed. Meeting documentation, including agendas, hazard maps, PowerPoint presentations, minutes, sign-in sheets, and other relevant handouts, are provided in Appendix B.

Table 3-4: Meeting Summary

Date	Meeting Type	Topics
March 30th, 2017	Planning Committee Kickoff Meeting #1	▪ *Welcome and Introductions* ▪ *Mitigation Planning Defined* ▪ *Background* ▪ *Local Hazard Mitigation Planning Process* ▪ *NFIP/ CRS Process* ▪ *Overall Objectives* ▪ *Project Schedule* ▪ *Today's Tasks / Accomplishments* ▪ *Next Steps*
May 4th, 2017	Planning Committee Meeting #2	▪ *Welcome and Introductions* ▪ *Project Re-Caps* ▪ *Vulnerability Data Initial Draft Review* ▪ *Hazard Ranking and Review* ▪ *Next Steps and Wrap Up*
June 15th, 2017	Planning Committee Meeting #3	▪ *Welcome and Introductions* ▪ *Project Briefs* ▪ *PC Meeting #2* ▪ *Flood Windshield Tour* ▪ *Wildfire Windshield Tour* ▪ *Public Open House* ▪ *Community Survey* ▪ *CRS Update* ▪ *Problem Statement Review*
July 13th, 2017	Planning Committee Meeting #4	▪ *Planning Process and Schedule Update* ▪ *Phase 3 Check-In* ▪ *Mitigation Guiding Principles, Goals and Objectives Review* ▪ *Capabilities Review* ▪ *Mitigation Action Review* ▪ *Mitigation Prioritization*

3.3 Public Involvement/Outreach

Public involvement is an important and required component of any HMP update. The Public Outreach Strategy for this update was developed to maximize public involvement throughout the planning process and utilized websites, local media, and community-based face-to-face efforts to engage the public.

As required by FEMA, the general public was given an opportunity to be involved in the planning process while updating the mitigation plan. This occurred through a public open house, surveys, a project website, and public review periods. Each is described below.

3.3.1 Hazard Mitigation Open House

A good public outreach effort educates the public and motivates them to mitigate hazards near or inside their homes. Many mitigation actions can be completed on private property to reduce property damage from natural hazard events. During the Hazard Mitigation Open House, the public was engaged early in the planning process to understand community priorities, and to provide education about mitigation actions that can be taken by County residents. In this setting, the Open house consisted of “Hazard Stations” to inform residents of local hazards and the mitigation of such. Various stations were manned by several agencies and experts in the fields of flood control, geohazards, wildfire and emergency response.

At one station, attendees had the chance to use different layers on the Google Earth mapping program to zoom in and look at what areas are considered at risk for flood, fire or earthquakes.

Another station showed maps of potential slope failures, particularly geo hazards, rock debris flow and avalanche, all of which are potentials due to weak soil. Visitors could also see a map that was a California Geological Survey of the Battle Creek Fault just north of Red Bluff.

Figure 3-2: Photo of Hazard Mitigation Open House Event on 6/14/2017

Other community organizations were on-hand with related topics, including; Cal Fire with information on the newly approved Tehama East and Tehama West Community Wildfire Protection Plan, and the Tehama County Sheriff's Department had a display of its new website with the new Records Information Management System. The new system is a place where someone can look up information on crimes occurring in a specific area or within a specific date range or request to have a STARS unit do extra patrol while the homeowner is out of town.

The Sheriff's Department also brought the Casspir vehicle, which was originally purchased for the SWAT team, however, it has also been found to be useful for rescuing people from flooded areas and was used during the storms in February.

Figure 3-3: Open House Event, with Casspir Vehicle.

Source: Julie Zeeb — Daily News, Red Bluff Daily News

In addition, members of the public assisted to identify community assets and problem areas, describe issues of concern, narrate threat and hazard history, prioritize proposed mitigation alternatives, and provide ideas for continuing public involvement after the plan is adopted.

Other booth participants included 211 Tehama which provides information on food and clothing, housing and utilities, transportation, child care, legal services, support groups, health care, senior services, drug and alcohol treatment, mental health services and various crisis hotlines available within the county.

Residents also had a chance to talk with PG&E about proper care for trees, including keeping at least 10 feet between the tree and power lines and how far to plant trees from the base of a power pole, a house or gas lines to what to do in the event of a gas leak or fire.

3.3.2 Surveys

A 17 question community survey was distributed via the County and Participating Jurisdictions' Hazard Mitigation Plan websites, Facebook pages and e-mail blasts as well as in person at the Red Bluff Farmers' Market and at the Hazard Mitigation Public Open House. A total of 77 survey responses were collected. The results of the survey were used to ensure that the priorities of the County and participating jurisdictions match those of the residents/ community members. For example, community members were asked if they believe their property was at risk from a natural hazard disaster (81.8% said "yes"). Those who said yes were then asked to identify the one hazard they thought was the highest threat to their neighborhood or property. As seen in Figure 3-4, the top hazards identified were flooding, wildfire, and severe weather which match the Planning Team's priority hazards in Table 4-65. The responses were also used to determine the incentives that would encourage home owners to protect their homes from natural disasters, which were integrated into the mitigation actions. The full survey results can be found in Appendix B.

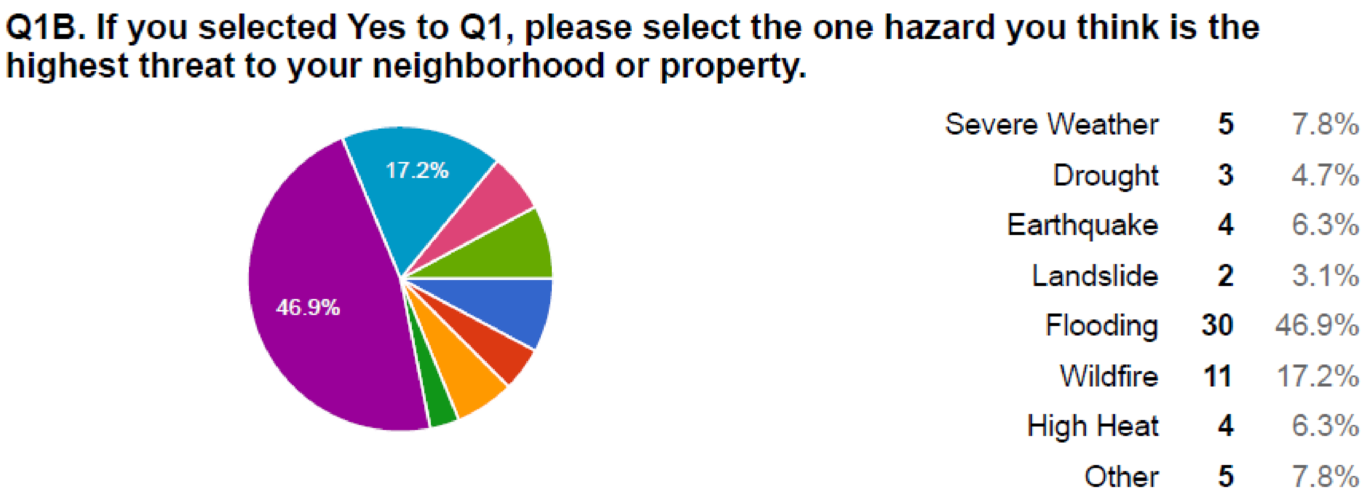


Figure 3-4: Snapshot of community survey results

3.3.3 HMP Update Website

For this MJHMP 2018 update, a project portal was created at www.mitigatehazards.com/tehama-hmp/ to serve as a centralized project information and file-sharing platform. This website provides a tool for project management, collaborative content, and one-stop-shop for mitigation planning resources.

In addition to internal coordination, the project portal played a critical role in involving the public throughout the planning process and documenting public involvement including the community survey, meetings, working sessions and the Public Open House. Resources such as the Cal OES MyHazards tool (used to assess risk to individual properties) and the link to the Draft MJHMP have also been made available to the public via the website.

Project participants and stakeholders have been using the website as a project resource for the duration of the planning process and will continue to have access during the 5 year update cycle and beyond.

3.4 Assess the Hazard

In accordance with FEMA requirements, the 2018 MJHMP Planning Committee identified and prioritized the natural hazards affecting Tehama County and assessed the vulnerability from them. Results from this phase of the HMP planning process aided subsequent identification of appropriate mitigation actions to reduce risk in specific locations from hazards. This phase of the HMP planning process is detailed in Section 4.

3.4.1 Identify/Profile Hazards and Assess Vulnerabilities

Based on a review of past hazards, as well as a review of the existing plans, reports, and other technical studies/data/information, the 2018 MJHMP Planning Committee determined if the existing hazards were still valid, and identified new hazards that could affect the County.

Hazard profiling exposes the unique characteristics of individual hazards and begins the process of determining which areas within Tehama County are vulnerable to specific hazard events. The vulnerability assessment included field visits and a GIS overlaying method for hazard risk assessments. Using these methodologies, vulnerable populations, infrastructure, and potential loss estimates impacted by natural hazards were determined.

Updated content for each hazard profile, including vulnerability, is provided in Section 4.4 through Section 4.10.

3.5 Develop Mitigation Plan

The 2018 MJHMP was prepared in accordance with DMA 2000 plan update requirements, the California Office of Planning and Research (OPR) and FEMA's HMP guidance documents. This document provides an explicit strategy and blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and Tehama County's ability to expand on and improve these existing tools. Developing the mitigation plan involved identifying goals, assessing existing capabilities, reviewing the 2012 HMP goals, and identifying new mitigation actions. This step of the HMP planning process is detailed in Section 5 and summarized below.

3.5.1 Identify Goals

To meet FEMA requirements, the Planning Committee reviewed the 2012 HMP goals and determined current day validity. Due to changes in County priorities, the goals and objectives have been updated to meet the current hazard environments. The Goals and Objectives are presented in Section 5.

3.5.2 Develop Capabilities Assessment

A capabilities assessment is a comprehensive review of all the various mitigation capabilities and tools currently available to the County to implement the mitigation actions that are prescribed in the 2018 MJHMP. The MJHMP Planning Committee identified the technical, financial, and administrative capabilities to implement mitigation actions, as detailed in Section 5.

3.5.3 Identify Mitigation Actions

As part of the 2018 MJHMP planning process, the Planning Committee reviewed and analyzed the status of the mitigation actions identified in the 2012 HMP and provided data and information on the status of the existing mitigation actions. Once the review and analysis of the 2012 HMP mitigation actions was complete, the Consultant Team and Planning Committee worked together to identify and develop new mitigation actions with implementation elements. Mitigation actions were prioritized and detailed implementation strategies were developed during Planning Committee Meeting #4. A detailed approach of the review of the existing mitigation actions, identification, and prioritization of new mitigation actions, and the creation of the implementation strategy is provided in Section 5.

3.6 Draft HMP Update

Once the risk assessment and mitigation strategy were completed, information, data, and associated narratives were compiled into the 2018 MJHMP. Section 2 provides detailed information on "what's new" and updated as part of the 2018 MJHMP.

3.6.1 Plan Review and Revision

Once the "Draft" 2018 MJHMP Update was completed, a public and government review period was established for official review and revision. Public comments were accepted, reviewed, and incorporated into this update. Applicable comments from the public have been received and addressed prior to the *"authorization to submit"* to FEMA and Cal OES review parties.

3.6.2 Plan Adoption and Submittal

This plan has been submitted and approved by FEMA and adopted by the County. A copy of the resolution is provided immediately following the executive summary.

3.7 Plan Maintenance

Updated plan maintenance procedures, found in Section 6, include the measures Tehama County and participating jurisdictions will take to ensure the MJHMP's continuous long-term implementation. The procedures also include the manner in which the MJHMP will be regularly monitored, reported upon, evaluated, and updated to remain a current and meaningful planning document.

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Section 4. Risk Assessment

The risk assessment is the process of measuring the potential impact to life, property and economic impacts resulting from natural hazards. The intent of the Risk Assessment is to identify, as much as practicable given existing/available data, the qualitative and quantitative vulnerabilities of a community. The results of the risk assessment allow for a better understanding of the impacts of natural hazards to the community and provide a foundation in which to develop and prioritize mitigation actions to reduce damage from natural disasters through increased preparedness and response times and the better allocation of resources to areas of greatest vulnerability.

This risk assessment section evaluates the potential loss from a hazard event by assessing the vulnerability of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards, how much of the County could be affected by a hazard, and the impact on County assets. The risk assessment approach consists of three (3) components:

- **HAZARD IDENTIFICATION**
  Identification and screening of hazards (Section 4.1)
- **HAZARD PROFILES**
  Review of historic occurrences and assessment of the potential for future events (Section 4.4 through Section 4.10)
- **VULNERABILITY ASSESSMENT**
  Determination of potential losses or impacts to buildings, infrastructure and population (Included in hazard profiles)
  Identified Hazards

4.1.1 Hazard Screening Criteria

Per FEMA Guidance, the first step in developing the Risk Assessment is identifying the hazards. The County's MJHMP Planning Team reviewed a number of previously prepared hazard mitigation plans and other relevant documents to determine the realm of natural hazards that have the potential to affect the County and the nearby region. Table 4-1 provides a crosswalk of hazards identified in the 2012 Tehama County HMP, 2009 Tehama County General Plan and 2013 CA State HMP. Twelve different hazards were identified based on a thorough document review. The crosswalk was used to develop a preliminary hazards list providing a framework for County MJHMP Planning Team members to evaluate which hazards were truly relevant to the County and which ones are not. For example, tsunamis were considered to have no relevance to the County, while earthquake, flood and wildfire were indicated in every hazard documentation.

Table 4-1: Document Review Crosswalk

Hazards	2012 Tehama County HMP	2009 Tehama County General Plan	2013 CA State HMP
Avalanche	■		■
Climate Change	■		■
Dam Failure	■		■
Drought	■		■
Earthquake	■	■	■
Flood	■	■	■
Landslide	■		■
Levee Failure			■
Severe Weather	■		■
Tsunami			■
Volcanoes			■
Wildfire	■	■	■

4.1.2 Climate Change

Climate refers to patterns of temperature, precipitation, humidity, wind and seasons. Climate shapes natural ecosystems and the human economies and cultures that depend on them. "Climate change" refers to changes over a long period of time. It is generally perceived that climate change will have a measurable impact on the occurrence and severity of natural hazards around the world. Impacts include the following:

- Snow cover losses will continue, and declining snowpack will affect snow-dependent water supplies and stream flow levels around the world.
- Drought and the frequency, intensity, and duration of heat waves are expected to increase.
- More extreme precipitation is likely, increasing the risk of flooding.
- The world's average temperature is expected to increase.

Climate change will affect communities in a variety of ways. Impacts could include an increased risk for extreme events such as drought, storms, flooding, and forest fires; more heat-related stress; and the spread of existing or new vector-born disease into a community. In many cases, communities are already facing these problems to some degree. Climate change can affect the frequency, intensity, extent and/or magnitude of the problems.

This hazard mitigation plan addresses climate change as a secondary impact for each identified hazard of concern. Each chapter addressing one of the hazards of concern includes a section with a qualitative discussion on the probable impacts of climate change for that hazard.

4.2 Vulnerability Assessment Methodology

A vulnerability assessment was conducted for each of the identified priority hazards. Geospatial data is essential in determining population and assets exposed to particular hazards. Geospatial analysis can be conducted if a natural hazard has a particular spatial footprint that can be overlaid against the locations of people and assets. In Tehama County earthquakes, flooding, wildfire, slope failure and dam inundation have known geographic extents and corresponding spatial information about each hazard.

Several sources of data are necessary to conduct a vulnerability analysis. Figure 4-1 provides an exhibit of the data inputs and outputs used to create the vulnerability analysis results presented in this section. U.S. Census data and Tehama County Assessor’s Parcel data are the primary sources in determining natural hazard exposure to County residents. Census data has been used to determine the population at risk, which is generally referred to as population exposure. Population exposure is provided for dam failure, earthquake, flooding, slope failure and wildfire as potential hazards later in this section.

Together with the U.S. Census data, County asset data was used to provide a snapshot of how County assets are affected by natural hazards. For purposes of this vulnerability analysis, asset data includes parcels and critical infrastructure within the County boundaries. Critical infrastructure is described as assets that are essential for people and a community to function. Critical infrastructure includes utilities, County and City-owned facilities, bridges, schools, and other community facilities that provide essential services to residents.

Critical facilities data was developed from a variety of sources including County and City owned and maintained data, State and Federal government datasets, and private industry datasets. A critical infrastructure spatial database was developed to translate critical facilities information into georeferenced[1] points. Critical facility points are intersected with the spatial hazard layers to develop a list of “at risk” critical facilities. The County critical facilities that intersect with natural hazards are referred to as facilities with hazard “exposure”. Exposure results are presented later in the Vulnerability sections of the Hazard Profiles.

Lastly, FEMA’s Hazus-MH 4.0 (Hazus) software was implemented to conduct detailed loss estimation for flood and earthquake. Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. HAZUS uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. For purposes of this planning effort, Hazus was used to graphically illustrate the limits of identified high-risk locations due to possible earthquakes and floods.

[1] To georeference something means to define its existence in physical space. That is, establishing its location in terms of map projections or coordinate systems. The term is used both when establishing the relation between raster or vector images and coordinates, and when determining the spatial location of other geographical features.

4.2.1 Population and Asset Inventory

In order to describe vulnerability for each hazard, it is important to understand the "total" population and "total" assets at risk. The exposure for each hazard described in this section will refer to the percent of total population or percent of total assets. This provides the possible significance or vulnerability to people and assets for the natural hazard event and the estimated damage and losses expected during a "worst case scenario" event for each hazard. Sections below provide a description of the total population, critical facilities, and parcel exposure inputs.

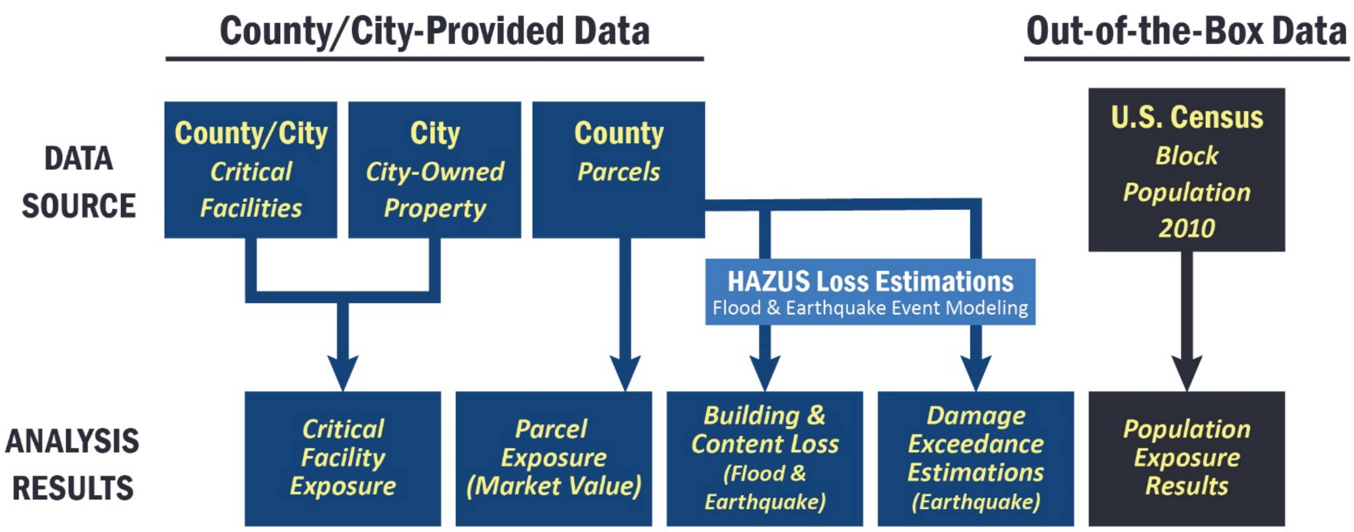


Figure 4-1: Data Source and Methodology

4.2.1.1 Population

In order to develop hazard-specific vulnerability assessments, population near natural hazard risks should be determined to understand the total "at risk" population. We can understand how geographically defined hazards may affect the County by analyzing the extent of the hazard in relation to the location of population. For purposes of the vulnerability assessment approximately 63,741[2] (100%) of the County's population is exposed to one or more hazards within or near the County boundaries. Each natural hazard scenario affects the County residents differently depending on the location of the hazard and the population density of where the hazard could occur. Vulnerability assessment sections presented later in this section summarize the population exposure for each natural hazard.

4.2.1.2 Vulnerable Populations

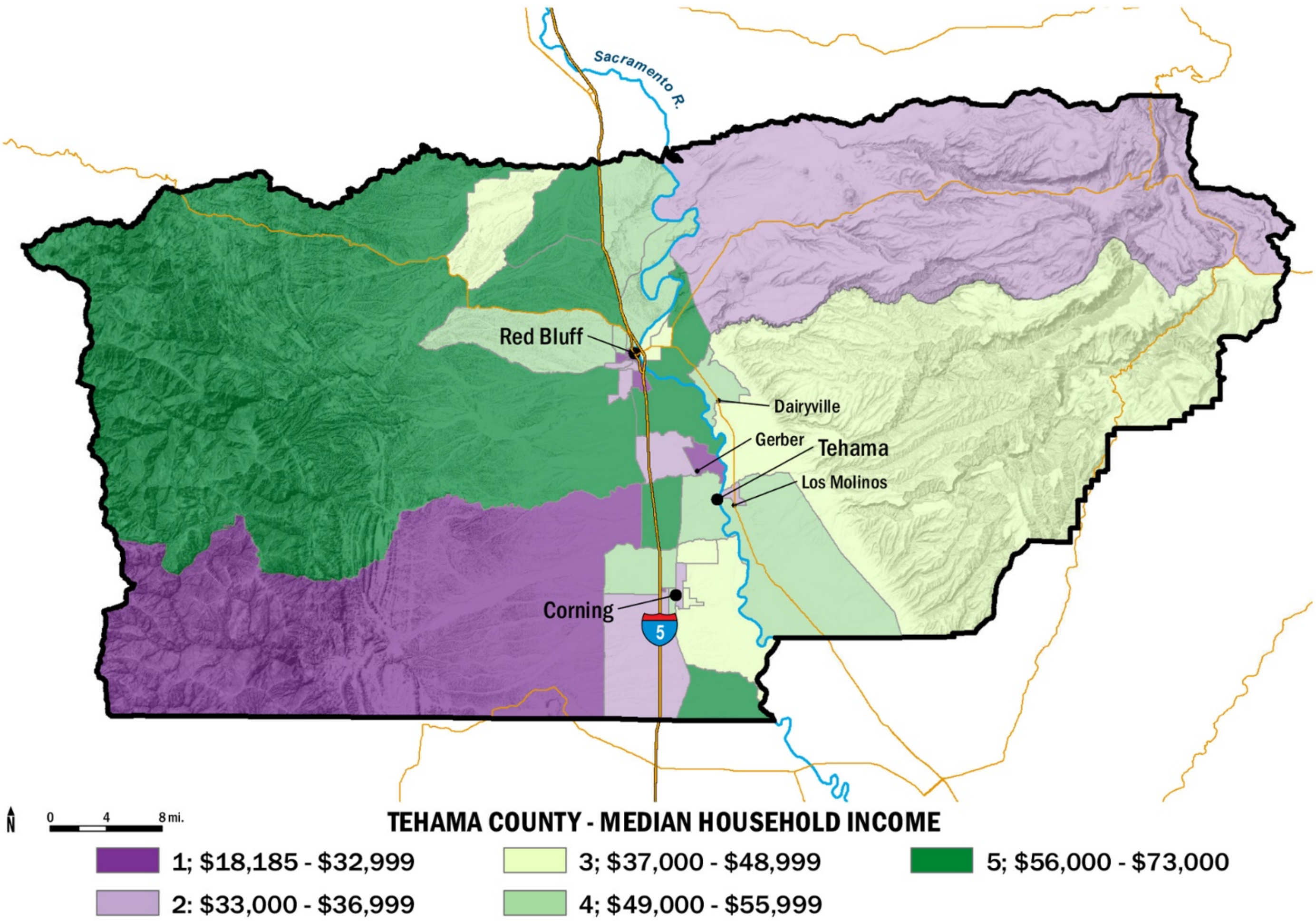
The severity of a disaster depends on both the physical nature of the extreme event and the socioeconomic nature of the populations affected by the event. Important socioeconomic factors tend to influence disaster severity. A core concept in a vulnerability analysis is that different people, even within the same region, have a different vulnerability to natural hazards.

[2] According to the 2010 U.S. Census Block pre-joined TIGER spatial data, the total population for the County in 2010 was 63,741.

4.2.1.2.1 Income and Housing Condition

Income or wealth is one of the most important factors in natural hazard vulnerability. This economic factor affects vulnerability of low income populations in several ways. Lower income populations are less able to afford housing and other infrastructure that can withstand extreme events. Low income populations are also less able to purchase resources needed for disaster response and are less likely to have insurance policies that can contribute to recovery efforts. Lower income elderly populations are less likely to have access to medical care due to financial hardship. Because of these and other factors, when disaster strikes, low income residents are far more likely to be injured or left without food and shelter during and after natural disasters.

Figure 4-2 shows the median household income distribution for Tehama County in 2015. The "median" is the value that divides the distribution of household income into two equal parts (e.g., the middle). The median household income in Tehama County in 2015 was estimated to be $41,001. In the United States during the same period, the median house household income was $53,889 (Bureau U. S., 2015). The most vulnerable residents (in terms of income and housing condition) to natural hazards are located in the southwest portion of the County.



Data Source: Census ACS 2015 3-year estimates, median income in last 12 mo., quantile classification from countywide sampling

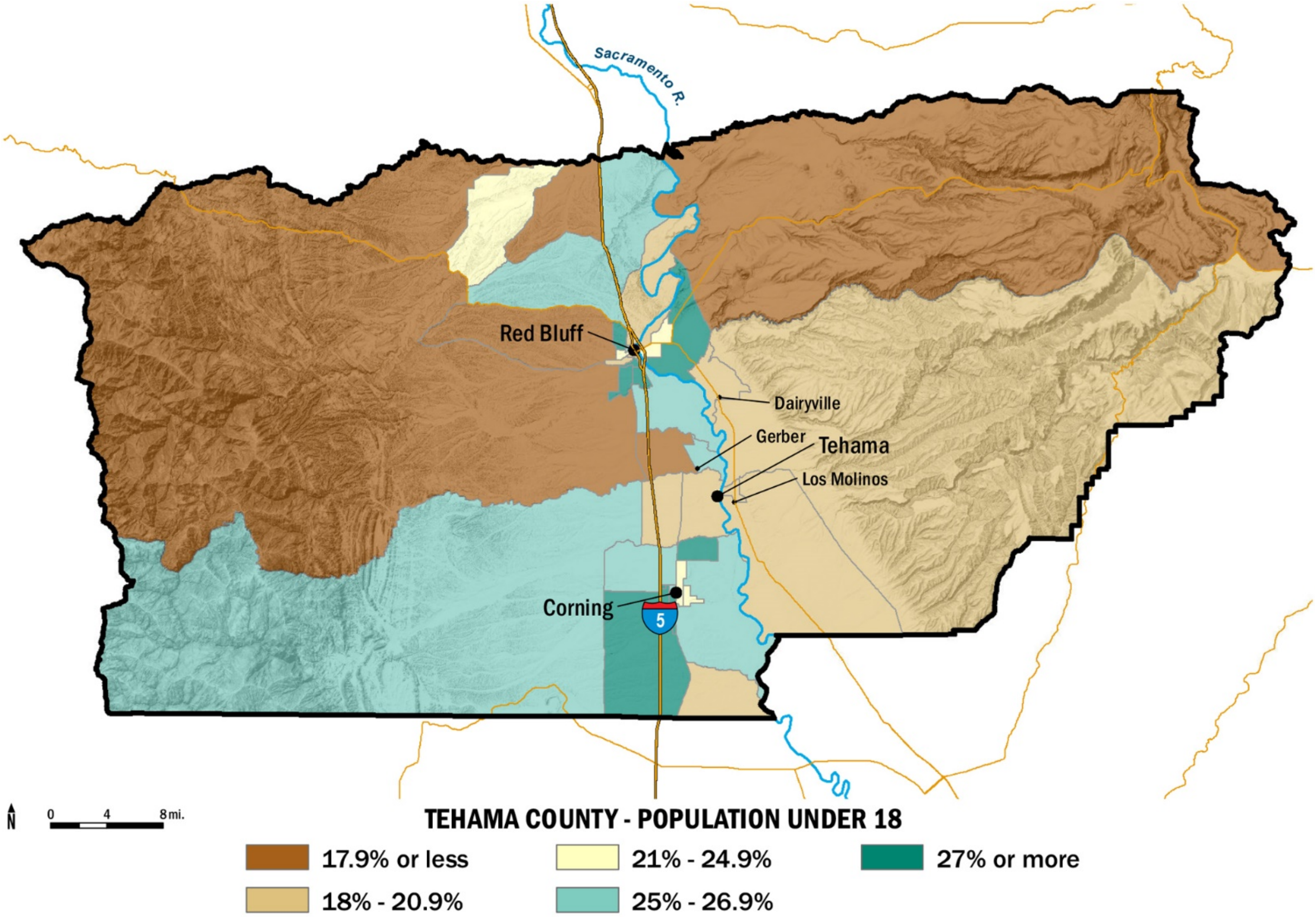
Figure 4-2: Median Household Income Distribution

4.2.1.2.2 Age

Children and the elderly tend to be more vulnerable during an extreme natural disaster. They have less physical strength to survive disasters and are often more susceptible to certain diseases. The elderly often also have declining vision and hearing and often miss reports of upcoming natural hazard events. Children, especially young children, have the inability to provide for themselves. In many cases, both children and the elderly depend on others to care for them during day to day life.

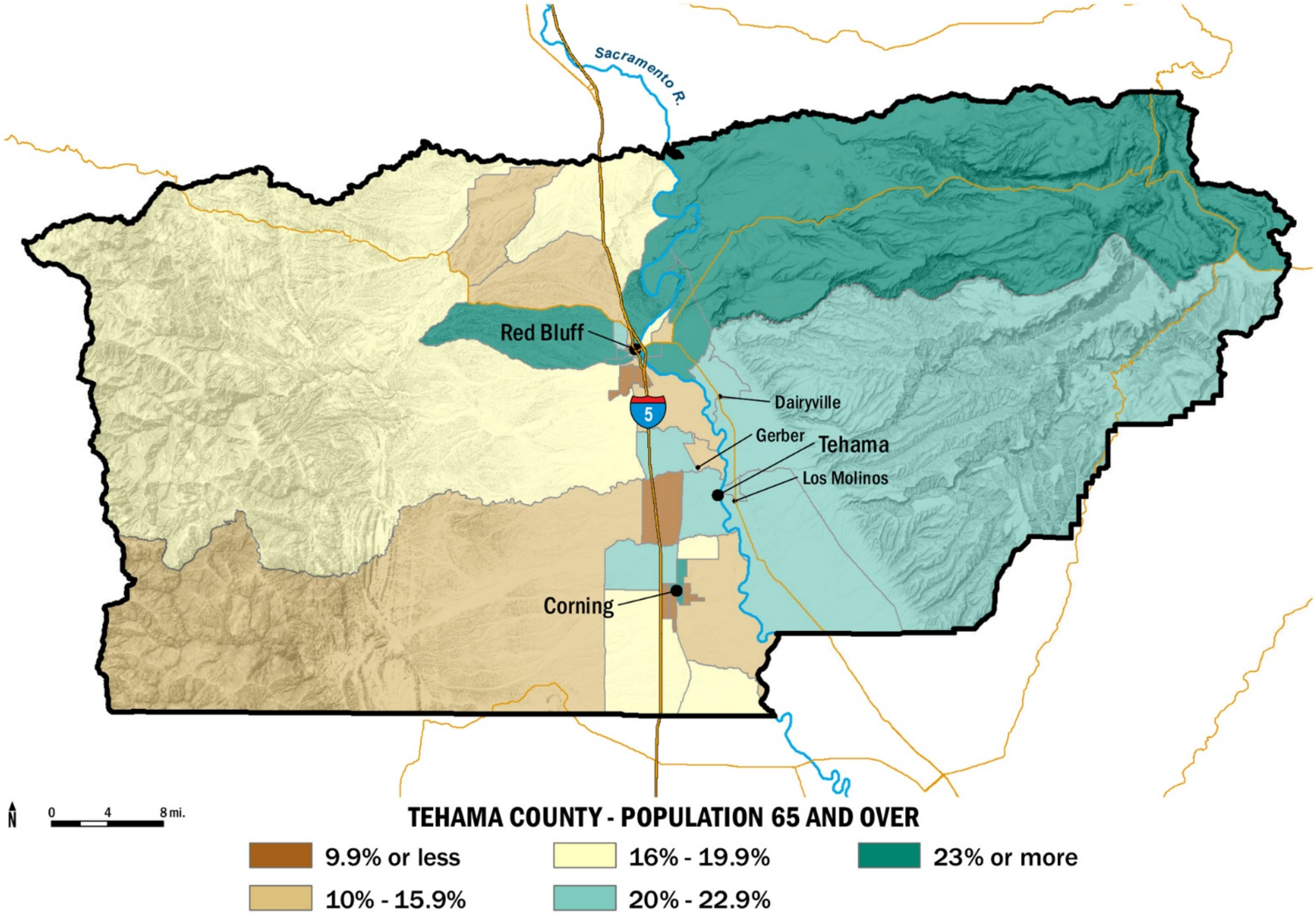
Finally, both children and the elderly have fewer financial resources and are frequently dependent on others for survival. In order for these populations to remain resilient before and after a natural hazard event, it may be necessary to augment county and city residents with resources provided by the County, cities, state and federal emergency management agencies and organizations.

As seen in Figure 4-3, the block groups with the highest concentration of people under 18 years old are located around Interstate 5 (I-5) in the City of Red Bluff and surrounding area to the east, and in and around the City of Corning including an area just north of the city and a large area to the southwest of the city surrounding I-5. Figure 4-4 shows that the highest concentration of people over the age of 65 is in the northeast portion of the County including the northern half of Red Bluff, an area just west of Red Bluff, and a portion of the City of Corning.



Data Source: Census ACS 2015 3-year estimates, percentage of total population, quantile classification from countywide sampling

Figure 4-3: Tehama County Population Under Age 18



Data Source: Census ACS 2015 3-year estimates, percentage of total population, quantile classification from countywide sampling

Figure 4-4: Tehama County Population Over Age 65

4.2.1.3 Critical Facilities Inventory

Critical facilities are of particular concern when conducting hazard mitigation planning. Critical facilities are defined as essential services, and if damaged, would result in severe consequences to the health, safety, and welfare of the public.

An inventory of critical facilities based on data from Tehama County and other publicly sourced information were used to develop a comprehensive inventory of facility points and lifelines. Critical facility points include police stations, fire stations, hospitals, buildings containing hazardous materials (HAZMAT), schools, transportation infrastructure, utilities, and government buildings. Lifelines include communication, electric power, liquid fuel, natural gas, and transportation routes. A current representation of the critical facilities and lifelines are provided in Table 4-2 and Table 4-3. Some critical facility information has been omitted from this document due to national security purposes. The Tehama County Sheriff's Office manages and maintains a complete list of critical facilities.

Table 4-2: Critical Facility Points (Unincorporated Tehama County)

Infrastructure Type	Total Feature Count
Essential Facility	49
EOC	2
Fire Station	16
Government Facility	4
Hospital	-
Police Station	1
School	26
High Potential Loss	56
Residential Child Care	-
Adult Residential Care	25
Child Care	11
Foster/Home Care	-
Home Care	-
Foster Care	-
Elder Care	9
Dam	9
Hotel	2
Transportation and Lifeline	463
Airport	-
Bridge	415
Bus Facility	-
FCC AM Tower	1
FCC Cell Tower	8
FCC FM Tower	9
Natural Gas Station	18
Power Plant	1
Substation	10
Waste Water Facility	1
Grand Total	**568**

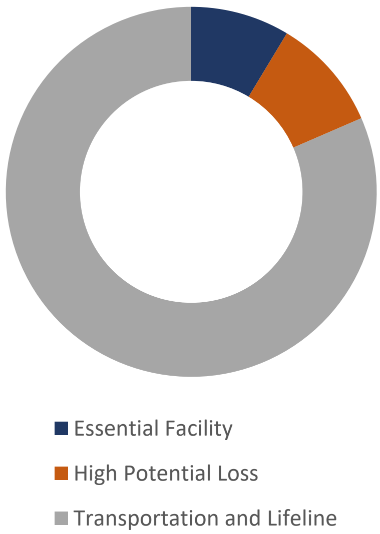


Table 4-3: Linear Utilities (Unincorporated Tehama County)

Infrastructure Type (Linear)	Total Linear Mileage
Transportation and Lifeline	**6,172.4**
FEMA Levee	24.8
USACE Levee	15.5
Natural Gas Pipeline	184.5
Transmission Line	430.2
Railroad	62.3
Street	5,455.2
-Interstate	73.8
-Primary Highway	93.4
-State/County Highway	688.7
-Local Road	4,182.6
-Other Road	148.7
-4WD Road	268.0
Grand Total	**6,172.4**

4.2.1.4 Parcel Value Inventory

Total count and value of parcels within Tehama County which could be exposed to a hazard event is referred to as parcel exposure in this plan. A standardized hazard overlay was conducted to develop hazard exposure results for improved city parcels presented later in this section. The total market value figures presented in this section reflect Tehama County Assessor data including fair market value where available. If no fair market value is available, this value reflects the assessed improvement value. Content replacement costs are calculated based on assessor's use codes translated to occupancy-based multipliers. Each occupancy class prescribes a specific content cost multiplier used to calculate the content cost values shown in the tables of this section. Occupancy-based content cost multipliers used in this report reflect those found in the FEMA Hazus-MH 4.0 technical manuals. The spatial overlay method identifies market value [3], content replacement value and total assessed value for a hazard's geographic extents. In the event of a disaster, it is generally the value of the infrastructure or improvements to the land that is of concern or at risk. Generally, the land itself is not a total loss and structures can be rebuilt. The Tehama County Assessor's data is pivotal to developing parcel values exposed to each hazard and includes current fair market value of assets at risk. Tehama County parcel information is summed and provided in Table 4-4. Both the market value and content value are the total value in the community at risk to a particular hazard.

Table 4-4: Parcel Counts and Value (IN THOUSANDS)

	Total Parcels	Total Market Value Exposure ($)	Total Content Value Exposure ($)	Total Value ($)
Tehama County	34,284	$ 3,409,758,850	$ 2,367,722,620	$ 5,777,481,470

[3] A long-term asset which indicates the cost of the constructed improvements to land, such as buildings, driveways, walkways, lighting, and parking lots.

4.2.2 Hazus Structure and Content Value Inventory

FEMA's loss estimation software, Hazus-MH 4.0, was used to analyze the County's building risk to flood and earthquake hazards. A Hazus level II assessment was performed, leveraging county-wide assessor's data in lieu of default Hazus data aggregated to the Census Block or Tract level. Hazus software operates on structure square footage, structure replacement, and content replacement costs to estimate potential losses specific to a modeled flood or earthquake scenario. Table 4-5 and Figure 4-5 provide value data for building categories at the census block and census tract levels. Census block and census tracts are used to provide input information for the Hazus analysis presented in this report. It is important to note that the full inventory basis within the Hazus software is different than the sum of values from the assessor's data due to a variance in replacement cost calculations. If a parcel has no market value or assessment value, Hazus calculates a default value based on construction type and year built.

Note: Data Source: Tehama County Assessor. Building values reflect fair market value where available. If no fair market value is available, this value reflects the assessed improvement value. Content replacement costs are calculated based on assessor's use codes translated to Hazus occupancy classes. Each HAZUS occupancy class prescribes a specific content cost multiplier used to calculate the content cost values shown above. Use codes including a "vacant" description have been removed along with agricultural use codes with no improvement value.

Table 4-5: Parcel Based Hazus Input Values (Total Community – Unincorporated Tehama County)

Building Type	Building Value ($)	Building Value (% of grand total)	Content Value ($)	Content Value (% of grand total *)	Total Value ($)	Proportion of Value (%)
Agricultural	$ 510,256,230	9.8%	$ 510,256,230	9.8%	$ 1,020,512,460	20%
Commercial	$ 409,744,808	7.9%	$ 410,117,490	7.9%	$ 819,862,298	16%
Education	$ 864,200	0.0%	$ 864,200	0.0%	$ 1,728,400	0%
Governmental	$ 387,156	0.0%	$ 504,263	0.0%	$ 891,419	0%
Industrial	$ 74,284,858	1.4%	$ 110,728,159	2.1%	$ 185,013,017	4%
Religion	$ 6,532,739	0.1%	$ 6,532,739	0.1%	$ 13,065,478	0%
Residential	$ 2,102,716,917	40.5%	$ 1,051,358,446	20.2%	$ 3,154,075,363	61%
Total	**$ 3,104,786,908**	**60%**	**$ 2,090,361,527**	**40%**	**$ 5,195,148,435**	

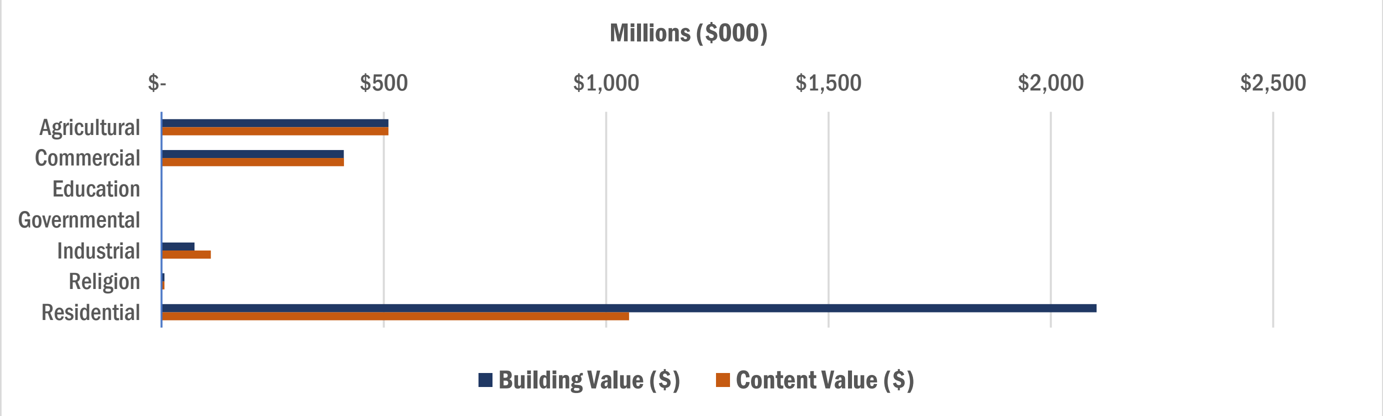


Figure 4-5: Hazus Inventory Building and Content Values ($000)

4.3 Tehama County Geographic and Demographic Profile

Tehama County is located in northern California, about two hours north of Sacramento (see Figure 4-6). Interstate-5, the primary north-south transportation corridor along the West Coast, and the meandering Sacramento River divide the eastern and western portions of the county. The County is bounded to the north by Shasta County, to the east by Butte and Plumas Counties, to the south by Glenn County, and to the west by Mendocino and Trinity Counties.

With its rural setting and sparse population, Tehama County is ranked 41st in population among California's 58 counties. The county's three small incorporated cities are Corning, Red Bluff and Tehama. Red Bluff, in north-central Tehama County, is the county seat and population center. Most of the population is located along the transportation corridors, which are also interspersed with commercial and industrial operations. Located on Interstate 5, Highway 99 and Highway 36, Red Bluff is a hub for area travel. Educational services, health care and social assistance services, retail trade and manufacturing are important base industries.

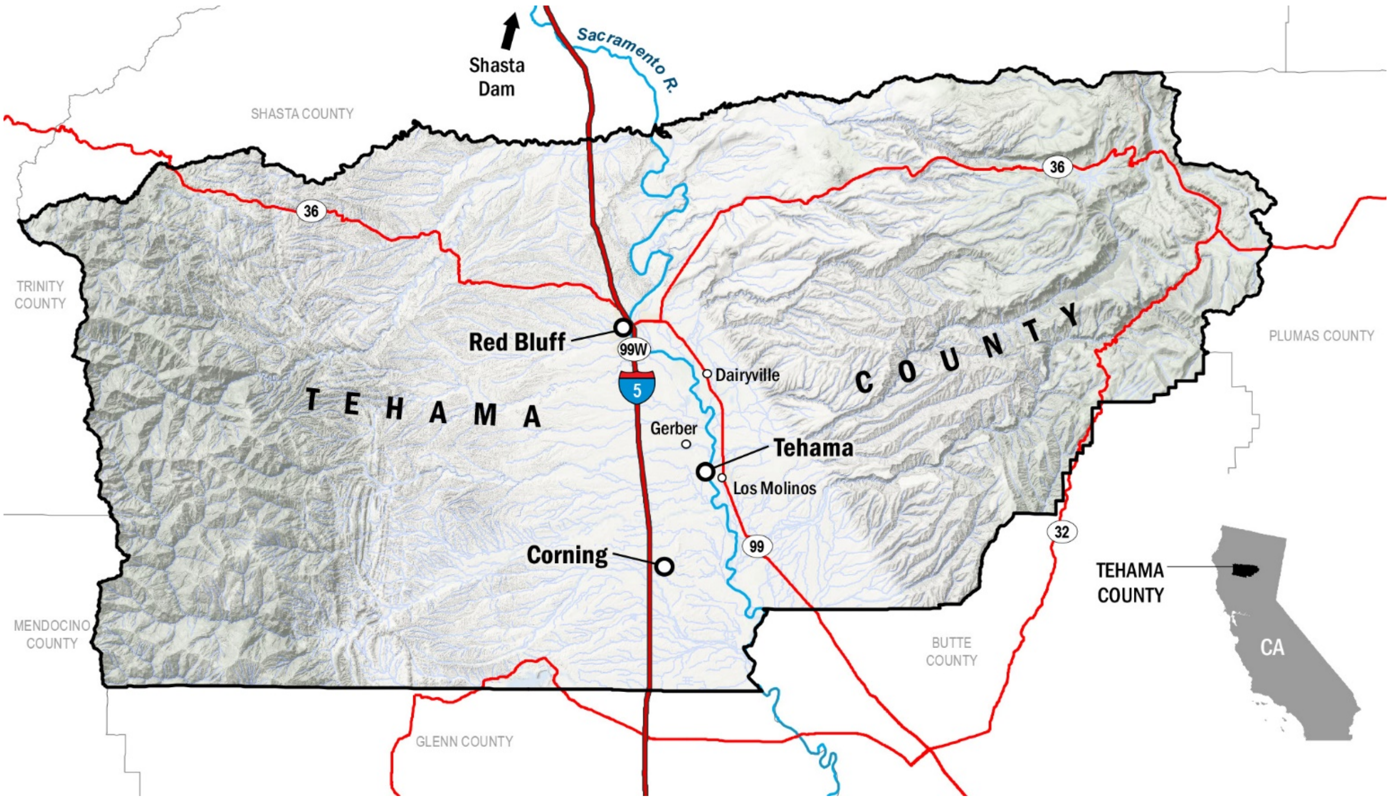


Figure 4-6: Main Features of Tehama County

Much of the land use in the county is resource-based, taking the form of cropland, range and pasture land as well as woodland. The county is home to multiple sheep farms and cattle ranches as well as fruit and nut orchards. About 71 percent of the land area is held in private ownership; the other 24 percent is managed by the federal government.

Tehama County consists of a variety of public open space, providing access to natural resources and recreation. The Sacramento River, one of the largest salmon-spawning rivers in the world, attracts tourists and residents alike, as do miles of trails in the Pacific Coast Range and Sierra Nevada. Black Butte Reservoir offers water-related recreation. Other outdoor activities abound at the Sacramento River Bend Area, Mendocino National Forest, Shasta-Trinity National Forest and Lassen National Forest. Nearby recreational features also include Lassen Volcanic National Park.

4.3.1 Geography

Tehama County covers nearly 3,000 square miles and is one of 10 counties in the northern Sacramento Valley. Tehama County's agricultural valley is bounded by the Sierra Nevada Mountains on the east and the Coastal Range on the west. Lassen Peak, the southernmost active volcano in the Cascade Range, is located to the northeast in Shasta County. At over 10,450 feet, it towers over Tehama County and has presented a series of powerful eruptions within the past century.

The Sacramento River winds a meandering path from north to south along the valley floor, dividing the County into two nearly equal parts. Cottonwood and Battle Creeks on the northern county boundary, along with Antelope, Reed's, Red Bank, Payne's, Deer, Dye, Mill, Elder and Thomes Creeks are among the principal tributaries flowing into the Sacramento River.

4.3.2 Historical Overview

Two primary Native American tribes once occupied the region presently recognized as Tehama County. The Yana tribe were hunter-gatherers whose territory covered about 2,400 square miles in the region's mountains, meadows and streams. From Round Mountain and the Pit River in Shasta County to Deer Creek in Tehama County, the Yana people lived on wild game, salmon, berries, acorns and roots. As gold miners and ranchers flocked into their territory, the tribe's food supply suffered and they experienced great losses as they fought with settlers. The Yana are now extinct as a functional tribe, although some individuals still exist.

The Nomlaki (Central Wintun) people occupied the Sacramento River Valley and west toward the coastal range in both Tehama and Glenn Counties. The Nomlaki subsisted by fishing, hunting and gathering. Pre-settlement estimates of tribal population members range from 1,000 to 8,000. Contact with early settlers and a malaria epidemic greatly reduced the tribe's population. The federal government restored the Paskenta Band of Nomlaki Indians to full tribal status in 1994. The tribe was able to acquire enough land to establish the Rolling Hills Casino near Corning.

European-American settlers first settled the area in the mid-1800s as a result of Mexican land grants. As Mexico gained independence from Spain in 1821, the reorganization of held lands soon followed. Four settlers were each given land grants by the government of Mexico in 1844. Robert Hasty Thomes received Rancho Saucos, Albert Gallatin Toomes settled Rancho Rio de los Molinos, William George Chard occupied Rancho Las Flores and Job Francis Dye took possession of Rancho Primer Cañon o Rio de Los Berrendos.

Peter Lassen developed the town site of Benton City, but the Gold Rush of 1848 led most settlers to the hills, undermining the success of the town. The gold rush brought considerable numbers of gold-seekers to Tehama County. Many failed gold-seekers stayed in the region establishing small settlements and boomtowns, along with roads, churches, hotels and schools. The town of Red Bluff was one such settlement, settled in the 1850s under various names.

Tehama County was created April 9, 1856 from three neighboring counties: Shasta, Butte and Colusa. The County was named for the City of Tehama, however the origin of the name is not entirely understood. Some possible roots are the Arabic word *Tehama* meaning “hot lowlands” or the Spanish word *tejamanil* which means “roof shingle.” It is generally accepted that *tehama* is an old Native American word meaning “high water,” “low land” or possibly “salmon” in reference to the abundant salmon in the Sacramento River. In the organization of the county, there was a strong attempt to locate the county seat at the community of Tehama, but Red Bluff was ultimately chosen by election.

In early days, Tehama County’s land was considered worthless for farming, so cattle ranching prevailed. However, in the 1850s settlers along Elder and Thomes Creeks began farming the land. From that time forward, agriculture successfully spread across the County and is presently evolving into fruit and nut farming.

Historically, Red Bluff’s location along the Sacramento River enabled it to serve as a transportation hub exporting local agricultural and lumber products by steamship. Corning, the County’s second largest city, was incorporated in 1907. It originally served as an agricultural hub, producing olives, plums, almonds, walnuts, and peaches, as well as cattle and sheep. Corning is home to the Lindsey Olive Company and Bell Carter Foods. The City of Tehama, established in 1846, is Tehama’s oldest and smallest incorporated city, with an area of less than one square mile. Other central area communities include Dairyville, Proberta, Las Flores, Gerber, El Camino, Los Molinos, Richfield, Vina and Kirkwood. Western communities in Tehama County include Red Bank, Flournoy, Paskenta and the Rancho Tehama Reserve. Eastern unincorporated areas include the towns of Manton, Mill Creek, Paynes Creek, Mineral and Dales.

4.3.3 Major Past Hazard Events

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses and public entities. Some of the programs are matched by state programs. Tehama County has experienced 17 events since 1964 for which presidential disaster declarations were issued. These events are listed in Table 4-6. Review of these events helps identify targets for risk reduction and ways to increase a community’s capability to avoid large-scale events in the future. Many natural hazard events that do not trigger federal disaster declaration protocols still have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for hazards of concern.

Table 4-6: Presidential Disaster Declarations for Hazard Events in Tehama County

Year	Date	Incident Description	Disaster Number
2017	4/1	California Severe Winter Storms, Flooding, Mudslides	4308
2012	8/18	Ponderosa Fire	5007
2005	8/26	Manton Fire	2580
1999	8/25	CA- Wildfires	3140
1998	02/09	Severe Winter Storms and Flooding	1203
1997	01/04	Severe Storms/Flooding	1155
1995	03/12	Severe Winter Storms, Flooding, Landslides, Mud Flows	1046
1995	01/10	Severe Winter Storms, Flooding, Landslides, Mud Flows	1044
1993	02/03	Severe Storm, Winter Storm, Mud & Landslides, Flooding	979
1991	02/11	Severe Freeze	894
1986	02/21	Severe Storms, Flooding	758
1983	02/09	Coastal Storms, Floods, Slides, Tornadoes	677
1977	1/20	California Drought	3023
1974	01/25	Severe Storms, Flooding	412
1970	02/16	Severe Storms, Flooding	283
1969	01/26	Severe Storms, Flooding	253
1964	12/24	Heavy Rains & Flooding	183

4.3.4 Physical Setting

4.3.4.1 Geology

The Northern Sacramento River Valley is characterized by surrounding mountain ranges: the wooded Northern Coast Ranges to the west, the forested Siskiyou Mountains to the north and the snow-capped Sierra Nevada to the east. The broad, flat valley floor sharply contrasts with the rugged mountains and gentle hills that are typical of most of California's terrain. The general terrain consists of a series of northwest-trending mountains and valleys formed by thousands of years of tectonic plate movement.

Primarily composed of granite, the Sierra Nevada Range on the east side of Tehama County formed as the oceanic plate began to move under the North American Plate. Magma from the melting oceanic plate rose in plumes to create the Sierra Nevada Batholith, which has since been weathered and worn down to form rolling mountains. River formation and glacial erosion cut deep canyons in the Sierra Nevada Range, exposing metamorphic rock at the top of some peaks.

Geologists theorize that the valley floor originated below sea level as an offshore depression created by movement of the Farallon Plate into a trench far off the California coast. The Central Valley was later enclosed by the uplift of the Coastal Range to the west. Many faults exist within both the Coastal Range and the Sierra Nevada Range, as the mountains continue building. Erosion of the surrounding mountains over thousands of years has filled the valley with stream-borne sediment creating the broad, flat surface. Prior to construction of California's enormous flood control and canal system, annual snow melt turned much of Tehama County's valley into an inland lake. The Sacramento River cuts through the valley, transporting and re-distributing nutrient-rich sediments throughout the productive floodplain.

The Northern Coastal Range extends from north to south along the eastern boundary of Tehama County. Bedrock of the Coastal Range varies greatly in type and geologic age. Most of the rocks were formed millions of years ago as deposits on the sea bottom. Less-dense deposits moving laterally on the oceanic crust as a result of plate tectonics failed to pass under the North American Plate and instead accumulated on the overriding plate. In some places, lava or igneous rock was forced in molten condition into cracks and crevices in the sedimentary rocks. Erosion of the softer sedimentary rock gives the range much of its present appearance.

Though both mountain ranges paralleling Tehama County have many active faults, seismic activity in the County is relatively low. However, smaller faults in the area are capable of producing numerous lower-magnitude earthquakes.

4.3.4.2 Soils

General soil types are fairly uniform in the upper Central Valley of California. The United States Department of Agriculture Soil Conservation Service and Forest Service published the soil survey for the Tehama County in 1967. The study identifies three major parts in Tehama County. These are (1) the flood plains and terraces, (2) the foothills, and (3) the mountains.

- Soils of the Flood Plains and Terraces
    - The soils of the flood plains and terraces are dominantly brown or reddish brown and are very deep to shallow. Soils of the flood plains form the nearly level and very gently sloping areas along the Sacramento River and its tributaries; these soils are deep to very deep. The elevation ranges from about 250 to 500 feet, and rainfall from 19 to 25 inches annually.

      Soils of the terraces are mostly west of the Sacramento River, but one large area is just east of Vina and Los Molinos. Here the elevation ranges from 300 to 800 feet, and annual rainfall ranges from 19 to 30 inches.
- Soils of the Foothills
    - The foothills are made up of mainly brown or reddish-brown soils that are shallow to deep. West of the Sacramento River, the soils occupy a wide area between the terraces and the mountains. The soils here formed in material from softly consolidated sediments and from sandstone and hard shale. They are medium textured to fine textured and are moderately steep to very steep. The elevation ranges from 500 to 2m000 feet, and annual rainfall ranges from 19 to 35 inches.

      East of the Sacramento River are shallow to moderately deep, rocky loams formed in material from volcanic rock. These soils are gently sloping to steep. They are at elevations of 500 to 4,000 feet where annual precipitation ranges from 20 to 35 inches.

- Soils of the Mountains
  - In the mountains are chiefly brown, reddish-brown, or light- gray soils that are shallow to moderately deep. The areas are in the western and eastern parts of the county and the elevation is mostly more than 3,000 feet. Precipitation ranges from 25 to more than 70 inches annually. (Soil Survey- Tehama County California, 1967)

4.3.4.3 Climate

As Tehama County's landscape varies from valley to surrounding mountains, so does its climate. The valley areas are characterized by hot, dry summers and mild, wet winters. Mountain regions in Tehama County offer warm, dry summer weather, while the higher elevations are considerably colder and snowy during winter.

Due to the inland location, temperatures in Tehama County vary significantly between summer and winter. Valley temperatures in the City of Red Bluff average 81.9ºF during July and 45.3ºF in January. Red Bluff is located about 350 feet above sea level and the mean annual temperature is 62.8ºF. It is not uncommon for temperatures to reach 110-115 degrees in the valleys during the summer. In the mountain town of Mineral, located at 4,872 feet above sea level, the annual average temperate is 44.8ºF, summer temperatures average 61.5ºF, and winter temperatures are typically around 32ºF. Summer maximum temperatures in the mountains are usually around 80ºF.

Rain may occur year-round in Tehama County, although most precipitation occurs during the winter. Much of the rainfall is due to storm fronts coming from the west across the Pacific Ocean. Much of the moisture from the Pacific storms falls on the windward (western) side of the Coastal Ranges. The leeward (east) side of the Coastal Range and valley within Tehama County is in a rain shadow and is therefore considerably drier. Annual average precipitation in Red Bluff is 22.4 inches. Areas of the County on the windward side of the Sierra Nevada, east of the valley, see higher precipitation levels. Mineral's mean annual precipitation exceeds 54 inches, its annual average snowfall is about 140 inches.

4.3.5 Critical Facilities and Infrastructure

Critical facilities are of particular concern when conducting hazard mitigation planning. Critical facilities are defined as essential services, and if damaged, would result in severe consequences to the health, safety, and welfare of the public.

Figure 4-7 shows the location of critical facilities in unincorporated areas of the county. Critical facilities within the cities participating in this plan are shown in maps for each city provided in Volume 2 of the plan. Due to the sensitivity of this information, a detailed list of facilities is not provided. The list is on file with each planning partner. Table 4-7 and Table 4-8 provide summaries of the general types of critical facilities and infrastructure in unincorporated County areas. The risk assessment for each hazard qualitatively discusses critical facilities with regard to that hazard.

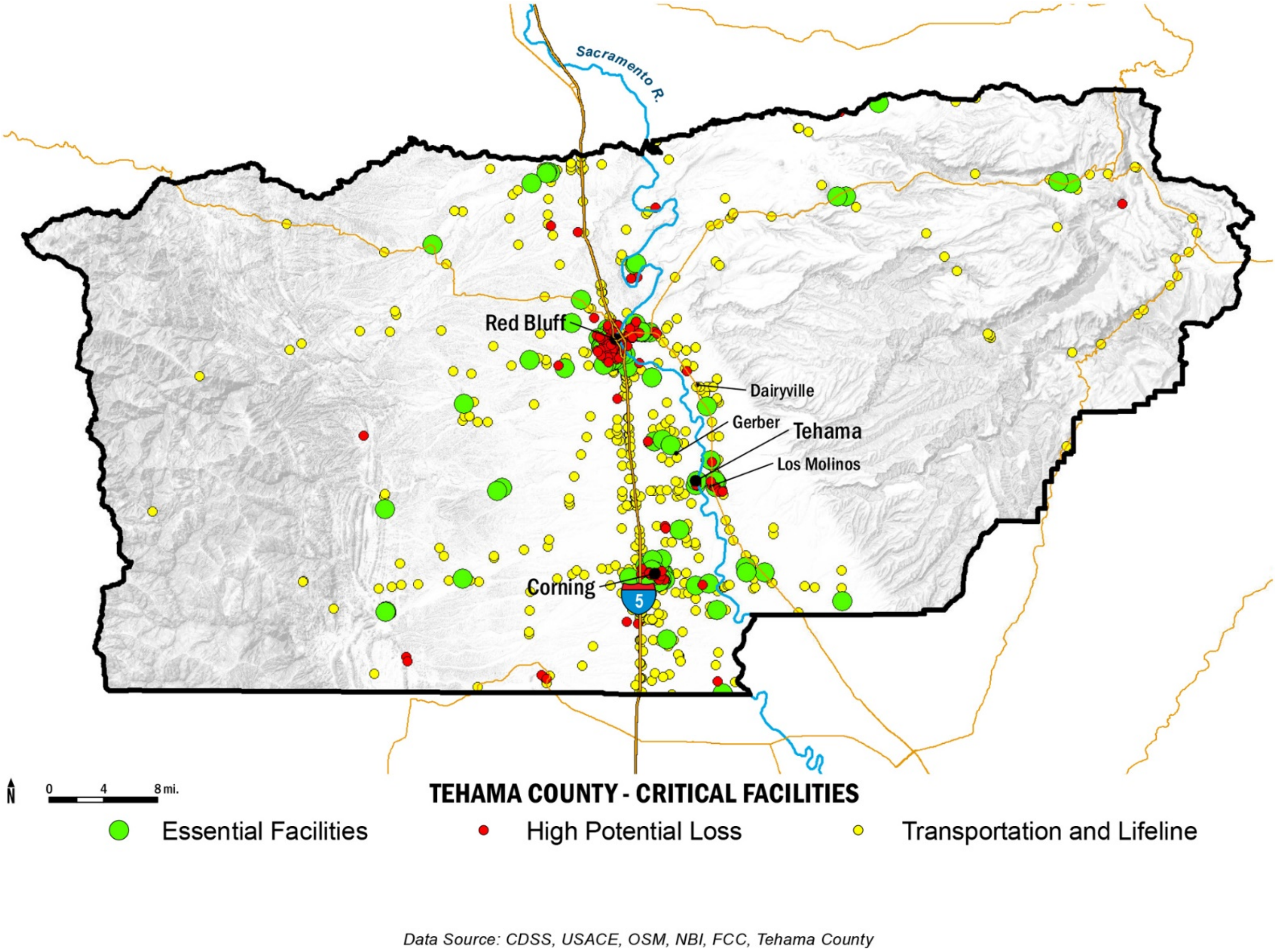


Figure 4-7: Critical Facilities

Table 4-7: Critical Facility Points (Unincorporated Tehama County)

Infrastructure Type	Total Feature Count
Essential Facility	49
High Potential Loss	56
Transportation and Lifeline	463
Grand Total	**568**

Table 4-8: Linear Utilities (Unincorporated Tehama County)

Infrastructure Type (Linear)	Total Linear Mileage
Transportation and Lifeline	**6,172.4**
FEMA Levee	24.8
USACE Levee	15.5
Natural Gas Pipeline	184.5
Transmission Line	430.2
Railroad	62.3
Street	5,455.2
Grand Total	**6,172.4**

4.3.6 Demographics

Some populations are at greater risk from hazard events because of decreased resources or physical abilities. Elderly people, for example, may be more likely to require additional assistance. Research has shown that people living near or below the poverty line, the elderly (especially older single men), the disabled, women, children, ethnic minorities and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap spatially and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would assist the County in extending focused public outreach and education to these most vulnerable citizens.

4.3.6.1 Tehama County Population Characteristics

Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. Knowledge of the composition of the population and how it has changed in the past and how it may change in the future provides information for making informed decisions about the future. A growing population generally indicates a growing economy, while a declining population generally signifies economic decline.

The United States Census Bureau reported Tehama County's population to be 63,463 in 2010. The population increased by 7,424 people (13.24%) since the last census in 2000. Of California's 58 counties, Tehama County ranks as the 41st most populous.

According to 2016 Census population estimates, about 65 percent of Tehama County's residents lived outside of incorporated areas. Overall growth in incorporated areas was approximately 16 percent from 1990 to 2016, while the unincorporated areas of the county grew about 25 percent during the same time frame. Red Bluff is the only incorporated city in Tehama County with a population of over 10,000. Corning is the second largest city, with over 7,500 residents. The City of Tehama hosts a population of just 416. Table 4-9 shows the population of incorporated municipalities and the combined unincorporated areas in Tehama County from 1990 through 2016.

Table 4-9: Census Population Estimates

POPULATION OF CITIES AND UNINCORPORATED COUNTY						
	Corning	Red Bluff	Tehama	Incorporated Total	Unincorporated County	Tehama County Total
1990	5,870	12,363	401	**18,634**	30,991	**49,625**
1991	6,036	12,535	397	**18,968**	31,762	**50,730**
1992	6,222	12,727	397	**19,346**	32,838	**52,184**
1993	6,228	12,760	409	**19,397**	33,591	**52,988**
1994	6,305	12,760	416	**19,481**	34,035	**53,516**
1995	6,390	13,152	427	**19,969**	34,230	**54,199**
1996	6,513	13,116	429	**20,058**	34,550	**54,608**
1997	6,560	13,042	426	**20,028**	34,895	**54,923**
1998	6,632	13,056	428	**20,116**	35,169	**55,285**
1999	6,663	13,092	427	**20,182**	35,277	**55,459**
2000	6,741	13,147	432	**20,320**	35,719	**56,039**
2001	6,733	13,157	431	**20,321**	35,910	**56,231**
2002	6,770	13,355	432	**20,557**	36,373	**56,930**
2003	6,849	13,491	435	**20,775**	37,089	**57,864**
2004	6,898	13,576	436	**20,910**	37,924	**58,834**
2005	7,012	13,678	435	**21,125**	38,751	**59,876**
2006	7,154	13,525	434	**21,113**	39,846	**60,959**
2007	7,164	13,671	426	**21,261**	40,365	**61,626**
2008	7,200	13,776	427	**21,403**	40,776	**62,179**
2009	7,396	13,776	425	**21,597**	41,239	**62,836**
2010	7,663	14,076	418	**22,157**	41,306	**63,463**
2011	7,632	14,049	415	**22,096**	41,158	**63,254**
2012	7,603	14,044	414	**22,061**	41,072	**63,133**
2013	7,547	14,018	411	**21,976**	40,859	**62,835**
2014	7,511	13,984	411	**21,906**	40,850	**62,756**
2015	7,522	14,084	414	**22,020**	41,053	**63,073**
2016	7,535	14,158	416	**22,109**	41,167	**63,276**

4.3.6.2 Income

In the United States, individual households are expected to use private resources to prepare for, respond to and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters.

This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impacted people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely decide not to evacuate.

Based on the 2015 American Community Survey estimates, the median household income in Tehama County was $41,001 (in 2015 inflation-adjusted dollars). It is estimated that there are 1,554 households with less than $10,000 in income per year and 5,297 households with $10,000 to $25,000 in income per year. About 13.9% of the households in Tehama County are below the poverty level.

4.3.6.3 Age Distribution

The vulnerability of elderly citizens can vary significantly based on health, age, and economic security. However, as a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

Based on the 2015 American Community Survey, 17.3% of Tehama County's population (63,152) is 65 or older (10,938), higher than the state average of 12.5%. In addition, 42.3% of the County's over-65 population have disabilities of some kind and 10.2% have incomes below the poverty line. It is estimated that 24% of the County's population is 18 or younger (15,250), around the same as the state average of 23.8%. About 27.6% of children under the age of 18 are living below the poverty level. The overall age distribution for Tehama County is illustrated in Figure 4-8.

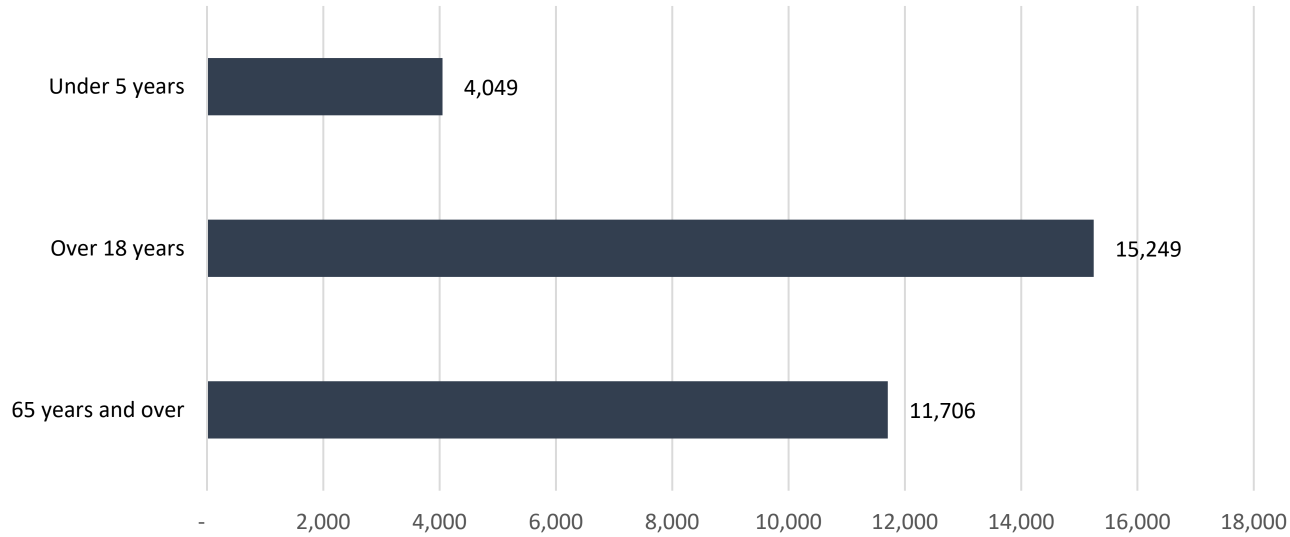


Figure 4-8: Age distribution in Tehama County for July 1, 2016

4.3.6.4 Race, Ethnicity and Language

Research shows that minorities are less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability.

According to the 2015 U.S. Census American Community Survey estimates, Tehama County is predominately white, at 70.1 percent of the total population. The largest minority population is Hispanic/Latino at 23.5 percent of the total county population. Figure 4-9 shows the racial distribution within Tehama County.

Tehama County has an 8.3% foreign-born population according to the 2010 US Census Demographic Profile. Other than English, the most commonly spoken language is Spanish (16.6%).

4.3.6.5 Disabled Populations

Because people living with disabilities are significantly more likely to have difficulty responding to a hazard event than the general population, they have a special stake in emergency planning efforts. According to U.S. Census figures, roughly one-fifth of the U.S. population lives with a disability, and the percentage is rising. Furthermore, disabled populations are increasingly integrated into society. This means that a relatively large segment of the population will require assistance during the 72 hours post-event, the period generally reserved for self-help. Disabilities can vary greatly in severity and permanence, making populations difficult to define and track. There is no “typical” disabled person, which can complicate disaster-planning processes that attempt to incorporate them. Disability is often compounded with other vulnerabilities, such as age, economic disadvantage and ethnicity, all of which mean that housing is more likely to be substandard.

While the percentage of disabled in Tehama County does not differ much from that of the state as a whole, the overall numbers are significant and warrant special attention from planners and emergency managers (see Table 4-10). According to 2000 U.S. Census data, 23.1 percent of the County's population over the age of 5 has a disability.

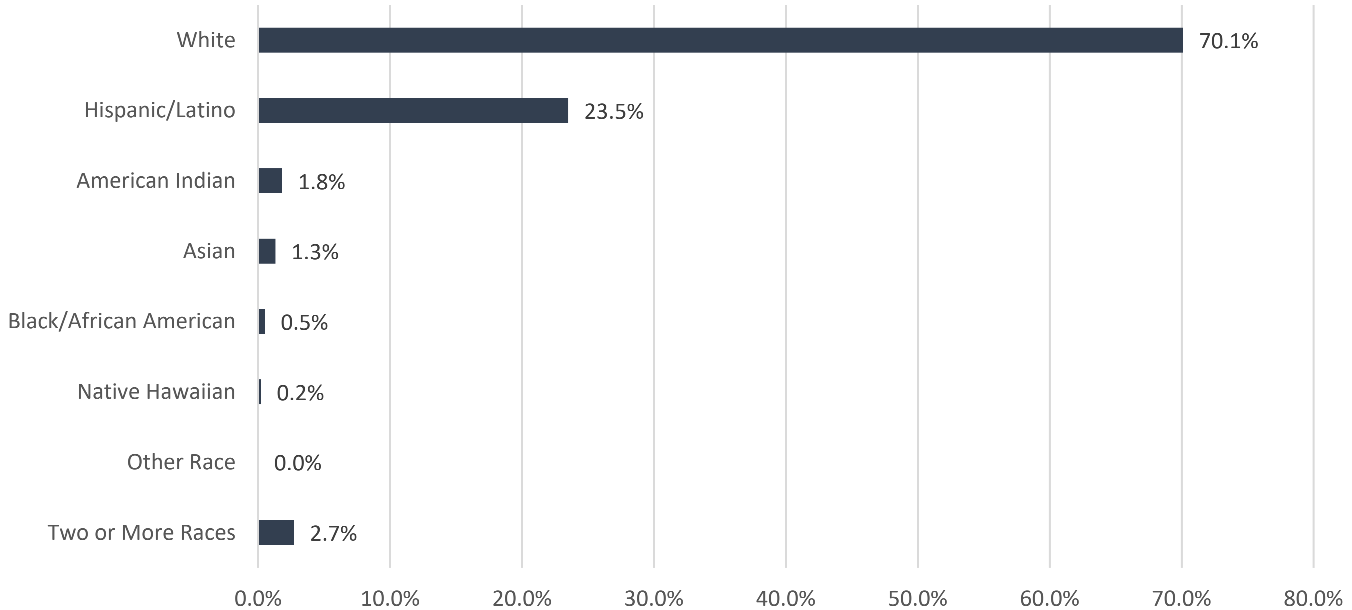


Figure 4-9: Tehama County Race Distribution

Table 4-10: Disability Status of Non-Institutionalized Population

Age	Persons with a Disability	Percent of Age Group
Age 5 to 20 years	1,207	8.8
Age 21 to 64 years	6,842	23.3
Age 65 years and over	3,913	44.8

Detailed spatial analysis to locate areas in which there are higher concentrations of vulnerable community members such as people with low incomes, people who are elderly or with disabilities, and people of minority ethnicity would assist the County in extending focused public outreach and education to these most vulnerable citizens.

4.3.7 Economy

Tehama County's General Plan indicates economic development as highly important to the community. Development of new businesses can expand the property tax base and increase sales tax, both directly and indirectly, as can the retention and expansion of existing businesses. Increasing County revenues has become more important in recent years due to declining revenues from the State of California and the decline in natural resource-related industries, including major declines in timber-related industries.

The County and its incorporated cities recognize that economic development is an important planning tool for managing growth to achieve a broad range of community goals and objectives, including economic diversification, entrepreneurial development, human resource development, job retention and growth of the tax base. These communities must coordinate economic development approaches to address logging cutbacks, lumber mill closures and other imminent changes.

In spite of current economic stresses, Tehama County possesses many crucial assets that may contribute to economic revitalization. Corning and Red Bluff are centrally located in Northern California on Interstate 5, the state's major north-south corridor. Tehama County is further advantaged by its proximity to major metropolitan growth centers including Shasta/Redding, Butte/Chico and the Sacramento Metropolitan Area. Many other County assets exist, including a large supply of entry-level labor; reasonably priced business environments; affordable housing; abundant cultural and recreational resources; and broad agricultural opportunities. Resource-based businesses are encouraged within the County by revitalizing traditional timber and agricultural industries. A change in demographics and culture promotes ecotourism, organic food production and to a lesser impact, recreation.

4.3.7.1 Industry, Businesses and Institutions

Tehama County's economy is strongly based in resource extraction as most of the land is used as cropland, range and pasture land, or woodland. The area's many natural resources support its primary industries of manufacturing, agriculture and trade.

The most common sectors in 2015, by number of people living in Tehama County were educational services and healthcare (4,753 total employees), retail trade (3,243 total employees) and arts, entertainment, recreation, accommodation and food services (2,156 total employees). (see Figure 4-10).

Tehama County hosts a range of major employers including the Tehama County Government, Sierra Pacific Lumber and Millwork Industries, Wal-Mart store and distribution center and the Rolling Hills Casino. The County benefits from a variety of business activity ranging from heavy industrial/manufacturing, to agriculture and to the retail services sectors.

4.3.7.2 Employment Trends and Occupations

According to the 2015 American Community Survey, about 53.7% of Tehama County's population is in the labor force. This number may be reflective of the number of retired persons in Tehama County, as the fourth largest age group (ages 65 to 74) is not typically in the active work force.

Tehama County's unemployment trends have closely mirrored the state's pattern; though the County's annual average unemployment rates are slightly higher. The County's unemployment rates were lowest in 2001 at 6.5 percent.

Unemployment rates again dipped to 6.5 percent in 2006, but have since been on an upward trend and are expected to rise. Preliminary labor market data from the California Employment Development Department indicated that Tehama County's unemployment rate stayed consistent at 6.8 percent as of August 2017.

Non-agricultural employment is led by educational services, and health care and social assistance (20.6%), followed by retail trade (14%). According to Tehama County Economic Development, the leading employers in the County are Bell Carter, Corning Chamber of Commerce, Crain Walnut Shelling, Inc., Lassen Medical Center, Los Molinos Chamber of Commerce, Louisiana Pacific, Red Bluff Chamber of Commerce, Rolling Hills Casino, Sierra Pacific, St. Elizabeth Hospital, TA-Petro and Wal-Mart Distribution Centers.

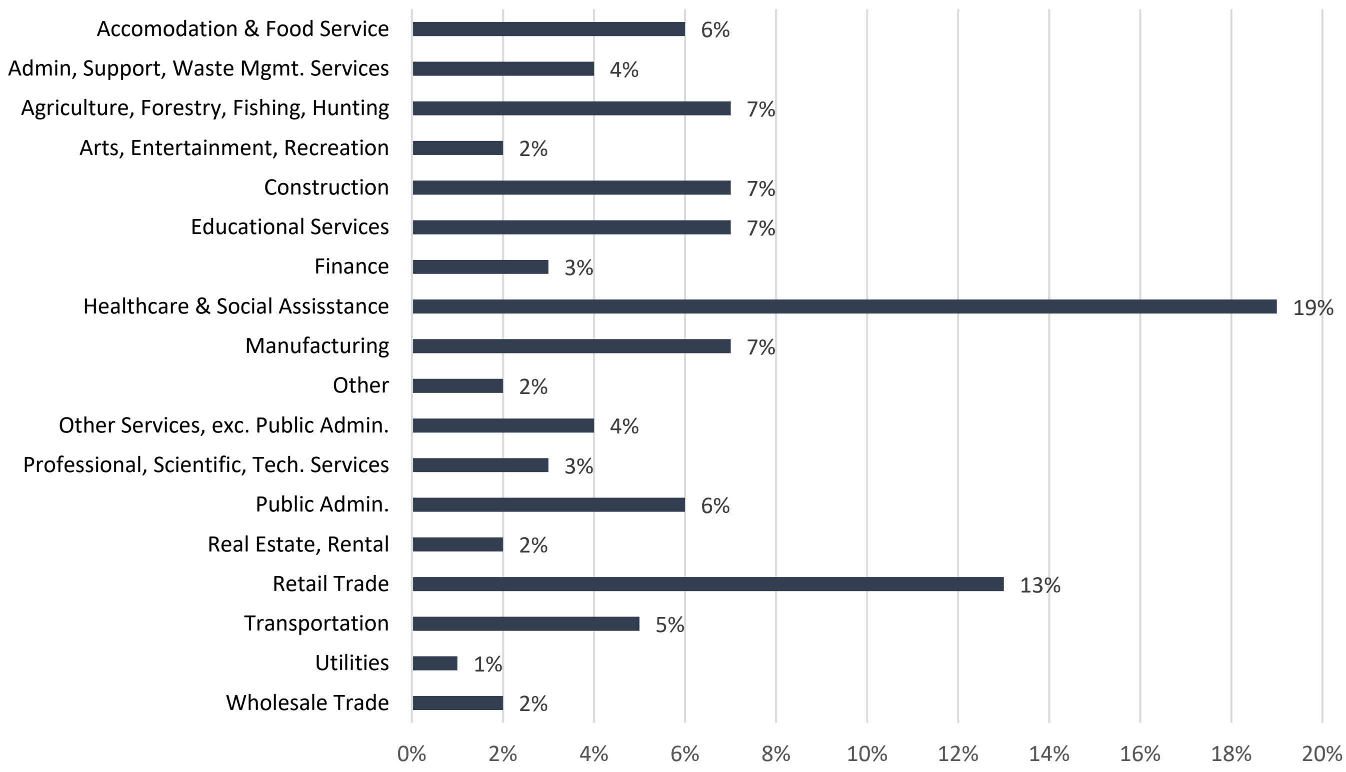


Figure 4-10: Industry in Tehama County

4.3.8 Future Trends in Development

The County and its participating cities have adopted comprehensive plans that govern land use decisions and policy making in their jurisdictions. Decisions on land use will be governed by these programs. This plan will work together with these programs to support wise land use in the future by providing vital information on the risk associated with natural hazards in Tehama County.

All municipal planning partners will incorporate by reference the Tehama County Multi- Jurisdictional Hazard Mitigation Plan in their comprehensive plans. This will assure that all future trends in development can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan.

Since the 2012 HMP was approved, the County has permitted single family residential units to be built in Zone A flood zones with mitigations per flood zone requirement. One single family residential unit was constructed in a floodway after a hydrology study and report showed that it was feasible with mitigations. All future development that will take place is planned to occur in accordance with the General Plan Land Use Zones and will consider all potential hazards identified within this plan. Additionally, all development will be in compliance with all Fire, Flood, and Seismic codes of the County and State at the time of development.

4.4 Dam Failure Hazard

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure, which accounts for 34 percent of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30 percent of all dam failures.
- Failure due to piping and seepage accounts for 20 percent of all failures. These are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10 percent of all failures.

The remaining 6 percent of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters, such as earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage. The most likely disaster-related causes of dam failure in Tehama County are earthquakes, excessive rainfall and landslides.

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

4.4.1 Regulatory Oversight

The potential for catastrophic flooding due to dam failures led to passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect the lives and property of the public.

4.4.1.1 California Division of Safety of Dams

California's Division of Safety of Dams (a division of the Department of Water Resources) monitors the dam safety program at the state level. When a new dam is proposed, Division staff inspect the site. When an application is received, the Division reviews the plans to ensure that the dam is designed to meet minimum requirements and that the design is appropriate for known geologic conditions. After approval of the application, the Division inspects the construction to ensure that the work is done in accordance with the approved plans. After construction, the Division inspects each dam on an annual basis to ensure that it is performing as intended and is not developing problems. Roughly a third of these inspections include in-depth instrumentation reviews. The Division periodically reviews the stability of dams and their major appurtenances in light of improved design approaches and requirements, as well as new findings regarding earthquake hazards and hydrologic estimates in California (DWR Website, 2007).

4.4.1.2 U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (U.S. Army Corps of Engineers, 1997).

4.4.1.3 Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) has the largest dam safety program in the United States. The FERC cooperates with a large number of federal and state agencies to ensure and promote dam safety and, more recently, homeland security. There are 3,036 dams that are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC staff inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent consulting engineer, approved by the FERC, must inspect and evaluate projects with dams higher than 10 meters (32.8 feet), or with a total storage capacity of more than 2,000 acre-feet.

FERC staff monitors and evaluates seismic research in geographic areas where there are concerns about seismic activity. This information is applied in investigating and performing structural analyses of hydroelectric projects in these areas. FERC staff also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC staff visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

The FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

4.4.2 Hazard Profile

4.4.2.1 Past Events

On December 3rd, 2014, heavy rain showers and thunderstorms brought record rainfall and flooding issues to portions of the Central Valley and foothills. There were 2 berm levees which failed in Tehama County, flooding over 200 homes and damaging farms and orchards. Significant traffic delays were caused by road flooding across interior Northern California. Snow levels remained above 7500 feet, so snowfall was limited to higher Sierra peaks and Lassen Peak.

There was flooding and impacts along Highway 99 from numerous creeks overtopping their banks in addition to earthen berm or earthen levee failures. There were issues on the following creeks: Salt Creek (Overtopped at Highway 99 and Highway 36 location), Antelope Creek (Private earthen berm failure at Rancho Ave), Craig Creek (Overtopped near Craig Road and Rancho Ave), Dye Creek (Over topped and earthen berm failure between Shasta Blvd. and 62nd Ave). Highway 99 was closed from highway 36 to Aramayo Way for many hours (Wednesday evening through early Thursday morning) until the water receded and things could be cleaned up. There were 213 homes impacted from the flooding, with significant damage from water and mud. Many homes had several feet of water. Fields and orchards were also flooded. Damage to homes, bridges, fencing, crops, and beehives totaled $2.5 million. Repairs and remediation to the berms totaled $4.25 million. (Administration, 2017)

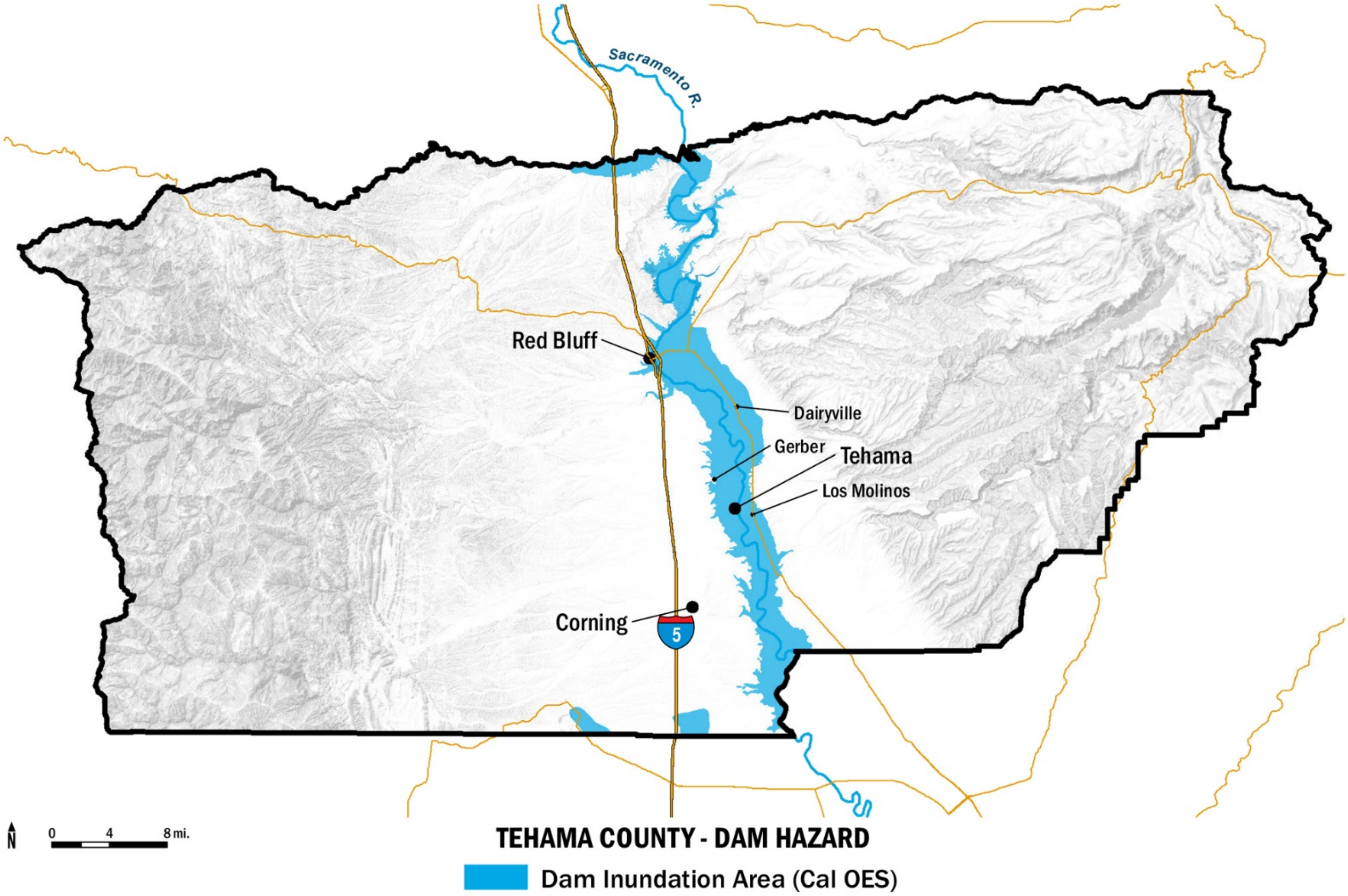
4.4.2.2 Location

According to California Department of Water Resources Division of Dam Safety, there are 5 dams in Tehama County (Resources, 2017), see Table 4-11 for a listing of these dams. There are also three dams outside the county with inundation areas that reach into Tehama County (Macumber, Shasta and Whiskeytown).

Table 4-11: Dams in Tehama County

Dam Number	Dam Name	Owner Name	Year Built
1266.000	Black Butte Reregulating	City of Santa Clara	1989
265.000	Corral	T.M. Cattle Company	1959
265.002	Rye	T.M. Cattle Company	1959
1261.000	Sunflower	Private Entity	1976
1260.000	Top Cat	Paskenta Band of Nomlaki Indians of California	1976

Figure 4-11 shows inundation zones for the Macumber, Shasta and Whiskeytown dams, the only dams affecting the planning area for which inundation mapping has been prepared. Additionally, the map shows an inundation zone for Black Butte Reservoir dam which enters the southern portion of the county. Areas of the County most threatened by dam inundation are those along the Sacramento River corridor, including the cities of Red Bluff and Tehama.



Data Source: California Office of Emergency Services

Figure 4-11: Dam Inundation Zones in Tehama County

4.4.2.3 Frequency

Dams are constructed with safety features known as "spillways" that allow water to overtop the dam if the reservoir fills too quickly. Spillway overflow events, often referred to as "design failures," result in increased discharges downstream and increased flooding potential. The "residual risk" associated with dams is the risk beyond that for which safeguards have been implemented. However, the probability of any type of dam failure is low in today's regulatory and dam safety oversight environment. Dam failure events usually coincide with events such as earthquakes, landslides and excessive rainfall and snowmelt.

4.4.2.4 Severity

Dam failure can be catastrophic to all life and property downstream. FEMA developed the classification system shown in Table 4-12 for the hazard potential of dam failures. This hazard potential classification system categorizes dams based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests. Improbable loss of life exists where persons are only temporarily in the potential inundation area. For instance, this hazard potential classification system does not contemplate the improbable loss of life of the occasional recreational user of the river and downstream lands, passer-by, or non-overnight outdoor user of downstream lands. It should be understood that in any classification system, all possibilities cannot be defined. High usage areas of any type should be considered appropriately. Judgment and common sense must ultimately be a part of any decision on classification. Further, no allowances for evacuation or other emergency actions by the population should be considered because emergency procedures should not be a substitute for appropriate design, construction, and maintenance of dam structures.

Table 4-12: FEMA Hazard Potential Classification

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Source: Federal Guidelines for Dam Safety- Hazard Potential Classification Systems for Dams, April 2004

4.4.2.5 Warning Time

Warning time for dam failure depends on the cause of failure. In an event of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to earthquake, there may be no warning time. A dam's structural type also affects warning time. Earthen dams do not tend to fail instantaneously. Once a breach is initiated, discharging water erodes the breach until the reservoir water is depleted or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach. The time of breach formation ranges from a few minutes to a few hours. Several planning partners have established protocols for warning and response to imminent dam failure in the flood warning portion of their emergency operations plans. These protocols are tied to emergency action plans created by the dam owner.

Development of Emergency Action Plans (EAPs) for all high and significant hazard potential dams for Tehama County is critical to reducing the risks of loss of life and property damage from dam failures. EAPs have been developed for dams of interest in this HMP. The EAP contains procedures and information to assist the dam owner in issuing early warning and notification messages to emergency management authorities. The EAP also contains inundation maps to identify the areas subject to flooding in the unlikely event of dam failure.

EAPs are critical in identifying areas downstream from dams requiring warning and evacuation in the event of dam failure. Documented cases have demonstrated that warning and evacuation time for EAPs can dramatically influence the loss of life. Loss of life can vary from 0.02 percent of the persons-at-risk when the warning time is 90 minutes to 50 percent when less than 15 minutes (Graham, 1988). Costa (85-560, 1985) reported that the average number of fatalities per dam failure is 19 times greater when there is little to no warning. Dam breach inundation studies usually assume one of two failure scenarios:

- Flows from a dam failure during "fair weather" or "sunny day" conditions with the reservoir at the normal pool level and receiving normal inflow (usually insignificant). A fair weather failure is generally considered to have the most potential for loss of human life, primarily due to the element of surprise.

- Flows from a dam failure during flood conditions or the inflow design flood. Failure during flood conditions is considered to show the upper limit of inundation and to have less potential for loss of human life because the downstream population is “on alert.” The flood conditions scenario is more expensive to analyze due to the additional cost for the necessary watershed and spillway studies.

Inundation mapping shows a continuous “line of inundation” identifying the area potentially at risk in event of dam failure. It starts at the dam and continues downstream to a point where the breach flood no longer poses a risk to life and property damage, such as a large river or reservoir with the capacity of storing the flood waters. The need to consider the “domino effect” should be made on a case-by-case basis if the assumed failure of a dam would cause the failure of any downstream dams.

Important to Note: EAPs are not publicly available but are on file at the Tehama County Sheriff’s Office. Information provided on flooding conditions at downstream locations will include:

- Distance downstream
- Arrival time of leading edge of flood wave
- Peak flow depth, incremental rise, or water surface elevation (as appropriate)
- Peak velocity

4.4.2.6 Secondary Hazards

Dam failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam failure are landslides around the reservoir perimeter, bank erosion on the rivers, and destruction of downstream habitat.

4.4.2.7 Climate Change Impacts

Dams are designed partly based on assumptions about a river’s flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures. If the hygrograph changes, then dam operators may be forced to release increased volumes earlier in a storm cycle to maintain required margins of safety. Such early releases can increase flood potential downstream. Throughout the western United States, communities downstream of dams are already experiencing increases in stream flows from earlier releases from dams. In 2017, areas of Tehama County experienced the effects of early releases from the Shasta Dam.

4.4.3 Dam Failure Vulnerability Analysis

The primary danger associated with dam failure is the high velocity flooding downstream of the dam and limited warning times for evacuation. Vulnerability varies by community and depends on the particular dam profile and the nature and extent of the failure. Vulnerable population is present directly below downstream elements of the dam, especially those incapable of escaping the area within the allowable time frame. This population includes the elderly and young who may be unable to self-evacuate from the inundation area. The vulnerable population also includes those who would not have adequate warning from a television or radio emergency warning system. Dam inundation zones created by Cal OES were used to develop at risk populations and loss estimations for dam failure.

Dam failure exposure numbers were generated using Tehama County Assessor and parcel data. County assessor data does not include tax exempt structures, such as federal and local government buildings. All data sources have a level of accuracy acceptable for planning purposes.

Table 4-13: Dam Failure Vulnerability Snap Shot

Exposed Population	Exposed Market Value ($)	Exposed Content Value ($)	Exposed Critical Facilities	Exposed Miles of Lifeline
12,883	$ 979,017,829	$ 701,500,731	148	412
31.06% *total pop.*	28.71% *total value*	29.63% *total cost*	26.01% *total count*	6.68% *total mileage*

4.4.3.1 Population

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable time frame. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television, radio emergency warning system, have not registered with reverse 911, or do not have cell phones that can receive amber alerts. The potential for loss of life is affected by the capacity and number of evacuation routes available to populations living in areas of potential inundation. The entire population in a dam failure inundation zone is exposed to the risk of a dam failure. The estimated population living in the inundation area mapped for this risk assessment is summarized in Figure 4-12 and Table 4-14.

Population Exposure

Population Count by Dam Inundation Zone

Figure 4-12: Population Exposure to Dam Failure (Tehama County Unincorporated)

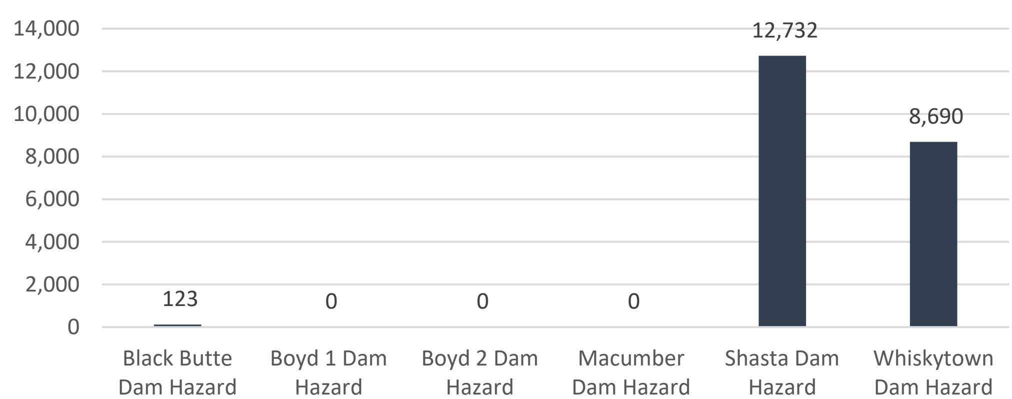


Table 4-14: Population Exposure to Dam Failure (Tehama County Unincorporated)

	Total Population
Tehama County Unincorporated	41,473

Dam Inundation Zone	Population Count	% of Total
Black Butte Dam Hazard	123	0.30%
Boyd 1 Dam Hazard	0	0.00%
Boyd 2 Dam Hazard	0	0.00%
Macumber Dam Hazard	0	0.00%
Shasta Dam Hazard	12,732	30.70%
Whiskytown Dam Hazard	8,690	20.95%
Cal OES Dam Inundation Area*	**12,883**	**31.06%**

4.4.3.2 Property

Vulnerable properties are those closest to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads and bridges in the path of the dam inundation. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

The county Assessor's parcel data was used as the basis for the inventory of current market values and content value summaries. GIS was used to create centroids, or points, to represent the center of each parcel polygon – this is assumed to be the location of the structure for analysis purposes. The centroids were then overlaid with the inundation zones to determine the at-risk structures. This methodology assumed that every parcel with a current net value or assessed value was an improved parcel. Building exposure was calculated based on current net values or when absent, assessor's values as provided by the assessor's office. Building content exposure was calculated based on occupancy type multipliers and improvement value. Table 4-15 shows the count of at-risk parcels and their associated building and content exposure values to dam failure.

The most vulnerable properties are those closest to the dam itself as they would experience the largest, most destructive surge of water. A total of $1,680,518,560 worth of buildings and contents are exposed to dam failure hazards within the County Boundaries representing 29.1% of the total value in the unincorporated county.

Table 4-15: Parcel Values at Risk from Dam Inundation

	Total Parcels	Total Market Value Exposure ($)	Total Content Value Exposure ($)	Total Value ($)
Tehama County	34,284	$ 3,409,758,850	$ 2,367,722,620	$ 5,777,481,470

Dam Inundation Zone	Improved Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Black Butte Dam Hazard	124	0.4%	$ 10,751,737	$ 8,637,629	$ 19,389,366	0.34%
Boyd 1 Dam Hazard	-	0.0%	$ -	$ -	$ -	0.00%
Boyd 2 Dam Hazard	-	0.0%	$ -	$ -	$ -	0.00%
Macumber Dam Hazard	-	0.0%	$ -	$ -	$ -	0.00%
Shasta Dam Hazard	6,650	19.4%	$ 967,081,684	$ 691,959,659	$ 1,659,041,343	28.72%
Whiskytown Dam Hazard	4,409	12.9%	$ 702,252,069	$ 497,437,863	$ 1,199,689,932	20.76%
Cal OES Dam Inundation Area*	**6,792**	**19.8%**	**$ 979,017,829**	**$ 701,500,731**	**$ 1,680,518,560**	**29.1%**

*total area is not equal to sum of all dam inundation zones due to dissolved overlapping inundation areas.

4.4.3.3 Critical Facilities

Critical Facilities at risk to dam inundation are on file with the County and for national security purposes can only be accessed through Tehama County's Sheriff's Office. As a general note, low-lying areas are vulnerable to dam inundation, especially transportation routes. This includes all roads, railroads, and bridges in the flow path of water. The most vulnerable critical facilities are those in poor condition that would have difficulty withstanding a large surge of water. Utilities such as overhead power lines and communication lines could also be vulnerable. Loss of these utilities could create additional compounding issues for emergency management officials attempting to conduct evacuation and response actions. GIS analysis determined that 148 of the planning area's critical facilities are in a mapped dam inundation area, as summarized in Table 4-16 and Table 4-17.

Table 4-16: Critical Infrastructure Points in Dam Inundation Zones

Infrastructure Type	Cal OES Dam Inundation Area*	Black Butte Dam	Boyd 1 Dam	Boyd 2 Dam	Macumber Dam	Shasta Dam	Whiskytown Dam
Essential Facility	10	0	0	0	0	10	5
EOC	0	0	0	0	0	0	0
Fire Station	3	0	0	0	0	3	1
Government Facility	0	0	0	0	0	0	0
Hospital	0	0	0	0	0	0	0
Police Station	1	0	0	0	0	1	1
School	6	0	0	0	0	6	3
High Potential Loss	35	2	0	0	1	32	24
Residential Child Care	0	0	0	0	0	0	0
Adult Residential Care	17	0	0	0	0	17	12
Child Care	6	0	0	0	0	6	5
Foster/Home Care	0	0	0	0	0	0	0
Home Care	0	0	0	0	0	0	0
Foster Care	0	0	0	0	0	0	0
Elder Care	7	0	0	0	0	7	5
Dam	5	2	0	0	1	2	2
Hotel	0	0	0	0	0	0	0
Transportation and Lifeline	103	9	0	0	2	92	52
Airport	0	0	0	0	0	0	0
Bridge	93	6	0	0	2	85	49
Bus Facility	0	0	0	0	0	0	0
FCC AM Tower	1	0	0	0	0	1	1
FCC Cell Tower	0	0	0	0	0	0	0
FCC FM Tower	0	0	0	0	0	0	0
Natural Gas Station	7	2	0	0	0	5	2
Power Plant	0	0	0	0	0	0	0
Substation	2	1	0	0	0	1	0
Waste Water Facility	0	0	0	0	0	0	0
Grand Total	**148**	**11**	**-**	**-**	**3**	**134**	**81**

*total counts are not equal to sum of all dam inundation zones due to dissolved overlapping inundation areas.

Table 4-17: Miles of Critical Infrastructure (Linear) in Dam Inundation Zones

Infrastructure Type (Linear)	Cal OES Dam Inundation Area*	Black Butte Dam	Boyd 1 Dam	Boyd 2 Dam	Macumber Dam	Shasta Dam	Whiskytown Dam
Transportation and Lifeline	**412.0**	**27.8**	**-**	**-**	**0.3**	**381.3**	**226.3**
FEMA Levee	14.9	-	-	-	-	14.9	11.2
USACE Levee	6.1	-	-	-	-	6.1	2.7
Natural Gas Pipeline	15.7	3.4	-	-	0.1	11.9	8.4
Transmission Line	29.1	0.9	-	-	0.1	27.6	8.7
Railroad	16.6	2.1	-	-	-	14.5	7.2
Street	330.0	21.4	-	-	0.1	306.5	188.0
-Interstate	5.3	1.3	-	-	-	4.0	1.6
-Primary Highway	18.8	-	-	-	-	18.8	13.6
-State/County Hwy	43.1	4.1	-	-	0.0	38.3	17.5
-Local Road	243.6	14.4	-	-	0.1	227.8	143.6
-Other Road	19.1	1.5	-	-	-	16.7	11.4
-4WD Road	-	-	-	-	-	-	-
Grand Total	**412.3**	**27.8**	**-**	**-**	**0.3**	**381.3**	**226.3**

*total length is not equal to sum of all dam inundation zones due to dissolved overlapping inundation areas.

4.4.3.4 Environment

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce foreign elements into local waterways, resulting in destruction of downstream habitat and detrimental effects on many species of animals, especially endangered species. The extent of the vulnerability of the environment is the same as the exposure of the environment.

4.4.3.5 Future Trends in Development

Land use in the planning area will be directed by general plans adopted under California's General Planning Law. The safety element of the general plan establishes standards and plans for the protection of the community from hazards. Dam failure is currently not addressed as a standalone hazard in the safety elements, but flooding is. The municipal planning partners have established comprehensive policies regarding sound land use in identified flood hazard areas. Most of the areas vulnerable to the more severe impacts from dam failure intersect the mapped flood hazard areas. Flood-related policies in the general plans will help to reduce the risk associated with the dam failure hazard for all future development in the planning area.

In 2007, Governor Arnold Schwarzenegger signed the 2007 legislative flood package into law. The flood package [AB 5 (Wolk), AB 70 (Jones), AB 156 (Laird), AB 162 (Wolk), SB 5 (Machado) and SB 17 (Florez)] is designed to help protect lives and property, ensure responsible local planning, and safeguard property from increased exposure to liability for damages caused by flooding.

As part of the 2007 Legislative Flood Package, changes were made to sections of the Water Code and Government Code which resulted in new requirements for flood hazard planning. As part of those changes, portions of Tehama County were determined to be within the “Sacramento-San Joaquin Valley”, as defined by Water Code Section 9602, and are therefore subject to additional agency requirements. The "Sacramento- San Joaquin Valley" includes lands in the bed or along or near the banks of the Sacramento River or San Joaquin River, or any of their tributaries or connected therewith, or upon any land adjacent thereto, or within any of the overflow basins thereof, or upon any land susceptible to overflow therefrom. Much of the southern portion of Tehama County is located within this area, and therefore must incorporate provisions relative to the Central Valley Flood Protection Plan.

4.4.3.6 Issues

Important issues associated with the dam failure hazard include the following:

- There is often limited warning time for dam failure. These events are frequently associated with construction methodology and or severe weather, which limits predictability of dam failure and compounds flood risk. Protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.
- Mapping that estimates inundation depths for federally regulated dams is already required and available; however, mapping for non-federal-regulated dams is needed to better assess the risk associated with failure of these facilities. Also, access to inundation zones is not readily available to residents area wide.

4.5 Drought Hazard

Drought is a prolonged period of dryness severe enough to reduce soil moisture, water and snow levels below the minimum necessary for sustaining plant, animal and economic systems. Droughts are a natural part of the climate cycle, but can have a widespread impact on the environment and the economy, depending upon their severity. Drought typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- Agricultural—Drought threatens crops that rely on precipitation.
- Water supply—Drought threatens supplies of water for irrigated crops and for communities.
- Fire hazard—Drought increases the threat of wildfires from dry conditions in forest and rangelands.

Defining when drought begins is a function of the impacts of drought on water users, and includes consideration of the supplies available to local water users as well as the stored water they may have available in surface reservoirs or groundwater basins. Different local water agencies have different criteria for defining drought conditions in their jurisdictions. Some agencies issue drought watch or drought warning announcements to their customers. Determinations of regional or statewide drought conditions are usually based on a combination of hydrologic and water supply factors.

4.5.1 Drought in California

Drought has impacted almost every county in California at one time or another, causing more than $2.6 million in damage. Droughts exceeding three years are relatively rare in northern California, the source of much of the state's water supply. The 1929-1934 drought established the criteria commonly used in designing storage capacity and yield for large northern California reservoirs. The driest single year in California's measured hydrologic history was 1977.

Past experience shows that drought impacts in California are felt first by those most dependent on annual rainfall: agencies fighting wildfires, ranchers engaged in dryland grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable water source.

Most of California's precipitation comes from storms moving across the Pacific Ocean. The path followed by the storms is determined by the position of an atmospheric high-pressure belt that normally shifts southward during the winter, allowing low pressure systems to move into the state. On average, 75 percent of California's annual precipitation occurs between November and March, with 50 percent occurring between December and February. If a persistent Pacific high-pressure zone takes hold over California mid-winter, there is a tendency for the water year to be dry.

A typical water year produces about 100 inches of rainfall over the North Coast, 50 inches of precipitation (combination of rain and snow) over the Northern Sierra, 18 inches in the Sacramento area, and 15 inches in the Los Angeles area. In extremely dry years, these annual totals can fall to as little as one half, or even one third of these amounts.

4.5.2 Regulatory Oversight

4.5.2.1 Groundwater Aquifer Protection Ordinance

During the 2014 drought, the County recognized that State and County water supplies continued to be severely depleted. In response, the County passed Ordinance 2006 which requires a permit for extraction of groundwater for use off-parcel. The ordinance also sets regulations for the maintenance of dormant wells. The ordinance can be read in its entirety at: https://www.co.tehama.ca.us/images/stories/environhealth/Groundwaterord2006.pdf

4.5.2.2 Tehama County Groundwater Management Plan

The primary purpose of the 2012 Tehama County Groundwater Management Plan is to sustain groundwater levels that balance long-term extraction and replenishment. Annual recovery of spring groundwater levels after the previous summer season of more intensive groundwater extraction and following each winter season will be used to assess annual groundwater recharge. Long-term trends of annual groundwater recharge shall be the primary basis for evaluating the long-term balance between extraction and replenishment.

4.5.2.3 Statewide Emergency Water Conservation Regulations

Adopted May 9th, 2016, the State Water Resources Control Board (Water Board) adjusted emergency water conservation regulations indefinitely in recognition of the differing water supply conditions across the state. Executive Order B-37-16 Making Water Conservation a California Way of Life updates temporary emergency water restrictions and transitions to permanent, long-term improvements in water use by taking the following actions.

- Use water more wisely
- Eliminate water waste
- Strengthen local drought resilience
- Improve agricultural water use efficiency and drought planning

The Executive Order can be read in its entirety at
http://www.tehamacountypublicworks.ca.gov/Flood/drought/exec%20order%20b-37-16.pdf

4.5.2.4 Sustainable Groundwater Management Act

On September 16, 2014, Governor Brown signed into law a package of bills (SB1168, AB1739 and SB1319) collectively called the Sustainable Groundwater Management Act. The Tehama County Flood Control and Water Conservation District was recognized by DWR as the Exclusive Groundwater Sustainability Agency on February 11, 2016, for the 10 groundwater subbasins or the portions of those subbasins located within Tehama County. The District also submitted a Basin Boundary Adjustment in March 2016 to incorporate the small portion of the Colusa Subbasin located within Tehama County into the Corning Subbasin. The District formed a Groundwater Commission in November of 2016 that will start the process of developing a Groundwater Sustainability Plan as required by the legislation before the January 31, 2022 deadline.

4.5.2.5 California Water Plan

The California Water Plan presents strategic plan elements including a vision, mission, goals, guiding principles, and recommendations for current water conditions, challenges and activities. The plan includes future uncertainties and climate change impacts, scenarios for 2050, and a roadmap for improving data and analytical tools needed for integrated water management and sustainability. The California Water Plan Update 2018 is currently in development.

See: http://www.water.ca.gov/waterplan/

4.5.3 Hazard Profile

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

4.5.3.1 Past Events

The California Department of Water Resources has state hydrologic data back to the early 1900s. The hydrologic data show multi-year droughts from 1912 to 1913, 1918 to 1920, 1922 to 1924, 2007-2009 and 2014 to 2017.

Some of the major droughts affecting Tehama County include:

- **1929 to 1934 Drought**—The 1929 to 1934 drought established the criteria for designing many large Northern California reservoirs. The Sacramento Valley runoff was 55 percent of average for the time period from 1901 to 1996, with only 9.8 million acre-feet received.

- **1975 to 1977 Drought**—California had one of its most severe droughts due to lack of rainfall during the winters of 1976 and 1977. 1977 was the driest period on record in California, with the previous winter recorded as the fourth driest in California’s hydrological history. The cumulative impact led to widespread water shortages and severe water conservation measures throughout the state. Only 37 percent of the average Sacramento Valley runoff was received, with just 6.6 million acre-feet recorded. Over $2.6 billion in crop damage was recorded in 31 counties. A federal disaster declaration was declared in some counties.

- **1987-1992 Drought**—California received precipitation well below average levels for four consecutive years. While the Central Coast was most affected, the Sierra Nevada Range in Northern California and the Central Valley counties were also affected. During this drought, only 56 percent of average runoff for the Sacramento Valley was received, totaling just 10 million acre-feet. By February 1991, all 58 counties in California were suffering from drought conditions, and urban areas as well as rural and agricultural areas were impacted. The 1987 drought was of enough significance to trigger a federal disaster declaration.

- **2014- 2017 Drought—** With California facing water shortfalls in the driest year in recorded state history, California State Governor Jerry Brown, declared a drought state of emergency on January 17, 2014. In the State of Emergency declaration, Governor Brown directed state officials to assist farmers and communities that are economically impacted by dry conditions and to ensure the state can respond if Californians face drinking water shortages. The Governor also directed state agencies to use less water and hire more firefighters and initiated a greatly expanded water conservation public awareness campaign. On April 17, 2017, Brown issued Executive Order B-40-17, officially ending the drought state of emergency in all California counties except Fresno, Kings, Tulare, and Tuolumne. (CA.gov, 2014)

Over the past five years, meteorological data show that the 60-month period between January 2012 and December 2016 was the hottest on record within California, with an average temperature of about 60.2 °F. It was also the 11th driest since record keeping began in 1895. While the California drought developed after months of precipitation deficits, the end of the statewide drought came quite swiftly in 2017.

Eleven authors, from the NDMC, NOAA and USDA, create the National Drought Monitor data and maps (http://droughtmonitor.unl.edu/). Figure 4-13 demonstrates the U.S. Drought Monitor conditions in California for both October 2016 and October 2017. Several severe winter storms since the beginning of the 2016/17 water year (which began on October 1, 2016) resulted in Northern California mountain region wettest water year on record as early as mid-April. During the winter of 2017 NASA data show that the snowpack in the Tuolumne River Basin in California's Sierra Nevada was larger than the four previous years combined. These conditions led to the end of a 3-year drought period in California.

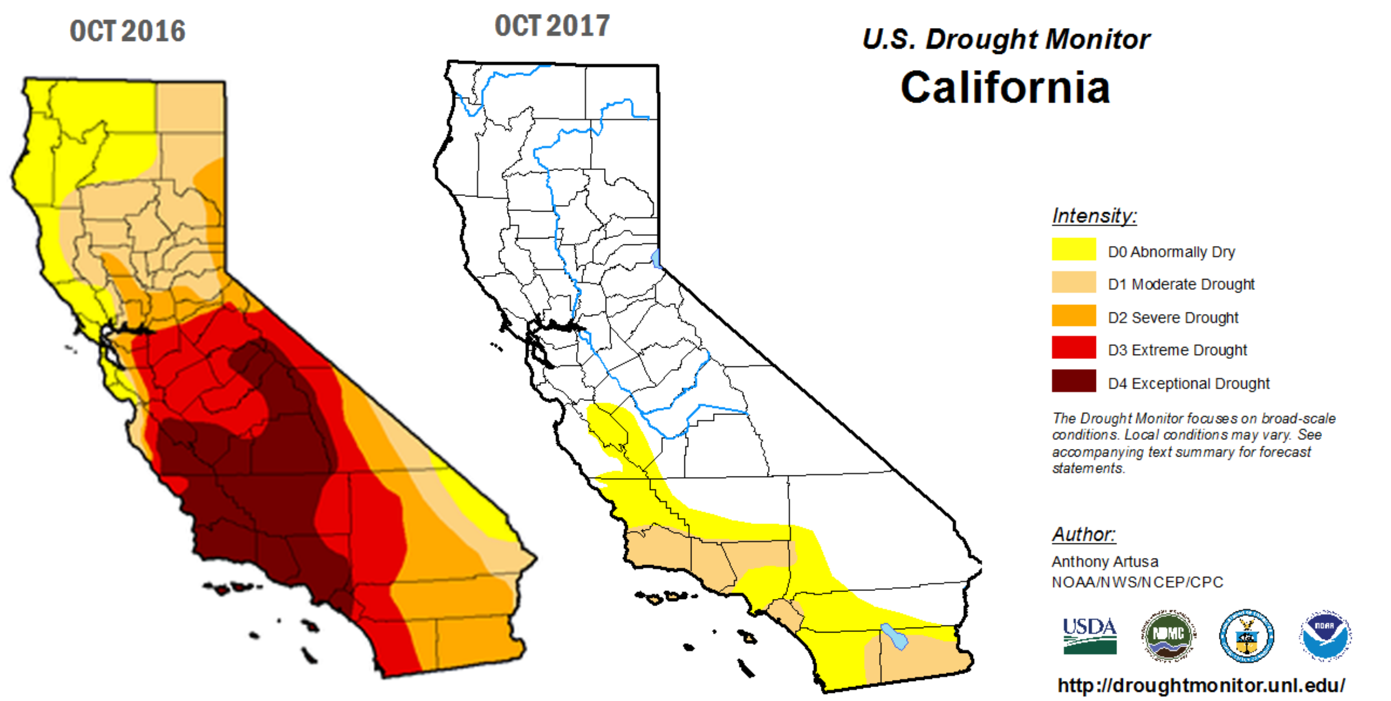


Figure 4-13: California Drought Conditions Current Year (2017) vs. Last Year (2016)

4.5.3.2 Frequency

Historical data for the Tehama County region indicate numerous period of drought, the most significant being the period from 1987 through 1994. Tehama County was affected by three drought incidents from 1950 to 2017.

4.5.3.3 Severity

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly. When measuring the severity of droughts, analysts typically look at economic impacts on a planning area.

Unlike most disasters, droughts normally occur slowly but last a long time. On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

Drought affects groundwater sources, but generally not as quickly as surface water supplies, although groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when steam flows are lowest.

A drought directly or indirectly impacts all people in affected areas. A drought can result in farmers not being able to plant crops or the failure of planted crops. This results in loss of work for farm workers and those in food processing jobs. Other water-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them.

4.5.3.4 Warning Time

Droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

4.5.4 Secondary Hazards

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends.

4.5.5 Drought and Climate Change Impacts

The long-term effects of climate change on regional water resources are unknown, but global water resources are already experiencing the following stresses without climate change:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure.

With a warmer climate, droughts could become more frequent, more severe, and longer-lasting. According to the UC Davis Center for Watershed Sciences, water shortages in 2016 were projected to cost the agriculture industry a total of $550 million in direct costs and 1,815 in lost jobs. More frequent extreme events such as droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages.

The State of California has been taking action to address climate change for over 20 years, focusing on both greenhouse gas emissions reduction and adaptation. The California Adaptation Planning Guide (APG) continues the state’s effort by providing guidance and support for communities addressing the unavoidable consequences of climate change.

Based on specific factors, 11 climate impact regions were identified. Some of the regions were based on specific factors particularly relevant to the region. As illustrated in Figure 4-14 Tehama County is located in the Northern Central Valley Region.

The Northern Central Valley is a largely agricultural, inland region with over 3.7 million people, with substantial cities, the largest being the state capitol, Sacramento (469,000+ people). The central portion of the region is defined by the Delta, with inland marshes intermingled with agriculture, interspersed with cities along transport corridors. The region contains the Port of Stockton, the most inland port for ocean-going vessels, approximately 80 miles from the Golden Gate Bridge. Agriculture is the predominant economic activity. The agricultural operations in this region include rice, dairy, and nut trees (almond and walnut) (California Farm Bureau Federation, 2012). The region’s agricultural activity is one of the most productive in the nation.

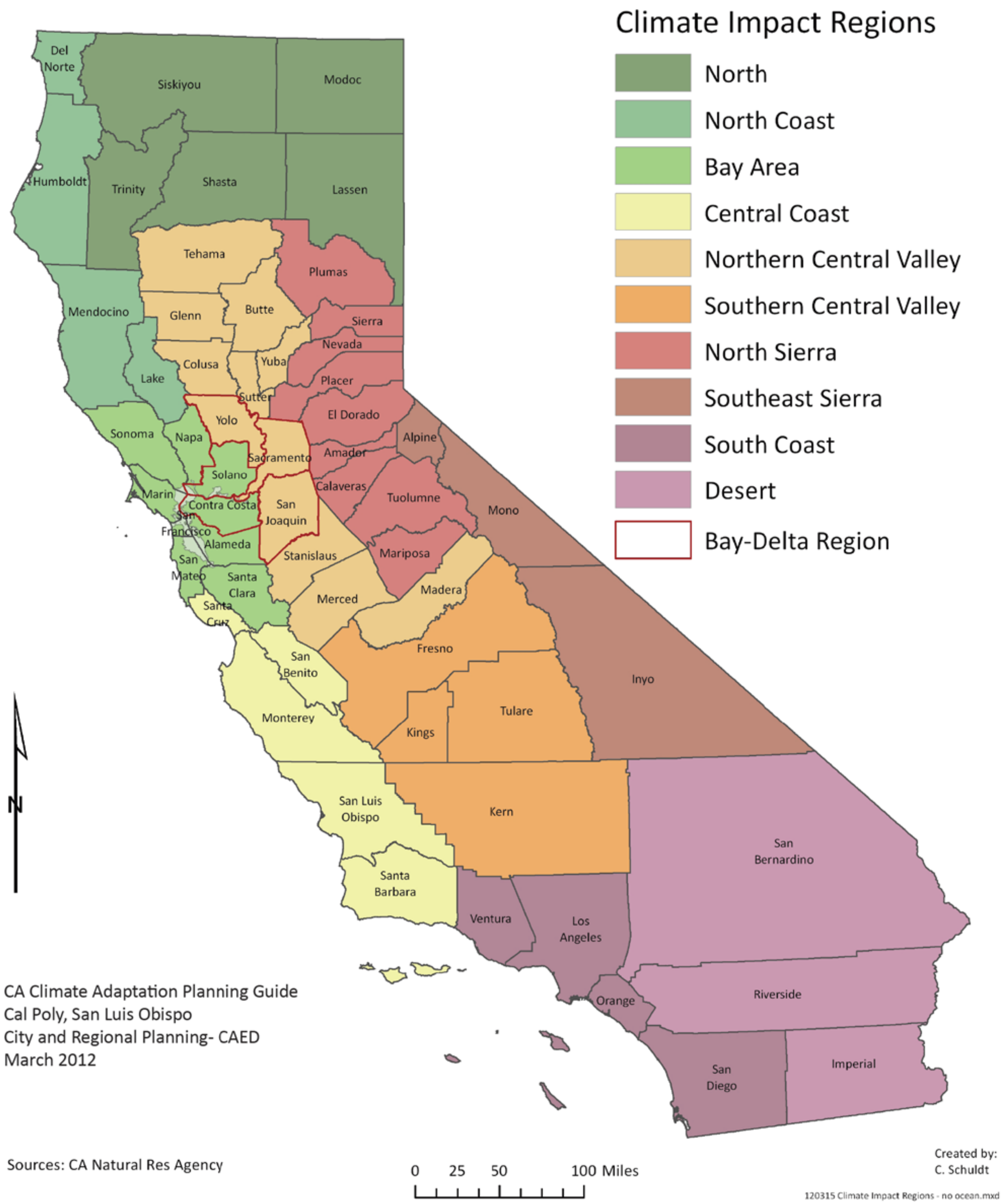


Figure 4-14: Climate Impact Regions

According to the APG, in the Northern Central Valley region, communities will need to assess vulnerability to the following impacts:

- Temperature increases – particularly nighttime temperature
- Reduced precipitation
- Flooding – increased flows, snowmelt, levee failure in the Delta
- Reduced agricultural productivity (e.g., nut trees, dairy)
- Reduced water supply
- Wildfire in the Sierra foothills
- Public health and heat
- Reduced tourism (California Adaptation Planning Guide: Understanding Regional Characteristics)

The California Adaptation Planning Guide has calculated projections for changes in temperature, precipitation, heat waves, snowpack and wildfire risk in the Northern Central Valley area, as shown in Table 4-18. Hotter, drier conditions are expected to exist in the Northern Central Valley area, increasing the risk for other natural hazards.

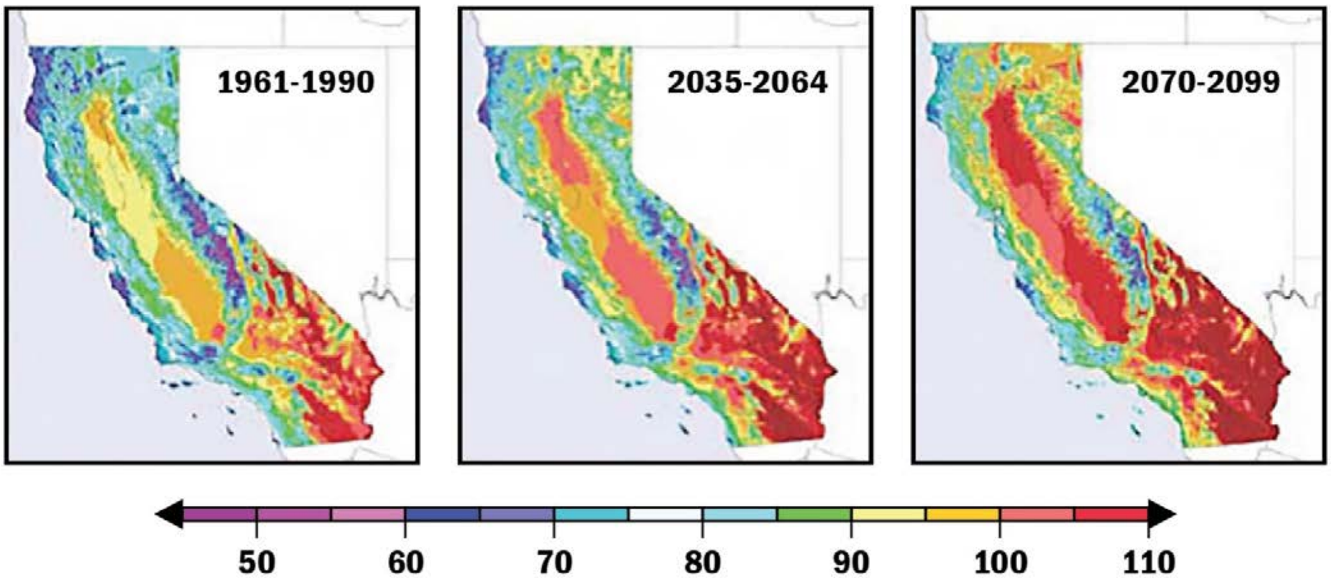
Table 4-18: Summary of Cal-Adapt Climate Projections for Northern Central Valley

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 high temperatures – average of all models; high carbon emissions scenario)
Precipitation	Annual precipitation is projected to decline by approximately one to two inches by 2050 and three to six inches by 2100. (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 Risk	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. (GFDL model, high emissions scenario)

Source: [Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org]

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

Figure 4-15: California Historical and Projected Temperature Increases - 1961 to 2099



Source: Dan Cayan; California Climate Adaptation Strategy

Figure 4-16 and Figure 4-17 provide Cal Adapt[4] modeled decadal July high temperature averages for 2010 and 2090. These figures provide current decade-long July temperature averages and possible annual high heating trends for the remaining portion of the century. The data presented in the figures represent a "projection" of potential future climate scenarios, they are not predictions. These figures illustrate how the climate may change based on a variety of different potential social and economic factors. The visualizations are comprised of average values from Coupled Climate model 2.1 (GFDL), Community Climate System Model Version 3 (CCSM3), Coupled Global Climate Model Version 3 (CNRM) and Parallel Climate Model 1 (PCM1). 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 (A2) are approximately twice as high as those projected in the lower emissions scenario (B1).

[4] Cal-Adapt has been funded to provide access to data and information that has been produced by the State's scientific and research community. The data available in this site offer a view of how climate change might affect California at the local level.

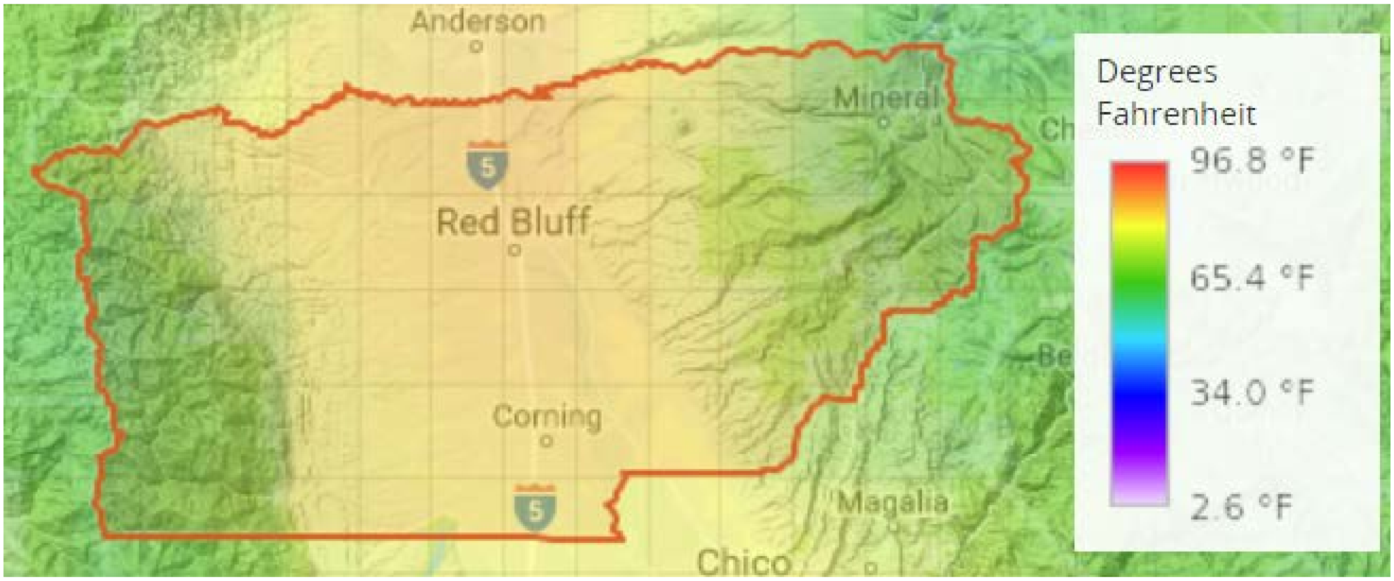


Figure 4-16: July Decadal Average High Temperature Map; 2010
Source: [Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org]

Figure 4-17: July Decadal Average High Temperature Map; 2090
Source: [Public Interest Energy Research, 2011. Cal-Adapt. Retrieved from http://cal-adapt.org]

4.5.6 Drought Vulnerability Analysis

All people, property and environments in the Tehama County planning area would be exposed to some degree to the impacts of moderate to extreme drought conditions.

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental and social activities. The vulnerability of an activity to the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand. California's 2013 Water Plan indicates that water demand in the state will increase through 2030. Although the Department of Water Resources predicts a modest decrease in agricultural water use, the agency anticipates that urban water use will increase by 1.5 to 5.8 million acre-feet per year.

4.5.6.1 Population

According to the Tehama County 2008 Housing Element, the County's population is expected to grow to 47,298 by 2020. This projected population growth would add additional strain to the groundwater supply. The planning partnership has the ability to minimize any impacts on residents and water consumers in the county should several consecutive dry years occur. The 2012 Tehama County Groundwater Management Plan seeks to sustain groundwater levels so the existing groundwater well infrastructure within Tehama County remains operational over the long term. To accomplish this, the plan develops a comprehensive groundwater management program.

No significant life or health impacts are anticipated as a result of drought within the planning area.

4.5.6.2 Property

During drought years, property owners with shallow wells can be impacted as there is an increased demand on groundwater resources thereby lowering groundwater levels and potentially putting some domestic water users at risk. Also during drought years, the cost of surface water increases which can sometimes cut the supply. This sometimes encourages orchard owners who historically used surface water to switch to groundwater, which has a permanent impact on the amount of users using groundwater.

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

4.5.6.3 Critical Facilities

Critical facilities, as defined for this plan, will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

4.5.6.4 Environment

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Another example of this is the destruction caused by bark beetles. Drought places additional stress on trees, making them more vulnerable to bark beetle attacks. This can cause large outbreaks of beetles, which can have long term effects on the planning area.

Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

4.5.6.5 Economic Impact

Long lasting droughts could be detrimental to industries such as agriculture that use water or depend on water for their business. For example, almond and walnut trees cannot survive on limited water, unlike olive trees and others that are more drought tolerant. Timber production can also be affected by bark beetle outbreaks, as mentioned in the previous section.

4.5.7 Future Trends in Development

The Tehama County Flood Control and Water Conservation District has been listed as the Exclusive Groundwater Sustainability Agency (GSA) for the following 11 subbasins or the portions of those subbasins located within the County: Rosewood, Bowman, Red Bluff, Corning, Colusa, Vina, Los Molinos, Dye Creek, Antelope, Bend and South Battle Creek as of February 11, 2016. The GSA develops future amendments, ordinances, rules and regulations, conducts investigations to determine the need for groundwater management, and review all proposed grant applications.

Land use in the planning area will be directed by general plans adopted under California's General Planning Law. Each municipal planning partner in this effort has an established General Plan that includes policies directing land use and dealing with issues of water supply and the protection of water resources. These plans provide the capability at the local municipal level to protect future development from the impacts of drought. All planning partners reviewed their general plans under the capability assessments performed for this effort. Deficiencies identified by these reviews can be identified as mitigation actions to increase the capability to deal with future trends in development.

4.5.8 Issues

The planning team has identified the following drought-related issues in Tehama County:

- Lack of recharge to stabilize the groundwater supply.
- The probability of increased drought frequencies and durations due to climate change.
- The lack of promotion of active water conservation during drought and non-drought periods.
- Illegal groundwater use and water diverted from streams contribute to water wells going dry during periods of drought. Related expenses include re-drilling and well head replacement.

4.6 Earthquake Hazard

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

California is seismically active because of movement of the North American Plate and the Pacific Plate. The movement of these tectonic plates creates stress that can be released as earthquakes.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

Faults are more likely to have earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve accumulating tectonic stresses. A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. In some areas, smaller, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant as a result of the fault's proximity to the area. In contrast, large regional faults can generate great magnitudes but, because of their distance and depth, may result in only moderate shaking in the area.

Geologists classify faults by their relative hazards. Active faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). Potentially active faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years). Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. Although there are probably still some unrecognized active faults, nearly all the movement between the two plates, and therefore the majority of the seismic hazards, are on the well-known active faults. However, inactive faults, for which no displacements have been recorded, maintain the potential to reactivate or experience displacement along a branch sometime in the future. Earthquake activity throughout California could cause tectonic movement along currently inactive fault systems.

4.6.1 Regulatory Oversight

Numerous building and zoning codes exist at a state and local level to decrease the impact of an earthquake event and resulting liquefaction on residents and infrastructure. Building and zoning codes include the Alquist-Priolo Earthquake Fault Zoning Act of 1972, Seismic Hazards Mapping Act of 1990 and the 2016 California Standards Building Code (CSBC).

4.6.1.1 Alquist-Priolo Earthquake Fault Zoning Act and Seismic Hazards Mapping Act.

The 1971 San Fernando Earthquake resulted in the destruction of numerous structures built across its path. This led to passage of the Alquist-Priolo Earthquake Fault Zoning Act. This Act prohibits the construction of buildings for human occupancy across active faults in the State of California. Similarly, extensive damage caused by ground failures during the 1989 Loma Prieta Earthquake focused attention on decreasing the impacts of landslides and liquefaction. This led to the creation of the Seismic Hazards Mapping Act. This Act increases construction standards at locations where ground failures are probable during earthquakes.

4.6.1.2 2016 California Standards Building Code

To protect lives and infrastructure in the County, the 2016 CSBC building and zoning codes have been adopted. The 2016 CSBC is based on the International Building Codes (IBC), which is widely used throughout the United States. CSBC was modified for California's conditions to include more detailed and stringent building requirements.

4.6.1.3 Tehama County General Plan

The 2009 Tehama County General Plan includes the following policies for minimizing the threat of personal injury and property damage to seismic and geologic hazards:

- The County shall require that all construction comply with the California Building Code, including the requirements for seismic design.
- The County shall require that all new development and redevelopment projects that have the potential for seismic or geological hazards, including liquefaction, landslides, and expansive soils, be subject to geotechnical evaluation prior to approval.
- The County shall maintain current information on seismic and geologic hazards.
- The County shall incorporate seismic and geologic hazards mitigation measures into County ordinances and procedures.

4.6.2 Earthquake Classifications

Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as **magnitude**; or by the impact on people and structures, measured as **intensity**.

4.6.2.1 Magnitude

The most common method for measuring earthquakes is magnitude, which measures the strength of earthquakes. Although the Richter scale is known as the measurement for magnitude, the majority of scientists currently use either the Mw Scale or Modified Mercalli Intensity (MMI) Scale. The effects of an earthquake in a particular location are measured by intensity. Earthquake intensity decreases with increasing distance from the epicenter of the earthquake.

The magnitude of an earthquake is related to the total area of the fault that ruptured, as well as the amount of offset (displacement) across the fault. As shown in Table 4-19, there are seven earthquake magnitude classes, ranging from great to micro. A magnitude class of great can cause tremendous damage to infrastructure, compared to a micro class, which results in minor damage to infrastructure.

Table 4-19: Moment Magnitude Scale

Earthquake Magnitude Classes		
Magnitude Class	**Magnitude Range (M = Magnitude)**	**Description**
Great	M > 8	Tremendous damage
Major	7 <= M < 7.9	Widespread heavy damage
Strong	6 <= M < 6.9	Severe damage
Moderate	5 <= M < 5.9	Considerable damage
Light	4 <= M < 4.9	Moderate damage
Minor	3 <= M < 3.9	Rarely causes damage.
Micro	M < 3	Minor damage

4.6.2.1.1 Intensity

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place.

The **lower** numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The **higher** numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above. Table 4-20 is an abbreviated description of the levels of Modified Mercalli intensity.

Table 4-20: Modified Mercalli intensity level descriptions

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS, Abridged from The Severity of an Earthquake, USGS General Interest Publication 1989-288-913

4.6.2.2 Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly mapped ground motion parameters are the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short period structures" (e.g. single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). Table 4-21 lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

Table 4-21: Mercalli Scale and Peak Ground Acceleration

		Potential Structure Damage		Estimated PGA
Modified Mercalli Scale	**Perceived Shaking**	**Resistant Buildings**	**Vulnerable Buildings**	**(%g)**
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17% - 1.4%
IV	Light	None	None	1.4% - 3.9%
V	Moderate	Very Light	Light	3.9% - 9.2%
VI	Strong	Light	Moderate	9.2% - 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VIII	Severe	Moderate/Heavy	Heavy	34% - 65%
IX	Violent	Heavy	Very Heavy	65% - 124%
X - XII	Extreme	Very Heavy	Very Heavy	>124%
Note: PGA measured in percent of g, where g is the acceleration of gravity				

Sources: USGS, 2008; USGS, 2010

4.6.2.3 Effect of Soil Types

The impact of an earthquake on structures and infrastructure is largely a function of ground shaking, distance from the source of the quake, and liquefaction, a secondary effect of an earthquake in which soils lose their shear strength and flow or behave as liquid, thereby damaging structures that derive their support from the soil. Liquefaction generally occurs in soft, unconsolidated sedimentary soils. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. Table 4-22 summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E and F. In general, these areas are also most susceptible to liquefaction.

Table 4-22: NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

4.6.3 Hazard Profile

Earthquakes can last from a few seconds to over five minutes; they may also occur as a series of tremors over several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides or releases of hazardous material, compounding their disastrous effects. Small, local faults produce lower magnitude quakes, but ground shaking can be strong and damage can be significant in areas close to the fault. In contrast, large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area.

4.6.3.1 Past Events

Tehama County does not have an extensive earthquake history. According to the California State Hazard Mitigation Plan, Tehama County had only one occurrence of earthquake activity that caused any measurable damage from 1800 to 2007. The only known seismic activity in the planning area occurred in concurrence with the volcanic eruption of Lassen Peak in 1914. There has been no declared disaster activity for earthquake within the planning area since 1950.

4.6.3.2 Location

The risk of seismic hazards to residents of Tehama County is based on the approximate location of earthquake faults within and outside the region. According to the USGS's Earthquake probability maps, shown in Figure 4-18, the Battle Creek Fault has under a 1% chance of an earthquake of 6.7 magnitude or greater in the next 30 years.

For decades, partnerships have flourished between the USGS, Cal Tech, the California Geological Survey, and universities to share research and educational efforts with Californians. Tremendous earthquake mapping and mitigation efforts have been made in California in the past two decades, and public awareness has risen remarkably during this time. Major federal, state, and local government agencies and private organizations support earthquake risk reduction, and have made significant contributions in reducing the adverse impacts of earthquakes. Despite the progress, the majority of California communities remain unprepared because there is a general lack of understanding regarding earthquake hazards among Californians.

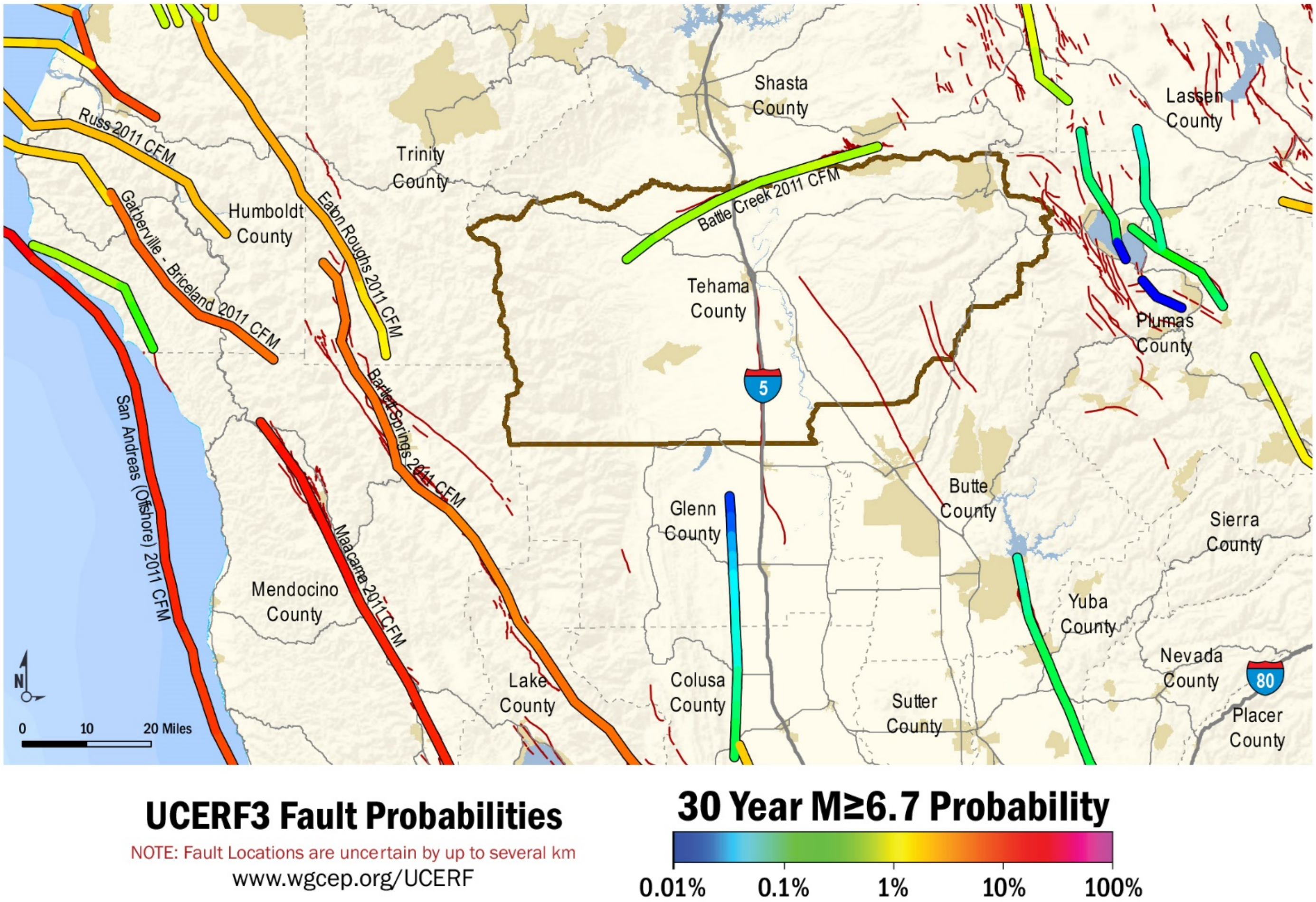


Figure 4-18: Fault Probability Map of Northern California

4.6.3.3 Frequency

According the California State Hazard Mitigation Plan, earthquakes large enough to cause moderate damage to structures—those of Magnitude 5.5 or larger—occur three to four times a year statewide. Strong earthquakes of Magnitude 6 to 6.9 strike on an average of once every two to three years. Major earthquakes (Magnitude 7 to 7.9) occur in California about once every 10 years.

While earthquake activity in California as a whole is frequent, the activity in Tehama County is not. Although no active faults are mapped in the county, there exists the potential for minor, localized earth-shaking events as precursors to eruptive activity of Mount Lassen. The Northern California Earthquake Data Center identifies no seismic events with a magnitude of 3.0 or higher felt in Tehama County between 1910 and 2017. Tehama County is in a moderate risk area.

4.6.3.4 Severity

The severity of an earthquake can be expressed in terms of intensity or magnitude. Intensity represents the observed effects of ground shaking on people, buildings, and natural features. If a 6.7 magnitude earthquake were to occur along the Battle Creek fault, most of the County would experience at least moderate shaking, as shown in Figure 4-19.

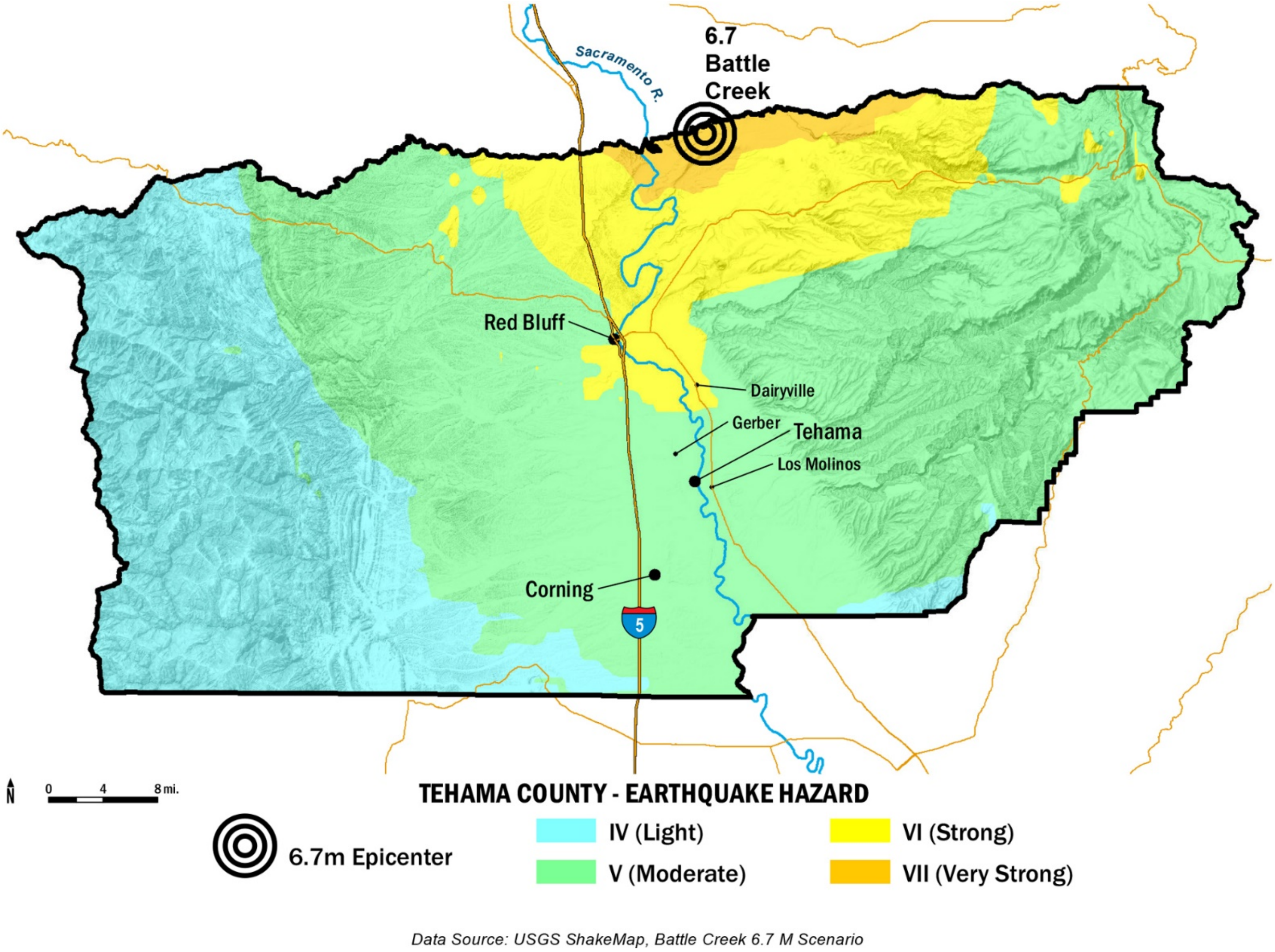


Figure 4-19: Tehama County Earthquake Shake Map

4.6.3.5 Warning Time

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. The seconds to minutes of advance warning can allow people and systems to take actions to protect life and property from destructive shaking. Even a few seconds of warning can enable protective actions such as:

- Public: Citizens, including schoolchildren, drop, cover, and hold on; turn off stoves, safely stop vehicles.
- Businesses: Personnel move to safe locations, automated systems ensure elevator doors open, production lines are shut down, sensitive equipment is placed in a safe mode.
- Medical services: Surgeons, dentists, and others stop delicate procedures.
- Emergency responders: Open firehouse doors, personnel prepare and prioritize response decisions.
- Power infrastructure: Protect power stations and grid facilities from strong shaking.

4.6.4 Secondary Hazards

Earthquakes can cause large and sometimes disastrous landslides and mudslides. River valleys are vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes.

4.6.5 Climate Change Impacts

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA, 2004).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

4.6.6 Earthquake Vulnerability Analysis

Both an exposure analysis and loss estimation analysis were conducted to develop earthquake vulnerabilities throughout Tehama County. Earthquake exposure numbers were generated using Tehama County Assessor and parcel data. County assessor data does not include tax exempt structures, such as federal and local government buildings. All data sources have a level of accuracy acceptable for planning purposes.

Earthquake vulnerability data was generated using a Level 2 HAZUS-MH 4.0 analysis. Once the location and size of a hypothetical earthquake are identified, HAZUS-MH estimates the intensity of the ground shaking, the number of buildings damaged, the number of casualties, the damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated cost of repair and clean up. Table 4-23 gives a snapshot of earthquake vulnerability.

Table 4-23: Earthquake Vulnerability Snap Shot

Exposed Population	Exposed Market Value ($)	Exposed Content Value ($)	Exposed Critical Facilities	Exposed Miles of Lifeline	Hazus Loss Estimation
41,006	$ 3,346,582,983	$ 2,313,459,027	534	4,882	$ 271,894,773
98.87%	98.15%	97.71%	94.01%	79.09%	5.23%
total pop.	*total value*	*total cost*	*total count*	*total mileage*	*Model Inventory*

4.6.6.1 Population

Three population groups are particularly vulnerable to earthquake hazards:

- **Linguistically Isolated Populations**——Approximately 5,500 residents in the planning area census blocks on NEHRP D and E soils do not speak English as their native language. This is about 19 percent of all residents in these census blocks. Problems arise when there is an urgent need to inform non-English speaking residents of an earthquake event. They are vulnerable because of difficulties in understanding hazard-related information from predominantly English-speaking media and government agencies.

- **Population Below Poverty Level**—Approximately 1,450 households in the planning area census blocks on NEHRP D and E soils are listed as being below the poverty level. This is about 13 percent of all households in these census blocks. These households may lack the financial resources to improve their homes to prevent or mitigate earthquake damage. Poorer residents are also less likely to have insurance to compensate for losses in earthquakes.

- **Population Over 65 Years Old**—Approximately 2,100 residents in the planning area census blocks on NEHRP D and E soils are over 65 years old. This is about 7 percent of all residents in these census blocks. This population group is vulnerable because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly residents also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations.

Impacts on persons and households in the planning area were estimated for the Battle Creek Scenario through a Level 2 HAZUS-MH analysis. Figure 4-20 and Table 4-24 summarize the results. The entire population of Tehama County is potentially exposed to direct and indirect impacts from earthquakes. 98.87% of the population of Tehama County is in Moderate, Strong, or Very strong shaking zones of the Battle Creek 6.7 magnitude scenario. The degree of exposure is dependent on many factors, including the age and construction type of the structures people live in, the soil type their homes are constructed on, their proximity to fault location, etc. Whether directly impacted or indirectly impact, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

Population Exposure

Population Count by Battle Creek Scenario Severity Zone

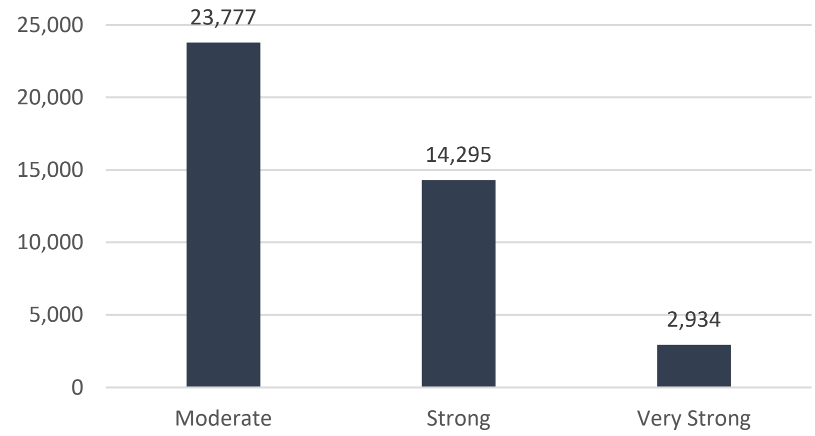


Figure 4-20: Population Exposure to the Battle Creek EQ Shake Severity Zones

Table 4-24: Population Exposure to the Battle Creek EQ Shake Severity Zones

	Total Population
Tehama County	41,473

Shake Severity Zone	Population Count	% of Total
V - Moderate	23,777	57.33%
VI - Strong	14,295	34.47%
VII - Very Strong	2,934	7.07%
Total	**41,006**	**98.87%**

4.6.6.2 Property

One of the key issues that must be addressed in an earthquake vulnerability assessment is the determination of (1) the year in which seismic codes were initially adopted and enforced by the jurisdiction having authority, and (2) the year in which significantly improved seismic codes were adopted and enforced, otherwise known as the benchmark year. The County adheres to the 2016 California Building Code. Table 4-25 provides a listing of code improvements. Benchmark years are indicated in bold. For reference, Table 4-26 provides the definitions of the building types listed in Table 4-25.

Table 4-25: Seismic Benchmark Years

Code Edition	Effective Date	Adoption Ordinance (s)	Building Type
(2016 CBC)	January 1, 2016		
(2013 CBC)	January 1, 2014	2013-0048	N/A
(2012 IBC)			
(2010 CBC)	January 1, 2011	2010-0053	N/A
(2009 IBC)			
(2007 CBC)	January 1, 2008	2007-0108	N/A
(2006 IBC)			
(2001 CBC)	November 1, 2002	2002-0076	N/A
(1997 UBC)			
(1998 CBC)	**July 1, 1999**	**99-0040**	**W1a, S2, S2a, RM1, PC1, PC1a**
(1997 UBC)			
(1994 UBC)	**January 7, 1996**	**95-0064**	**S1, S1a, C1, C2, C2a, RM2**
(1991 UBC)	**November 29, 1992**	**92-0114**	**URM**
(1988 UBC)	**April 29, 1990**	**90-0045**	**S2 & S2a**
(1985 UBC)	November 8, 1987	87-0177	N/A
(1982 UBC)	December 9, 1984	84-0211	N/A
(1979 UBC)	June 21, 1981	12340	N/A
(1976 UBC)	**November 1, 1977**	**11574**	**W1 and W2**
(1973 UBC)	April 13, 1975	11095	N/A
(1970 UBC)	August 29, 1971	10323	N/A
(1967 UBC)	July 12, 1968	9541	N/A
(1964 UBC)	July 1, 1965	8809	N/A
(1961 UBC)	August 17, 1962	8242	N/A
(1958 UBC)	October 1, 1958	7384	N/A
(1955 UBC)	January 1, 1956	6768	N/A
(1955 UBC)	January 1, 1956	6768	N/A
(1946 UBC)	June 18, 1948	5119	N/A
(1943 UBC)	July 13, 1944	4367	N/A
(1940 UBC)	April 4, 1941	3787	N/A
(1937 UBC)	September 10, 1937	2966	N/A
(1930 UBC)	March 20, 1933	2225	N/A

Source: ASCE 41-13

Table 4-26: Definitions of FEMA Building Types

FEMA Building Type	Definition
W1	Wood Light Frame
W1A	Wood Light Frame (multi-unit residence)
W2	Wood Frame (commercial and industrial)
S1	Steel Moment Frames
S2	Steel-braced Frames
S3	Steel Light Frames
S4	Steel Frames with concrete shear walls
S5	Steel Frames with infill masonry walls
C1	Concrete Moment Frames
C3	Concrete Frames with infill masonry shear walls
C2	Concrete Shear Walls
PC1	Tilt-Up Concrete shear walls
PC2	Precast Concrete Frames with shear walls
RM1	Reinforced Masonry Walls with flexible diaphragms
RM2	Reinforced Masonry Walls with stiff diaphragms
URM	Unreinforced Masonry Bearing Walls

4.6.6.2.1 Building Ages

The California State Building Code Council identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of development in California. Using these time periods, the planning team used county-provided assessor's data to identify the number parcels with improvements within the County by date of construction. Table 4-27 shows the results of this analysis. The number of parcels does not reflect the number of total housing units, as many multi-family units and attached housing units are reported upon one parcel.

Table 4-27: Age of Structures in Tehama County

Time Period	No. of County Parcels with Improvements in Period	Significance of Time Frame
Pre-1933	1,814	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
1933-1940	696	In 1940, the first strong motion recording was made.
1941-1960	3,649	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions.
1961-1975	3,658	In 1975, significant improvements were made to lateral force requirements.
1976-1994	7,557	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
1994 - present	5,392	Seismic code is currently enforced.
Total	**22,766**	

4.6.6.2.2 Soft-Story Buildings

A soft-story building is a multi-story building with one or more floors that are "soft" due to structural design. If a building has a floor that is 70-percent less stiff than the floor above it, it is considered a soft-story building. This soft story creates a major weak point in an earthquake. Since soft stories are typically associated with retail spaces and parking garages, they are often on the lower stories of a building. When they collapse, they can take the whole building down with them, causing serious structural damage that may render the structure totally unusable.

These floors can be especially dangerous in earthquakes, because they cannot cope with the lateral forces caused by the swaying of the building during a quake. As a result, the soft story may fail, causing what is known as a soft story collapse. Soft-story collapse is one of the leading causes of earthquake damage to private residences. The level of vulnerability due to this type of construction within the planning area is not currently known. This type of data should be generated to support future risk assessments of the earthquake hazard.

4.6.6.2.3 Property Value Exposure

The county Assessor's parcel data was used as the basis for the inventory of current market values and content value summaries. GIS was used to create centroids, or points, to represent the center of each parcel polygon – this is assumed to be the location of the structure for analysis purposes. The centroids were then overlaid with the shaking severity zones of the Battle Creek 6.7 magnitude earthquake severity zones to determine the at-risk structures. This methodology assumed that every parcel with a current net value or assessed value was an improved parcel. Building exposure was calculated based on current net values or when absent, assessor's values as provided by the assessor's office. Building content exposure was calculated based on occupancy type multipliers and improvement value. Table 4-28 shows the count of at-risk parcels and their associated building and content exposure values to dam failure.

Table 4-28: Total Parcel Value Exposure from Battle Creek Scenario

	Total Parcels	Total Market Value Exposure ($)	Total Content Value Exposure ($)	Total Value ($)
Tehama County	34,284	$ 3,409,758,850	$ 2,367,722,620	$ 5,777,481,470

Shake Severity Zone	Improved Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
V - Moderate	19,532	57.0%	$ 1,879,681,809	$ 1,369,376,637	$ 3,249,058,446	56.237%
VI - Strong	10,193	29.7%	$ 1,197,015,728	$ 785,606,669	$ 1,982,622,397	34.316%
VII - Very Strong	2,524	7.4%	$ 269,885,446	$ 158,475,722	$ 428,361,168	7.414%
Total	**32,249**	**94.1%**	**$ 3,346,582,983**	**$ 2,313,459,027**	**$ 5,660,042,010**	**98.0%**

4.6.6.2.4 Property Loss Estimation

Earthquake vulnerability data was generated using a Level 2 HAZUS-MH 4.0 analysis. Once the location and size of a hypothetical earthquake are identified, HAZUS-MH estimates the intensity of the ground shaking, the number of buildings damaged, the number of casualties, the damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated cost of repair and clean up. Table 4-29 shows the results for parcel damage potentials and average economic loss for each building category type for the County Unincorporated Parcels.

To understand building damage, damage outputs from Hazus are categorized into slight, moderate, and extensive damage. Ranges of damage are used to provide the user with an understanding of the building's physical condition. Table 4-29 provides a physical description of each damage state.

Table 4-29: Hazus Building Damage Descriptions

Damage State	Damage Description
Slight	Small plaster cracks at corners of door and window openings and wall/ceiling intersections; small cracks in masonry chimneys and masonry veneers. Small cracks are assumed to be visible with a maximum width of less than 1/8 inch (cracks wider than 1/8 inch are referred to as "large" cracks).
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations.
Complete	Structure may have large permanent lateral displacement or be in imminent danger of collapse due to cripple wall failure or failure of the lateral load resisting system; some structures may slip and fall off the foundation; large foundation cracks. Three percent of the total area of buildings with Complete damage is expected to be collapsed, on average.

While there are several limitations to the FEMA Hazus earthquake models, it does allow for potential loss estimation for each building construction category. County wide loss estimation results are summarized by building category type in Table 4-30 and Figure 4-21 for the Battle Creek 6.7 magnitude earthquake scenario. It is important to understand that the Hazus loss estimation values for earthquake are categorized in exceedance values. From reviewing Table 4-30, the probability of structures exceeding extensive damage is relatively low. However, if damage were to occur, the economic loss is summarized in each table. Damage estimates are approximately $271 million, or 5.2% percent of the total modeled value improvements within the County.

Table 4-30: HAZUS Loss Estimations for Battle Creek 6.7M Event

Building Type	Average of Potential Damage to Exceed "Slight"	Average of Potential Damage to Exceed "Moderate"	Average of Potential Damage to Exceed "Extensive"	Average Economic Loss for Each Building Category	Sum of Economic Loss	Proportion of Loss (%)
Agricultural	21%	9%	2%	$ 20,744	$ 35,534,001	13%
Commercial	26%	12%	3%	$ 25,704	$ 26,552,118	10%
Education	17%	6%	1%	$ 14,107	$ 42,322	0%
Governmental	30%	13%	3%	$ 2,148	$ 27,928	0%
Industrial	25%	10%	2%	$ 42,736	$ 5,085,529	2%
Religion	25%	10%	2%	$ 15,766	$ 520,284	0%
Residential	29%	13%	3%	$ 11,258	$ 204,132,590	75%
Total	**28%**	**13%**	**3%**	**$ 12,918**	**$ 271,894,773**	

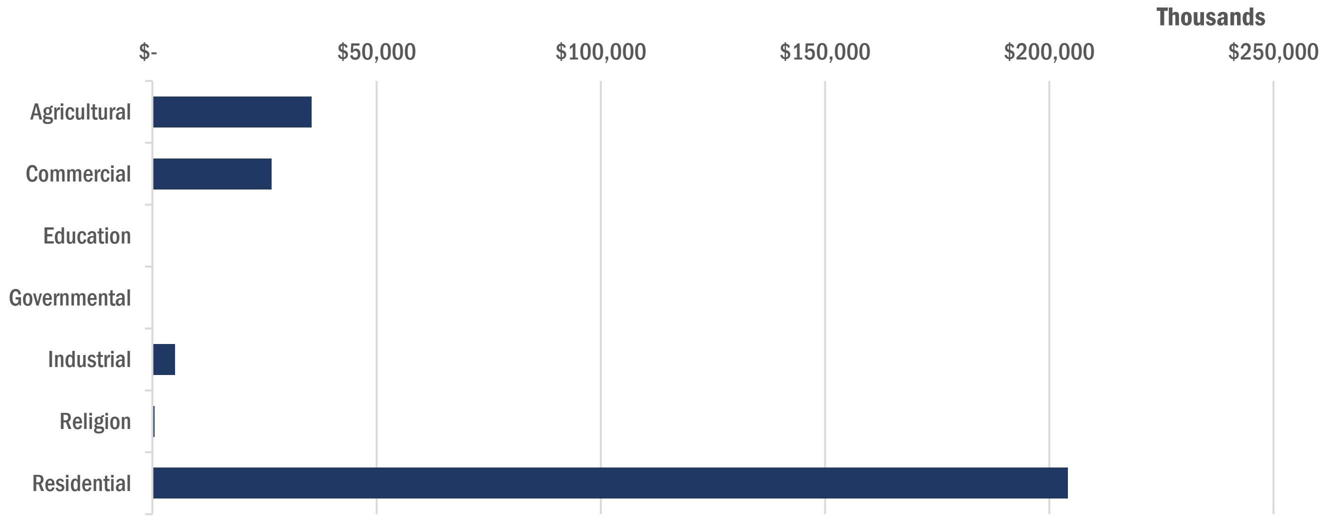


Figure 4-21: Economic Loss by Occupancy

Loss estimation is worst case scenario. Loss estimation does not include damage to transportation routes, infrastructure, and other public and private utilities located throughout the County.

An important concept in loss data is the "probability" of damage to exceed a certain degree. It is unlikely that buildings in County would receive "extensive" damage from earthquake shaking. Residential occupancy types are more likely to receive damage than any building occupancy category.

4.6.6.3 Critical Facilities and Infrastructure

Earthquakes pose numerous risks to critical facilities and infrastructure. Seismic risks, or losses, that are likely to result from exposure to seismic hazards include:

- Casualties (fatalities and injuries).
- Utility outages.
- Economic losses for repair and replacement of critical facilities, roads, buildings, etc.
- Indirect economic losses such as income lost during downtime resulting from damage to private property or public infrastructure.
- Roads or railroads that are blocked or damaged can prevent access throughout the area and can isolate residents and emergency service providers needing to reach vulnerable populations or to make repairs.

Linear utilities and transportation routes are vulnerable to rupture and damage during and after a significant earthquake event. The cascading impact of a single failure can have affects across multiple systems and utility sectors. Degrading infrastructure systems and future large earthquakes with epicenters near critical regional infrastructure could result in system outages that last weeks for the most reliable systems, and multiple months for others.

All critical facilities in Tehama County are exposed to the earthquake hazard. Table 4-31 lists the number of each type of facility in the Moderate, Strong and Very Strong shake severity zones with the County for Battle Creek 6.7 magnitude earthquake.

Table 4-31: Critical Facility Points with Earthquake Risk

Infrastructure Type	Moderate	Strong	Very Strong	Total Feature Count
Essential Facility	27	18	1	46
EOC	1	1	0	0
Fire Station	9	6	0	0
Government Facility	4	0	0	0
Hospital	0	0	0	0
Police Station	0	1	0	0
School	13	10	1	0
High Potential Loss	25	27	1	53
Residential Child Care	0	0	0	0
Adult Residential Care	11	14	0	0
Child Care	5	6	0	0
Foster/Home Care	0	0	0	0
Home Care	0	0	0	0
Other Care Facility	0	0	0	0
Elder Care	4	5	0	0
Dam	3	2	1	0
Hotel	2	0	0	0
Transportation and Lifeline	323	105	7	435
Airport	0	0	0	0
Bridge	302	88	6	0
Bus Facility	0	0	0	0
FCC AM Tower	0	1	0	0
FCC Cell Tower	4	2	0	0
FCC FM Tower	0	4	0	0
Natural Gas Station	11	5	0	0
Power Plant	1	0	0	0
Substation	5	4	1	0
Waste Water Facility	0	1	0	0
Grand Total	**375**	**150**	**9**	**534**

4.6.6.3.1 Critical Facility Level of Damage

HAZUS-MH 4.0 was used to estimate the loss potential to county facilities exposed to the 6.7 magnitude Battle Creek earthquake scenario. HAZUS-MH reports the damage potential and loss potential from a given earthquake scenario in four categories: slight damage, moderate damage, extensive damage, and economic loss. Economic loss consists of estimations on the cost of repair and replacement to damaged or destroyed buildings and contents, relocation expenses, capital-related income, wage losses, and rental income losses. The results shown in Table 4-32 summarizes these results. The data source used in this analysis is different than the data shown in the exposure analysis portrayed in Table 4-31. County insurance data was obtained and formatted for use in HAZUS for a detailed damage estimation. This dataset has additional information including number of floors, building value, content value, and construction type that greatly enhances results from default Hazus database. The results shown in Table 4-33 summarizes essential facility and high potential loss facilities not included in the county insurance holding data. The data in Table 4-33 corresponds to the data shown in the exposure analysis portrayed in Table 4-31.

Table 4-32: County Insurance Holdings by Level of Damage (Battle Creek Scenario)

		Average Probability of Potential Damage Exceedance			
County Building Site	**Building Count**	**Slight**	**Moderate**	**Extensive**	**Sum of Economic Loss**
AB 109 Workfarm	*1*	*31%*	*13%*	*3%*	*$ 28,118*
Ag Center	*1*	*29%*	*12%*	*2%*	*$ 114,611*
Ag Extension Office	*1*	*29%*	*12%*	*2%*	*$ 23,545*
Agriculture Department	*2*	*29%*	*12%*	*2%*	*$ 24,330*
Animal Services	*1*	*29%*	*12%*	*2%*	*$ 35,162*
Annex #2	*1*	*27%*	*11%*	*2%*	*$ 86,425*
Antelope VFC	*1*	*30%*	*13%*	*3%*	*$ 0*
Bend Vol Fire Co	*1*	*40%*	*19%*	*4%*	*$ 17,562*
Bowman Vol Fire Co	*2*	*36%*	*16%*	*4%*	*$ 78,228*
Camp Tehama	*2*	*25%*	*10%*	*2%*	*$ 47,923*
Child Support Services Dept	*1*	*28%*	*11%*	*2%*	*$ 0*
Community Senior Center	*1*	*29%*	*12%*	*2%*	*$ 292,309*
Community/Senior Ctr	*1*	*29%*	*12%*	*2%*	*$ 8,615*
Cone Grove Park	*3*	*29%*	*12%*	*2%*	*$ 13,915*
Corning Court Building	*1*	*15%*	*5%*	*1%*	*$ 10,631*
Corning Library	*1*	*15%*	*5%*	*1%*	*$ 0*
Corning Veterans Hall	*2*	*15%*	*5%*	*1%*	*$ 65,050*
Corning Vol Fire Co	*4*	*15%*	*5%*	*1%*	*$ 28,690*
County Administration	*1*	*27%*	*11%*	*2%*	*$ 17,230*
County Administration Office	*1*	*27%*	*11%*	*2%*	*$ 342,105*
Courthouse	*10*	*27%*	*11%*	*2%*	*$ 440,997*
Courthouse Annex Office	*1*	*27%*	*11%*	*2%*	*$ 576,762*
Day Reporting Center	*1*	*31%*	*13%*	*3%*	*$ 30,930*
Dibble Creek VFC	*1*	*29%*	*12%*	*2%*	*$ 23,103*
District Attorney	*1*	*27%*	*11%*	*2%*	*$ 32,555*
DRC Service House	*1*	*31%*	*13%*	*3%*	*$ 5,232*
El Camino Vol Fire Co	*1*	*22%*	*8%*	*2%*	*$ 31,657*
Facilities Maintenance	*1*	*27%*	*11%*	*2%*	*$ 5,310*
Facilities Maintenance Office	*1*	*27%*	*11%*	*2%*	*$ 31,703*
Facilities Maintence	*1*	*27%*	*11%*	*2%*	*$ 0*

County Building Site	Building Count	Average Probability of Potential Damage Exceedance			Sum of Economic Loss
		Slight	Moderate	Extensive	
Gerber Park	*1*	*22%*	*8%*	*2%*	*$ 3,849*
Health Services Agency	*11*	*28%*	*12%*	*2%*	*$ 705,047*
HSA/Social Services	*1*	*15%*	*5%*	*1%*	*$ 0*
Law Library / Veterans Svc Office	*1*	*27%*	*11%*	*2%*	*$ 0*
Los Molinos Fire	*1*	*20%*	*7%*	*1%*	*$ 25,549*
Los Molinos Library	*1*	*20%*	*7%*	*1%*	*$ 0*
Los Molinos Satellite Office	*1*	*20%*	*7%*	*1%*	*$ 0*
Los Molinos Senior Center	*1*	*20%*	*7%*	*1%*	*$ 20,649*
Los Molinos Senior Ctr	*3*	*20%*	*7%*	*1%*	*$ 3,757*
Los Molinos Vets Hall	*2*	*20%*	*7%*	*1%*	*$ 56,119*
Manton Vol Fire Co	*2*	*73%*	*47%*	*18%*	*$ 135,623*
Mill Creek Park	*3*	*20%*	*7%*	*1%*	*$ 7,065*
Mill Creek Vol Fire Co	*1*	*18%*	*7%*	*1%*	*$ 0*
Mineral Vol Fire Co	*1*	*30%*	*13%*	*3%*	*$ 11,096*
Misc. Equipment	*1*	*27%*	*11%*	*2%*	*$ 0*
Noland Park	*1*	*40%*	*19%*	*4%*	*$ 3,197*
Paynes Creek Vol Fire Co	*1*	*39%*	*18%*	*4%*	*$ 11,563*
Probation Department	*2*	*29%*	*12%*	*2%*	*$ 811,612*
Probation Dept	*1*	*29%*	*12%*	*2%*	*$ 2,927*
Public Guardian-Conservator	*1*	*28%*	*12%*	*2%*	*$ 0*
Public Health Modular Office	*1*	*29%*	*12%*	*2%*	*$ 29,376*
Public Works	*4*	*28%*	*11%*	*2%*	*$ 97,683*
Public Works Dept	*12*	*20%*	*7%*	*1%*	*$ 220,004*
Rancho Tehama VFC	*1*	*17%*	*6%*	*1%*	*$ 0*
Red Bluff Library	*1*	*27%*	*11%*	*2%*	*$ 195,192*
Red Bluff Library - New	*1*	*29%*	*12%*	*2%*	*$ 38,592*
Red Bluff Veterans Hall	*1*	*27%*	*11%*	*2%*	*$ 125,058*
Richfield Vol Fire Co	*2*	*18%*	*6%*	*1%*	*$ 8,112*
Ridgeway Park	*4*	*23%*	*9%*	*2%*	*$ 41,796*
Ridgeway Vol Fire Co	*1*	*23%*	*9%*	*2%*	*$ 4,753*
Sheriff'S Department	*3*	*29%*	*12%*	*2%*	*$ 246,747*
Sheriff'S Dept	*1*	*31%*	*13%*	*3%*	*$ 0*
Sheriffs Repeater Station	*1*	*46%*	*23%*	*6%*	*$ 4,603*
Simpson-Finnell Park	*3*	*6%*	*2%*	*0%*	*$ 1,689*
Social Services Dept	*2*	*29%*	*12%*	*2%*	*$ 375,619*
Sportsman'S Lodge	*1*	*31%*	*13%*	*3%*	*$ 0*
Tehama Co River Park	*3*	*15%*	*5%*	*1%*	*$ 6,488*

County Building Site	Building Count	Average Probability of Potential Damage Exceedance: Slight	Moderate	Extensive	Sum of Economic Loss
Tehama County Jail	*1*	*27%*	*11%*	*2%*	*$ 970,238*
Vehicles	*1*	*27%*	*11%*	*2%*	*$ 0*
Vehicles - Lease	*1*	*27%*	*11%*	*2%*	*$ 0*
Vina Vol Fire Co	*2*	*15%*	*5%*	*1%*	*$ 7,990*
Workfarm	*1*	*31%*	*13%*	*3%*	*$ 0*
Grand Total	**133**	**25%**	**10%**	**2%**	**$ 6,584,692**

Table 4-33: Essential & High Potential Loss Facilities by Level of Damage (Battle Creek Scenario)

Infrastructure Type	Average Potential Damage to Exceed...: Slight	Moderate	Extensive	Sum of Economic Loss
Essential Facilities	***19%***	***7%***	***1%***	***$ 27,554***
School	***14%***	***5%***	***1%***	***$ 20,405***
Live Oak School	*10%*	*3%*	*0%*	*$ 1,479*
Lowery School	*9%*	*3%*	*0%*	*$ 2,136*
Merrill School	*13%*	*4%*	*1%*	*$ 7,004*
Moon School	*13%*	*4%*	*1%*	*$ 332*
Orchard Park School	*27%*	*11%*	*2%*	*$ 9,454*
Fire Station	***29%***	***12%***	***2%***	***$ 7,149***
CAL FIRE Baker Station	*26%*	*10%*	*2%*	*$ 5,268*
CAL FIRE/Tehama County Fire Headquarters/Station 1	*32%*	*14%*	*3%*	*$ 1,881*
High Potential Loss	***27%***	***11%***	***2%***	***$ 525,185***
Hotel	***18%***	***7%***	***1%***	***$ 16,192***
Mill Creek Resort	*18%*	*7%*	*1%*	*$ 16,192*
Res Elder Care Facility	***28%***	***12%***	***2%***	***$ 109,947***
ALOHA HOUSE	*32%*	*14%*	*3%*	*$ 14,160*
REHG'S CHATEAU ASSISTED LIVING	*37%*	*17%*	*4%*	*$ 45,957*
ROBIN'S NEST	*21%*	*8%*	*1%*	*$ 20,954*
ROBIN'S NEST RESIDENTIAL CARE HOME LLC	*21%*	*8%*	*1%*	*$ 20,954*
ROSE CARE HOME	*19%*	*7%*	*1%*	*$ 461*
VINTAGE ROSE INN	*30%*	*13%*	*3%*	*$ 7,462*
Adult Res Facility	***26%***	***11%***	***2%***	***$ 251,595***
ADOBE RESIDENTIAL	*32%*	*14%*	*3%*	*$ 5,406*
CASA SERENITY LLC	*30%*	*13%*	*3%*	*$ 14,659*
FAYE STREET HOUSE	*31%*	*13%*	*3%*	*$ 6,996*
GILMORE RANCH HOME	*29%*	*12%*	*2%*	*$ 6,812*

Infrastructure Type	Average Potential Damage to Exceed... Slight	Moderate	Extensive	Sum of Economic Loss
LEE STREET HOUSE	*19%*	*7%*	*1%*	*$ 5,675*
LEE STREET HOUSE 1	*19%*	*7%*	*1%*	*$ 1,160*
LEE STREET HOUSE 2	*19%*	*7%*	*1%*	*$ 1,160*
LEE STREET HOUSE II	*19%*	*7%*	*1%*	*$ 1,160*
LIGHTHOUSE LIVING SERVICES	*31%*	*13%*	*3%*	*$ 8,751*
MASON'S RESIDENCE III	*30%*	*13%*	*3%*	*$ 9,224*
NORTH VALLEY SERVICES - A/C WEST	*28%*	*11%*	*2%*	*$ 8,372*
NORTH VALLEY SERVICES - BEHAVIOR MANAGEMENT PGRM	*27%*	*11%*	*2%*	*$ 71,396*
NORTH VALLEY SERVICES - LUCKNOW HOME	*32%*	*14%*	*3%*	*$ 25,692*
NORTH VALLEY SERVICES - RAWSON HOME	*25%*	*10%*	*2%*	*$ 3,520*
NORTH VALLEY SERVICES - SPECIALIZED RES SERVICES	*23%*	*9%*	*2%*	*$ 3,306*
NORTHERN OAKS	*28%*	*12%*	*2%*	*$ 21,285*
PRS - BAKER HOUSE	*28%*	*12%*	*2%*	*$ 11,668*
PRS - MARY LANE	*32%*	*14%*	*3%*	*$ 12,008*
PRS - SHERMAN HOUSE	*30%*	*13%*	*3%*	*$ 11,983*
RUSSELL'S FAMILY HOME	*20%*	*7%*	*1%*	*$ 694*
SAIL HOUSE INC. THE	*29%*	*12%*	*2%*	*$ 8,917*
SERENITY HOUSE	*13%*	*4%*	*1%*	*$ 2,546*
STONYBROOK RESIDENTIAL INC.	*30%*	*13%*	*3%*	*$ 9,202*
Child Care Centers	***27%***	***11%***	***2%***	***$ 147,451***
ANTELOPE STATE PRESCHOOL	*32%*	*14%*	*3%*	*$ 31,902*
BERRENDOS EXCEPTIONAL NEEDS	*32%*	*14%*	*3%*	*$ 31,902*
BERRENDOS STATE PRESCHOOL	*32%*	*14%*	*3%*	*$ 31,902*
BRIGHT HORIZONS T.I.P.	*32%*	*14%*	*3%*	*$ 31,902*
CATERPILLAR COTTAGE & BUTTERFLY BUNGALOW	*30%*	*13%*	*3%*	*$ 8,724*
LITTLE FRIENDS OF CAPAY	*11%*	*4%*	*0%*	*$ 10,439*
LOS MOLINOS STATE PRESCHOOL	*19%*	*7%*	*1%*	*$ 681*

4.6.6.3.2 HazMat Fixed Facilities

Although earthquakes are low probability events, they produce hazardous materials (HazMat) threats at very high levels when they do occur. Depending on the year built and construction of each facility containing HazMat, earthquake initiated hazardous material releases (EIHR) potential will vary. HazMat contained within masonry or concrete structures built before certain benchmark years reflecting code improvements may be of particular vulnerability.

4.6.6.3.3 Transportation

Earthquake events can significantly impact bridges and overpasses which often provide the only access to some neighborhoods. Since soft soil regions generally follow floodplain boundaries, bridges that cross water courses are considered vulnerable.

Interstate 5 (I-5) is a major north–south route of the Interstate Highway System in the U.S. state of California. It begins at the Mexico–United States border at the San Ysidro crossing, goes north across the length of California and crosses into Oregon south of the Medford-Ashland metropolitan area. It is the more important and most used of the two major north-south routes on the Pacific Coast. I-5 crosses into Tehama County, passing through Corning before entering Red Bluff and intersecting SR 36, which connects to the northern end of SR 99. I-5 crosses the Sacramento River twice before entering Shasta County.

There are currently 80 bridges on State Highways in Tehama County, built between the years of 1940 and 2011 (CalTrans, July 2017). Highway bridges provide throughways to significant County and regional corridors in Tehama County. A single overpass failure can severely disrupt travel and emergency access from County public safety and mutual aid from other neighboring public safety districts.

4.6.6.3.4 Public Schools

The Field Act was enacted on April 10, 1933, one month after the Long Beach Earthquake in which many schools were destroyed or suffered major damage. Public school construction has been governed by the Field Act since 1933 and enforced by the Division of the State Architect. In any community, public schools constructed under the Field Act after 1978 are likely to be among the safest buildings in which to experience a major earthquake. The Field Act requires:

- School building construction plans be prepared by qualified California licensed structural engineers and architects;
- Designs and plans be checked by the Division of the State Architect (DSA) for compliance with the Field Act before a contract for construction can be awarded;
- Qualified inspectors, independent of the contractors and hired by the school districts, continuously inspect construction and verify full compliance with plans;
- The responsible architects and/or structural engineers observe the construction periodically and prepare changes to plans (if needed) subject to approval by DSA;
- Architects, engineers, inspectors and contractors file reports, under penalty of perjury, to verify compliance of the construction with the approved plans emphasizing the importance of testing and inspections to achieve seismically safe construction. Any person who violates the provisions or makes any false statement in any verification report or affidavit required pursuant to the Act, is guilty of a felony.

Private schools are not subject to the Field Act and fall solely under the jurisdiction of the local building departments and their requirements. Private schools are covered under the Private Schools Building Act of 1986, with the legislative intent that children attending private schools be afforded life safety protection similar to that of children attending public schools.

In the late 1960s (Section 15516, Appendix X, Education Code, 1968) regulations were put in place to have pre-Field Act (1933) buildings retrofitted, removed from school use or demolished. The Field Act also prohibits use of unreinforced masonry buildings as school buildings. Seismic building standards in general were greatly strengthened after significant damage to buildings was observed, especially in the 1971 San Fernando earthquake. The Field Act regulations in place since 1978 are considered adequate for most public school buildings in most cases.

4.6.6.3.5 Utilities

Linear utilities and transportation infrastructure would likely suffer considerable damage in the event of an earthquake. Due to the amount of infrastructure and sensitivity of utility data, linear utilities are difficult to analyze without further investigation of individual system components. Table 4-34 provides best available linear utility data and it should be assumed that these systems are exposed to breakage and failure.

Table 4-34: Lifelines with Earthquake Risk

Infrastructure Type (Linear)	Moderate	Strong	Very Strong	Total Mileage
Transportation and Lifeline	**47.5**	**-**	**-**	**47.5**
FEMA Levee	-	-	-	-
USACE Levee	-	-	-	-
Natural Gas Pipeline	-	-	-	-
Transmission Line	1.7	-	-	1.7
Railroad	1.3	-	-	1.3
Street	44.4	-	-	44.4
-Interstate	0.1	-	-	0.1
-Primary Highway	-	-	-	-
-State/County Highway	11.2	-	-	11.2
-Local Road	32.0	-	-	32.0
-Other Road	1.1	-	-	1.1
-4WD Road	-	-	-	-
Grand Total	**47.5**	**-**	**-**	**47.5**

Water Supply Utilities

Tehama County receives approximately two thirds of its water supply from groundwater and the remaining one third from surface water (District, 2003). Most of the wells in the unincorporated County are individual domestic wells. Residents throughout the County have grouped together to form agricultural and municipal water supply agencies. These agencies were interviewed as part of the Tehama County Flood Control and Water Conservation District’s Inventory and Analysis to learn more about the agency history, the water demands and water sources, and any issues and concerns. Table 4-35 includes these agencies, their customers, and their water sources.

Table 4-35: Summary of Water Supplier and Water Source

Water Supplier	Municipal	Agricultural	Groundwater	Surface Water	Mixed Source
City of Red Bluff	x		x		
Proberta Water District		x		x	
El Camino Irrigation District		x	x		
Thomes Creek Water District		x		x	
City of Tehama	x		x		
Gerber-Las Flores CSD	x		x		
City of Corning	x		x		
Corning Water District		x		x	
Stanford Vina Ranch Irrigation Company		x			x
Deer Creek Irrigation District		x			x
Los Molinos MWC		x		x	
Rio Alto Water District	x				x
Anderson Cottonwood Irrigation District		x		x	
Mineral County Water District	x				x
Golden Meadows Estates CSD	x		x		
Los Molinos CSD	x		x		
Thomes Creek Water Users Association	x			x	

Source: Tehama County Flood Control and Water Conservation District Water Inventory and Analysis

Natural Gas Utilities

The U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) defines natural gas pipelines under two categories, "Transmission" and "Distribution." Transmission pipelines are primarily used to receive gas from suppliers and move it to distribution load centers or to storage facilities.

Several common characteristics of earthquakes and their impacts on natural gas safety are:

- Earthquake ground shaking will generally lead to substantially more instances of building damage than fire ignitions.
- Ground motions that are sufficient enough to damage buildings are the most likely to impact utility and customer gas systems and create a potential for gas-related fire ignitions.
- The number of post-earthquake fire ignitions related to natural gas can be expected to be 20% to 50% of the total post-earthquake fire ignitions.

- The consequences of post-earthquake fire ignitions for residential gas customers are largely financial. A fire ignition only becomes a life safety concern when inhabitants are unable to exit the building following earthquakes. Experience in past earthquakes indicates that egress from earthquake damaged single-family homes is generally possible because of the limited structure height, low numbers of occupants, and multiple direct escape paths through doors and windows.
- The potential life safety dangers from post-earthquake fires are considerably more serious in seismically vulnerable apartment or condominium buildings since they provide a greater chance for damaging the structure and trapping the occupants.

Pacific Gas and Electric Company (PG&E), Tehama County's natural gas utility, is responsible for designing, constructing, maintaining, and operating the natural gas system safely and efficiently. This includes all the facilities used in the delivery of gas to any customer up to and including the point of delivery to the customers' gas piping system.

Gas customers and Tehama County residents are responsible for using gas safely on their property and within their buildings and other facilities. Customers meet this responsibility by maintaining their gas appliances in good working condition, assuring that only qualified individuals are engaged to modify or maintain their gas service and facility piping, and knowing what to do before and after earthquakes to maintain the safe operation of their natural gas service.

The following conditions, when combined, pose the greatest risk for severe post-earthquake fire damage:

1. Buildings are unoccupied and individuals are not present to mitigate damage to gas systems or control small fires.
2. High building density or dense, fire-prone vegetation.
3. High wind and low humidity weather conditions.
4. Damage to water systems that severely limits firefighting capabilities.
5. Reduced responsiveness of firefighting resulting from impaired communications, numerous requests for assistance, direct damage to fire stations, restricted access because of traffic congestion and damaged roadways, and delays in mutual aid from neighboring fire districts.

4.6.7 Future Trends in Development

Land use in the planning area will be directed by general plans adopted under California's General Planning Law. The safety elements of the general plans establish standards and plans for the protection of the community from hazards. The information in this plan provides the participating partners a tool to ensure that there is no increase in exposure in areas of high seismic risk. Development in the planning area will be regulated through building standards and performance measures so that the degree of risk will be reduced. The geologic hazard portions of the planning area are heavily regulated under California's General Planning Law. The International Building Code establishes provisions to address seismic risk.

4.6.8 Issues

Important issues associated with an earthquake in Tehama County include but are not limited to the following:

- More information is needed on the exposure and performance of soft-story construction within the planning area. There are many undocumented unreinforced masonry buildings.
- Low probability of liquefaction within the planning area is evident from data collection efforts. Having this information developed would significantly enhance seismic risk assessment.

4.7 Flood Hazard

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

4.7.1 Regulatory Oversight

4.7.1.1 National Flood Insurance Program (NFIP)

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-YR flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

Tehama County entered the NFIP on June 1, 1982. Structures permitted or built in the County before then are called "pre-FIRM" structures, and structures built afterwards are called "post-FIRM." The insurance rate is different for the two types of structures. The effective date for the current countywide FIRM is September 29, 2011. This map is a digital flood insurance rate map (DFIRM).

All three incorporated cities in Tehama County participate in the NFIP. The County and cities are currently in good standing with the provisions of the NFIP. Compliance is monitored by FEMA regional staff and by the California Department of Water Resources under a contract with FEMA. Maintaining compliance under the NFIP is an important component of flood risk reduction. All planning partners that participate in the NFIP have identified initiatives to maintain their compliance and good standing.

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRMs in Tehama County were published in the 1980s. They were converted into a countywide digital FIRM (DFIRM) on August 29, 2011.

4.7.1.2 Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Table 4-36 lists NFIP and CRS statistics for the County. The statistics show 197 flood insurance claims paid since June 1, 1982 for a total of $3,011,802.

Table 4-36: Flood Insurance Statistics for Tehama County

NFIP and CRS Status & Information	
Tehama County	
NFIP Status	Participating since 06/01/1982
CRS Class	N/A
Policies in Force	945
Policies in SFHA	580
Policies in non-SFHA	365
Total Claims Paid	197
Paid Losses	$ 3,011,802
Repetitive Loss Properties	24
Severe Repetitive Loss Properties	3
Repetitive Loss Payment by NFIP on Building	$ 85,481.00
Repetitive Loss Payment by NFIP on Contents	$ 15,412.00

The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this plan does not identify the repetitive loss properties or include claims data for any individual property.

The following information from flood insurance statistics is relevant to reducing flood risk (Tehama County, 2012):

- The use of flood insurance in Tehama County is below the national average. Only 38 percent of insurable buildings in the county are covered by flood insurance. According to an NFIP study, about 49 percent of single-family homes in special flood hazard areas are covered by flood insurance nationwide.
- The average claim paid in the planning area represents about 2.44 percent of the 2012 average assessed value of structures in the floodplain.
- The percentage of policies and claims outside a mapped floodplain suggests that not all of the flood risk in the planning area is reflected in current mapping. Based on information from the NFIP, 67.5 percent of policies in the planning area are on structures within an identified SFHA, and 32.5 percent are for structures outside such areas. Of total claims paid, 21.2 percent were for properties outside an identified 100-YR floodplain.

4.7.1.3 Floodplain Management Regulations

Tehama County adopted Floodplain Management Regulations (Code Chapter 15.52) effective July 1, 1999. These regulations are administered by the Tehama County Building and Safety Department. The purpose of the regulations are to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas. The methods and provisions of reducing flood losses through the regulations include the following:

- 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 that 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 flood waters.
- Control filling, grading, dredging, and other development that may increase flood damage.
- Prevent or regulate the construction of flood barriers that unnaturally divert floodwaters or that may increase flood hazards in other areas. (County, 2006)

4.7.2 Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is a statistical tool used to define the probability that a certain river discharge (flow) level will be equaled or exceeded within a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-YR discharge has a 1-percent chance of being equaled or exceeded in any given year. The “annual flood” is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-YR or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-YR flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.

4.7.2.1 Floodplain Ecosystems

Floodplains can support ecosystems that are rich in quantity and diversity of plant and animal species. A floodplain can contain 100 or even 1000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly; however, the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

4.7.2.2 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

4.7.3 Hazard Profile

Flooding in Tehama County is typically caused by high-intensity, short-duration (1 to 3 hours) storms concentrated on a stream reach with already saturated soil. Two types of flooding are typical:

- Flash floods that occur suddenly after a brief but intense downpour. They move rapidly, end suddenly, and can occur in areas not generally associated with flooding (such as subdivisions not adjacent to a water body and areas serviced by underground drainage systems). Although the duration of these events is usually brief, the damage they cause can be severe. Flash floods cannot be predicted accurately and happen whenever there are heavy storms.
- Riverine floods described in terms of their extent (including the horizontal area affected and the vertical depth of floodwater) and the related probability of occurrence (expressed as the percentage chance that a flood of a specific extent will occur in any given year).

Flooding can be a major problem in almost any part of the County. Large portions of Tehama County are within a 100-YR floodplain. Most of the floodplains in the County are along the Sacramento River corridor, including the Cities of Red Bluff and Tehama, or along the corridors of its associated tributaries.

4.7.3.1 Principal Flooding Sources

Except for small areas that drain to Black Butte Reservoir and Stony Creek on the west side and Pine Creek on the east side, all water originating in Tehama County drains to the Sacramento River within the county or on the county's boundary. Cottonwood Creek and Battle Creek form the boundary between Tehama and Shasta Counties. The Sacramento River at the Red Bluff Diversion Dam drains 9,150 square miles. Shasta Dam, an important flood control structure on the Sacramento River, is 69 miles upstream of Red Bluff and controls runoff from approximately 6,670 square miles, or 73 percent of the Sacramento River watershed upstream of Red Bluff. (Tehama County Flood Insurance Study, 2011)

Table 4-37 lists the principal tributaries to the Sacramento River from the west and from the east. Several smaller tributaries enter the Sacramento River in between the principal watersheds listed. Generally, the tributaries whose watersheds originate in the higher elevations are perennial; those originating at lower elevations are generally seasonal.

Table 4-37: Sacramento River Tributaries

West Side Tributaries		Eastside Tributaries	
Cottonwood Creek (P)[a]	McClure Creek	Battle Creek (P)[a]	Dye Creek
Reeds Creek	Thomes Creek (P)	Salt Creek	Mill Creek (P)[a]
Red Bank Creek (P)	Jewett Creek	Antelope Creek (P)	Dry Creek
Oat Creek	Burch Creek	Craig Creek (D)	Deer Creek (P)[a]
Elder Creek (P)	Hall Creek	Paynes Creek (D)	Pine Creek[b]

(P) = Perennial Creek

(D) = Distributary

a. Creeks for which a Watershed Conservancy has been formed.

b. Pine Creek discharges into the Sacramento River in Butte County.

Runoff from watersheds on the west side is mostly influenced by precipitation as rain and, as a consequence, tends to be more “flashy” than runoff from streams on the east side, which are influenced to a greater extent by snowmelt (rain and snow events on the east side can cause flood events). Storm runoff frequently exceeds the capacity of the stream channels. The result is widespread overland/sheet flow that floods roads and mobile home parks, requiring the evacuation of people and moving mobile homes. The flooding resulting from high tributary flow is exacerbated when it is coincident with high stages in the Sacramento River.

4.7.3.2 Past Events

Since 1950, the State of California has proclaimed nine states of emergencies due to flooding that included Tehama County. Major floods occurred in December 1937, December 1955, December 1963, February 1986, January 1995, January 1997, December 2014 and February 2017 ranging from a 20-year flood to more than a 100-YR event causing millions of dollars in property damage. Numerous road closures occur during these events, isolating people and restricting access by emergency vehicles. Table 4-38 summarizes flood events in the planning area since 1964.

Table 4-38: Tehama County Flood Events

Date	Declaration #	Type of event	Estimated Damage
2/20/17		Heavy Rain	$400,000 [d]
2/17/17		Heavy Rain caused flooding in Los Molinos, Red Bluff, Vina and Jelly’	$50,000 [d]
1/23/16		Heavy Rain in Corning	$5,000 [d]
12/11/14		Flooding caused by heavy rain	$400,000 [d]
12/6/14		Flash flooding caused by heavy rain	$0 [d]
12/3/14		Flash Flood caused by Dam/ Levee Break	$6,000,000 [d]
11/21/12		Flash Flood caused by Heavy Rain	$5,000 [d]
10/3/08		Flash Flood caused by heavy rain in a burn area	$0 [d]

Date	Declaration #	Type of event	Estimated Damage
02/09/98	1203	Severe Winter Storms and Flooding	$2,971,428[a] ($669,963[b])
01/04/97	1155	Severe Storms/Flooding	$1,238,671[b]
03/12/95	1046	Severe Winter Storms, Flooding, Landslides, Mud Flows	$871,254[b]
01/10/95	1044	Severe Winter Storms, Flooding, Landslides, Mud Flows	$11,241,379[a, c]
02/03/93	979	Severe Storm, Winter Storm, Mud & Landslides, Flooding	$40,108[b]
02/14/92	—	Flooding-Winter weather	$20,717[a]
02/21/86	758	Severe storms, flooding	$5,000,000[a]
02/09/83	677	Coastal storms, floods, slides, tornadoes	$1,791,666[a]
01/25/74	412	Severe storms, flooding	
01/16/73	—	Flooding - Severe Storm/Thunder Storm	$86,207[a]
02/16/70	283	Severe storms, flooding	$10,416[a]
01/26/69	253	Severe storms, flooding	
12/24/64	183	Heavy Rains & Flooding	$1,785,174[a]

a. Data obtained from Spatial Hazard Events and Losses Database for the United States (SHELDUS)
b. Information taken from the Tehama County Flood Mitigation Plan, October 2006
c. Crop damage loss only
d. Data obtained from NOAA

4.7.3.3 Historic Flood Areas

4.7.3.3.1 Sacramento River

The Sacramento River divides Tehama County, flowing through the County from north to south. The Sacramento River at the Red Bluff Diversion Dam drains approximately 9,150 square miles. Except for small drainage areas that drain to Black Butte Reservoir and Stony Creek on the west side and Pine Creek on the east side, all water originating in Tehama County drains to the Sacramento River within the county or on the county's boundary.

The flooding resulting from high tributary flow is exacerbated when it is coincident with high stages in the Sacramento River.

The 100-YR floodplain along the Sacramento River that has been delineated by the USACE, based upon its Comprehensive Study of the Sacramento and San Joaquin Rivers, is broader than that delineated on the FEMA FIRMs. The differences and the reasons for the differences between these maps and any other 100-YR flood stage designations should be reviewed so that Tehama County, in administering the NFIP, can be certain the new information can and should be used as the "best available" information. The 2006 Tehama County Flood Mitigation Plan recommends that the County should conduct a workshop with FEMA, the USACE, the State Reclamation Board, and DWR to address this matter. (County, 2006)

4.7.3.3.2 Jewett and Burch Creek

The primary creeks and channels in the Antelope and the Corning areas overtop during high runoff events causing the respective areas to be plagued with widespread overland flooding that adversely impacts roadways and properties. These problems are attributed largely to Antelope, Jewett, and Burch Creeks for the two areas, respectively. Burch Creek overflows in to Jewett Creek or west of town during localized rain events. These areas do not have active stream flow stations. A precipitation station is located at the Corning airport. The respective areas would benefit from having access to real-time data and flood forecasting information in view of the “flashy” hydrology of the systems. It is recommended by the 2006 Tehama County Flood Mitigation Plan that both watersheds be equipped with real-time data monitoring stations and data acquisition systems for stream flow and precipitation.

Another high priority project listed in the 2006 Tehama County Flood Mitigation was to formulate a Flood Management Plan for Jewett and Burch Creeks in the vicinity of Corning. so that a comprehensive evaluation can be made of the constraints and opportunities for managing floodwater from the watersheds. The consideration of detention storage and other flood management facilities was first investigated in 1969 by the California Department of Conservation. Although nothing materialized from that effort, the concept could offer opportunity to mitigate damage to public infrastructure and provide floodplain information to facilitate sound land use planning and a basis for administering the NFIP for the area. (County, 2006)

4.7.3.3.3 Dairyville

The Dairyville area and surrounding rural residential properties are at risk to flooding due to the Antelope Creek and its distributaries. Dairyville is an example where several repetitive loss properties are not within a mapped flood zone. Properties in Dairyville and Antelope have been damaged by floods, however, they were not covered under the NFIP and repairs were paid for by the owners.

Figure 4-22: Dairyville Flooding

Salt Creek and Antelope Creek distributaries cause flood risk to McHie Subdivision, Dairyville and other rural residential areas. More studies need to be done locally to validate the accuracy of the existing flood hazard mapping produced by FEMA reflecting the true flood risk within the planning area. This is most prevalent in areas protected by levees not accredited by the FEMA mapping process such as the Antelope/ Salt Creek area and others. Flood control structures that are not recognized by FEMA include roads, railroads and other non-certified flood control structures. (County, 2006)

4.7.3.4 Repetitive Loss Areas (RL)

A RL property is a FEMA designation defined as an insured property that has made two or more claims of more than $1,000 in any rolling 10-year period since 1978. The term “rolling 10-year period” means that a claim of $1,000 can be made in 1991 and another claim for $2,500 in 2000; or one claim in 2001 and another in 2007, as long as both qualifying claims happen within 10 years of each other. Claims must be at least 10 days apart but within 10 years of each other. RL properties may be classified as a Severe Repetitive Loss property under certain conditions. A Severe Repetitive Loss property (SRL) has had four or more claims of at least $5,000, or at least two claims that cumulatively exceed the buildings reported value. A property that sustains repetitive flooding may or may not be on Tehama County’s RL property list for a number of reasons:

- Not everyone is required to carry flood insurance.
- Owners who have completed the terms of the mortgage or who purchased their property outright may not choose to carry flood insurance and instead bear the costs of recovery on their own.
- The owner of a flooded property that does carry flood insurance may choose not to file a claim.
- Even insured properties that are flooded regularly with filed claims may not meet the $1,000 minimum threshold to be recognized as an RL property.
- The owner adopted mitigation measures that reduce the impact of flooding on the structure, removing it from the RL threat and the RL list (in accordance with FEMA’s mitigation reporting requirements).

Many jurisdictions are required to address only the individual properties on the updated FEMA RL list. A property appears on FEMA’s RL inventory because the structure had flood insurance and received two or more claims. These properties are merely representative of the community’s overall repetitive flooding problem.

Extensive FEMA NFIP databases are used to track claims for every participating community including unincorporated Tehama County. Currently, unincorporated portions of Tehama County contain 24 RL properties under their jurisdictional umbrella. The total dollar amount of claims paid to date by the NFIP is $85,481 of structural and $15,412 content claims. Together, the total claims paid by the NFIP are in excess of $100,893 for the unincorporated areas of the County. In order to make the NFIP a viable program, the NFIP and CRS programs work to reduce the flood risk in the community and develop mitigation measure to reduce insurance payouts.

A property does not have to be currently carrying a flood insurance policy to be considered a RL or SRL property. Often homes in communities are not carrying flood insurance but are still on the community’s repetitive loss list. The “repetitive loss” designation follows a property from owner to owner; from insurance policy to no insurance policy, and even after the property has been mitigated. Having an insurance policy and making claims that fall into the repetitive loss criteria will put a property on the RL list. Even after the policy on a property has lapsed or been terminated, the property will remain on Tehama County’s RL list.

The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this plan does not identify the repetitive loss properties or include claims data for any individual property. Figure 4-23 shows the repetitive loss areas in Tehama County. Loss statistics by jurisdiction are presented in Table 4-39.

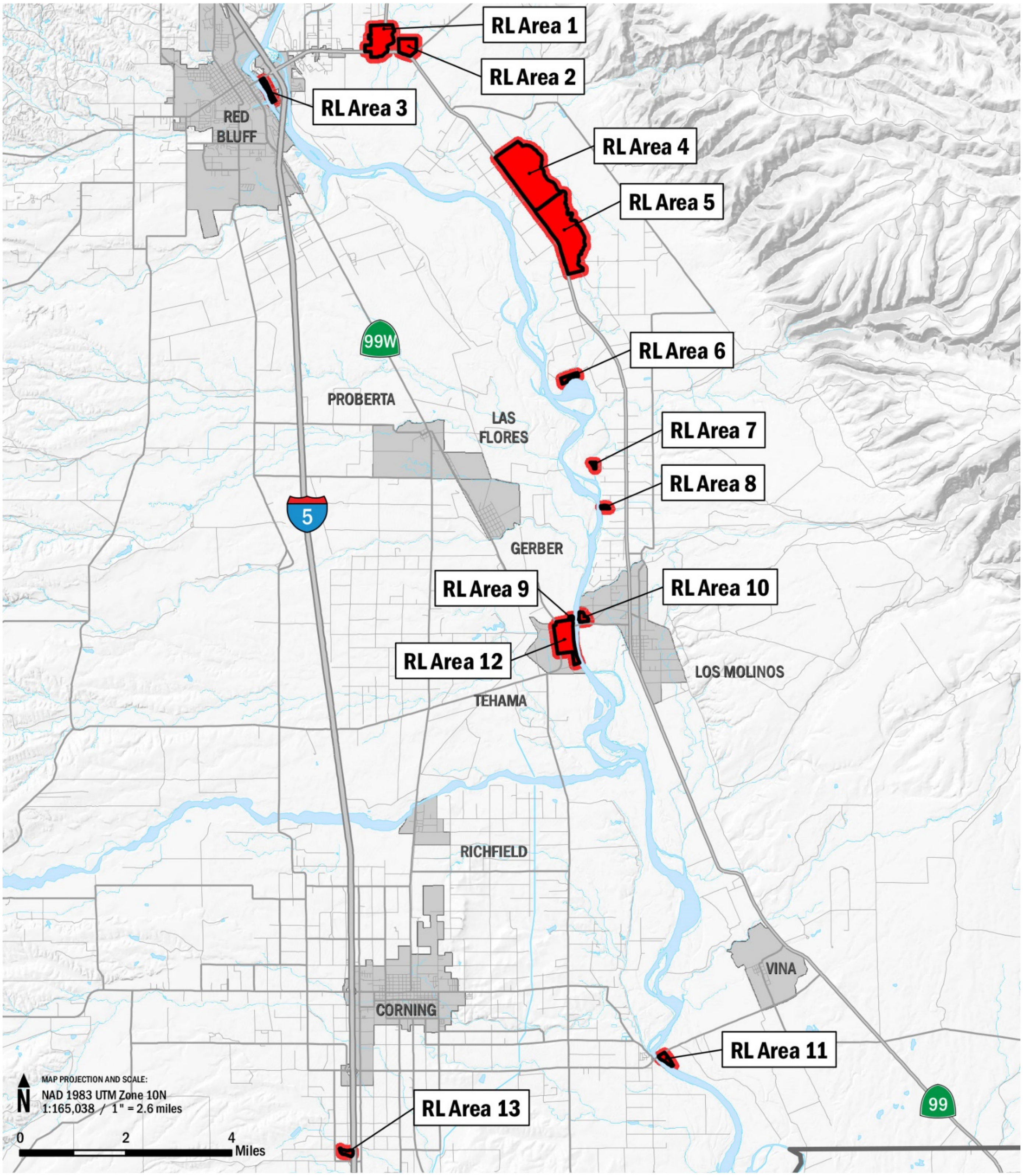


Figure 4-23: Repetitive Loss Areas

Table 4-39: Loss Statistics for Tehama County from 1/1/1978 to 4/30/2017

Community Name	Total Losses	Closed Losses	Open Losses	Closed Without Pay (CWOP) Losses	Total Payments
City of Corning	21	17	0	4	92,233.51
City of Red Bluff	62	44	0	19	376,567.91
Tehama County	273	205	0	68	3,290,767.89
City of Tehama	43	32	0	11	386,813.08

4.7.3.5 Location

The major floods in Tehama County have resulted from intense weather rainstorms between December and March. The flooding has been documented by gage records, high water marks, damage surveys and personal accounts. This documentation was the basis for the August 29, 2011 FIRM generated by FEMA for Tehama County. The 2011 Flood Insurance Study is the sole source of data used in this risk assessment to map the extent and location of the flood hazard. Figure 4-24 shows the location of flood hazard zones in Tehama County.

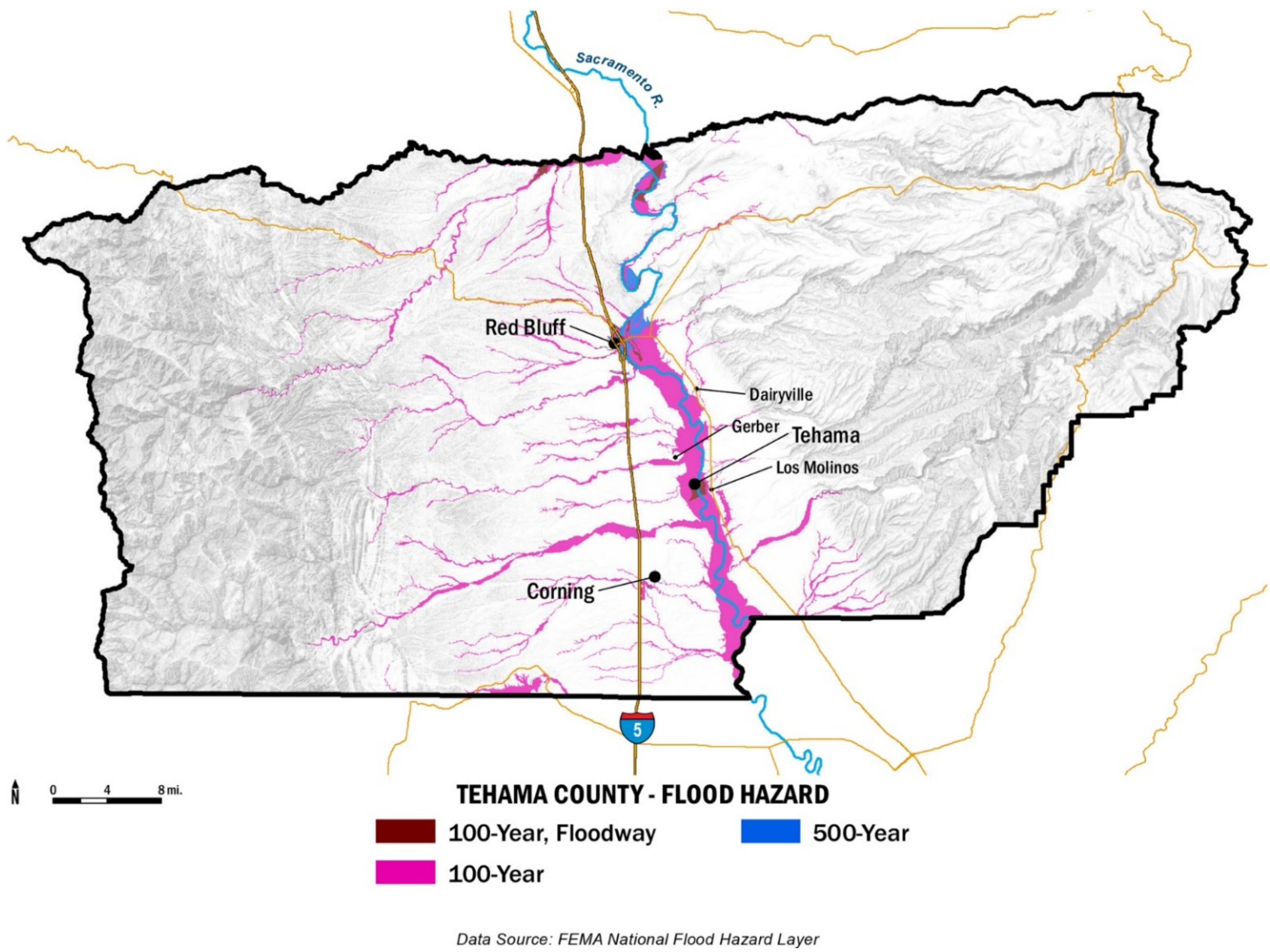


Figure 4-24: Location of Flood Hazard Zones in Tehama County

4.7.3.5.1 State Awareness Zones

The intent of the Awareness Floodplain Mapping project is to identify all pertinent flood hazard areas for areas that are not mapped under the Federal Agency Management Agency's (FEMA) National Flood Insurance Program (NFIP) and to provide the community and residents an additional tool in understanding potential flood hazards currently not mapped as a regulated floodplain. The awareness maps identify the 100-YR flood hazard areas using approximate assessment procedures. These floodplains are shown simply as flood prone areas without specific depths and other flood hazard data.

There are currently six Awareness Floodplain Maps available for Tehama County. These maps cover the following areas: Red Bluff West, Red Bluff East, Los Molinos, Acorn Hollow, Ishi Caves and Vina. Shown in Figure 4-25.

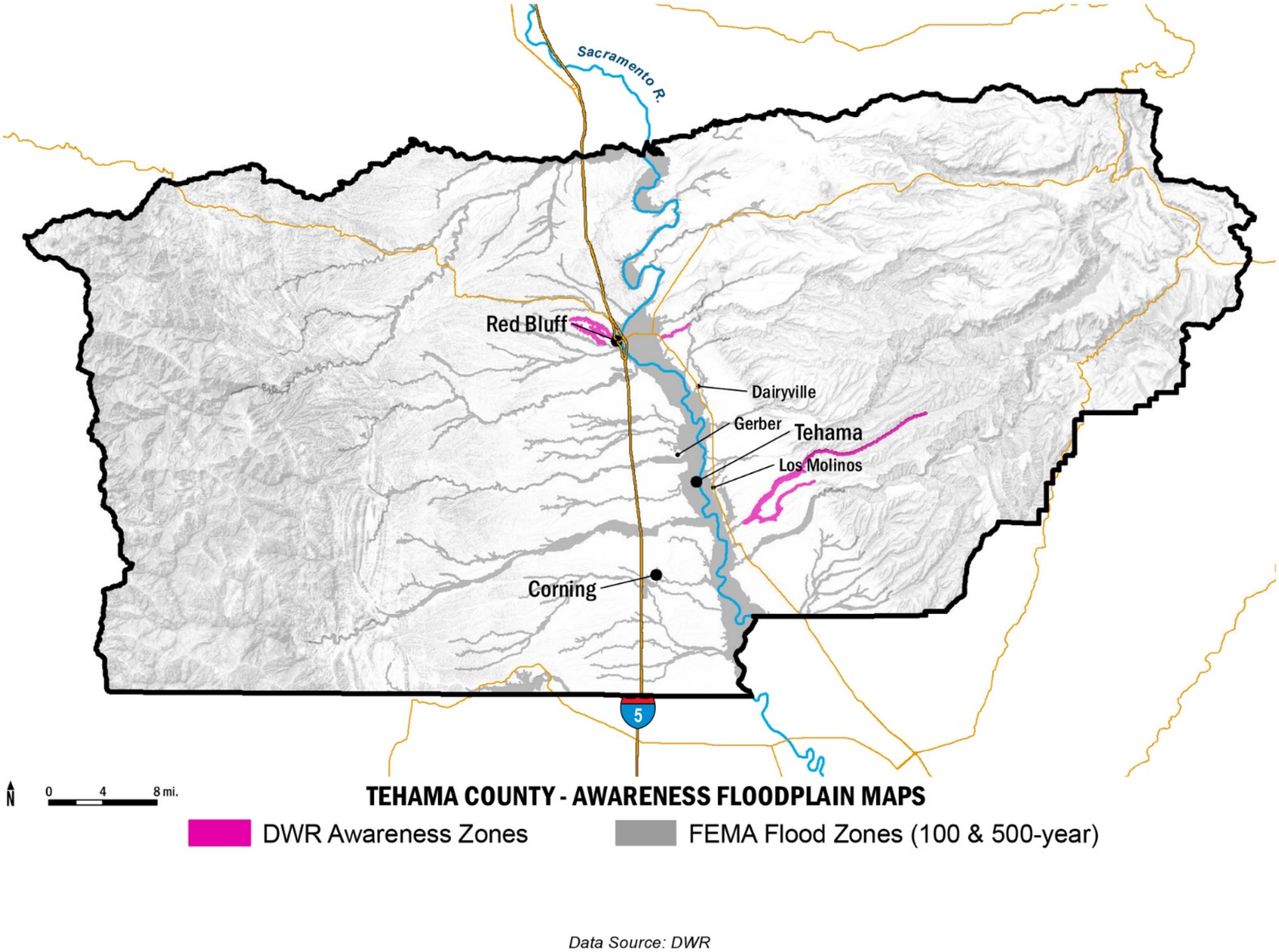


Figure 4-25: DWR Awareness Zones

4.7.3.6 Frequency

Tehama County experiences episodes of river flooding almost every winter due to heavy precipitation. Large floods that can cause property damage typically occur every three to seven years. Urban portions of the county annually experience nuisance flooding related to drainage issues.

4.7.3.7 Severity

The main factors affecting flood damage are water depth and velocity. Deeper and faster flood flows can cause more damage. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges; Table 4-40 lists peak flows used by FEMA to map the floodplains of Tehama County.

Table 4-40: Summary of Peak Discharges in Tehama County

	Drainage sq. MILES	Discharge (cubic feet/second)			
Source/Location	**Area**	**10-Year**	**50-Year**	**100-YR**	**500-Year**
Brewery Creek, at the mouth	2.3	290	720	1,020	1,800
Brewery Creek Tributary, at the mouth	0.5	—	—	230	—
Brickyard Creek, at the mouth	7.0	840	1,750	2,340	3,610
Cottonwood Creek					
At US Highway 99	917	54,153	—	102,750	—
Upstream of confluence with Hooker Creek	878	—	—	98,500	—
Upstream of confluence with SF Cottonwood Creek	475	—	—	54,280	—
Dibble Creek					
At mouth	31.1	2,580	5,440	6,700	9,860
At McCoy Bridge	13.5	1,310	—	3,325	—
~ 3.25 miles upstream of McCoy Rd. Bridge	7.1	—	—	2,030	—
East Sand Slough, at divergence from Sacramento River	—	35,300	55,500	65,000	*a*
Grasshopper Creek, at the mouth	4.8	410	980	1,330	2,310
HWY 99 overflow, at confluence of Red Bank Creek	—	—	—	130	1,280
Hooker Creek, at confluence with cottonwood Creek	26.5	2,830	—	4,050	—
Jewett Creek					
At Interstate 5	8.1	800	1,200	2,300	3,350
Downstream of State HWY 99 (Edith Ave)	—	—	—	2,500[1]	—
Downstream of Toomes Ave	—	—	—	2,100[1]	—
Payne Creek Slough, at divergence from Sacramento River	**—**	11,400	24,500	31,000	[2]

	Drainage sq. MILES	Discharge (cubic feet/second)			
Source/Location	**Area**	**10-Year**	**50-Year**	**100-YR**	**500-Year**
Reeds Creek					
At the mouth	74.7	4,950	9,500	13,500	17,650
Upstream of confluence with Brickyard Creek	67.7	—	—	12,000	—
Sacramento River, near the City of Tehama	10,000	155,000	220,000	245,000	580,000
Sacramento River, near the city of Red Bluff					
At Red Bluff Diversion Dam	9,150	141,000	194,000	220,000	546,000
Downstream of confluence with Reeds Creek	8,900	140,000	192,000	217,500	541,000
Sacramento River, near Lake California, below confluence with Battle Creek	8,800	133,000	183,000	205,000	525,000
Samson Slough, at divergence from Paynes Creek Slough	—	3,300	8,000	11,750	[2]
South Fork Cottonwood Creek, *(At confluence with Cottonwood Creek)*	395	23,560	—	45,390	—
Spyglass Dr. overflow, *(At convergence with Grasshopper Creek)*	[3]	[3]	[3]	200	890

[1]Jewett Creek floodwaters collect against the upstream (west) embankment of Interstate Highway 5 (I-5) and then continue to the east through the opening in I-5. However, the channel capacity downstream of I-5 is increasingly smaller as it continues through the study area, resulting in overbank losses and decreased channel flows.

[2]Controlling Discharge from Sacramento River

[3] Drainage not available

Source: Table 5 Summary of Discharges from FEMA FIS Text, 2011

4.7.3.8 Warning Time

The type and rate of flooding experienced in Tehama County varies. Along the Sacramento River the depth and timing of flooding is somewhat predictable with information from the forecast in flood releases from Shasta Dam and stream flow gages on major tributaries between Shasta Dam and Tehama County. On the valley floor, however, the flooding occurs quickly both east and west of the Sacramento River without advance warning, which causes widespread flooding of property and primary transportation routes. This renders ingress and egress problematic for extended periods of time. (County, 2006)

In general, warning times for floods can be between 24 and 48 hours. Flash flooding can be less predictable, but potential hazard areas can be warned in advanced of potential flash flooding danger. While many streams in the planning area have gauges to monitor flows in real time, the County has no real-time flood warning protocol, with the exception of the Sacramento River, which has flows controlled by Shasta Dam. The City of Tehama and Gerber have sirens to warn residents of floods. The recently upgraded reverse 911 system is also used to alert residents of flood danger.

4.7.3.8.1 DWR Awareness Zones Notification

The Flood Risk Notification Program (FRN Program) is part of the Department of Water Resources' (DWR) FloodSAFE California Initiative. The program's key goal is to increase flood risk awareness by effectively communicating that risk to individual property owners, the public, and local, state, and federal agencies. This includes encouraging people to understand the levee system that protects them; be prepared and aware of their flood risk; and take appropriate actions before, during, and after flooding to protect themselves, minimize damage to their property or personal possessions, and facilitate recovery.

To achieve this goal, the FRN Program is:

- Sending out an annual notice to property owners whose property is at risk of flooding
- Maintaining accurate Levee Flood Protection Zone (LFPZ) maps and an associated parcel information database (please note: these maps are different from Federal Emergency Management Agency regulatory maps)
- Providing people with useful ways to assess risk and reduce flood loss
- Establishing outreach and educational projects with public involvement
- Expanding its interactive Flood Risk Notification website
- Collaborating with federal agencies, local agencies, and communities

In September 2010, DWR provided the first annual written notice of flood risks to each landowner whose property is protected by State Plan of Flood Control levees and is within an LFPZ. The notice informs recipients of their property's potential flood risks and potential sources of flooding, and offers flood emergency planning and preparedness tips. It encourages recipients to take preventative actions such as purchasing flood insurance, elevating or "floodproofing" their buildings, and preventing blockage of channels, drains, and ditches.

4.7.4 Secondary Hazards

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true on the Sacramento River, where floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Hazardous materials spills are a secondary hazard of flooding if storage tanks rupture and spill into streams or storm sewers.

It is also recognized that wildland fires within a watershed can exacerbate the flood hazard by virtue of increased rate and volume of runoff and attendant erosion and sediment discharge.

4.7.5 Climate Change Impacts

Use of historical hydrologic data has long been the standard of practice for designing and operating water supply and flood protection projects. For example, historical data are used for flood forecasting models and to forecast snowmelt runoff for water supply. This method of forecasting assumes that the climate of the future will be similar to that of the period of historical record. However, the hydrologic record cannot be used to predict changes in frequency and severity of extreme climate events such as floods. Going forward, model calibration or statistical relation development must happen more frequently, new forecast-based tools must be developed, and a standard of practice that explicitly considers climate change must be adopted. Climate change is already impacting water resources, and resource managers have observed the following:

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

The amount of snow is critical for water supply and environmental needs, but so is the timing of snowmelt runoff into rivers and streams. Rising snowlines caused by climate change will allow more mountain area to contribute to peak storm runoff. High frequency flood event s (e.g. 10 -year floods) in particular will likely increase with a changing climate. Along with reductions in the amount of the snowpack and accelerated snowmelt, scientists project greater storm intensity, resulting in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. As stream flows and velocities change, erosion patterns will also change, altering channel shapes and depths, possibly increasing sedimentation behind dams, and affecting habitat and water quality. With potential increases in the frequency and intensity of wildfires due to climate change, there is potential for more floods following fire, which increase sediment loads and water quality impacts.

As hydrology changes, what is currently considered a 100-YR flood may strike more often, leaving many communities at greater risk. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, floodways, bypass channels and levees, as well as the design of local sewers and storm drains.

4.7.6 Flood Vulnerability Analysis

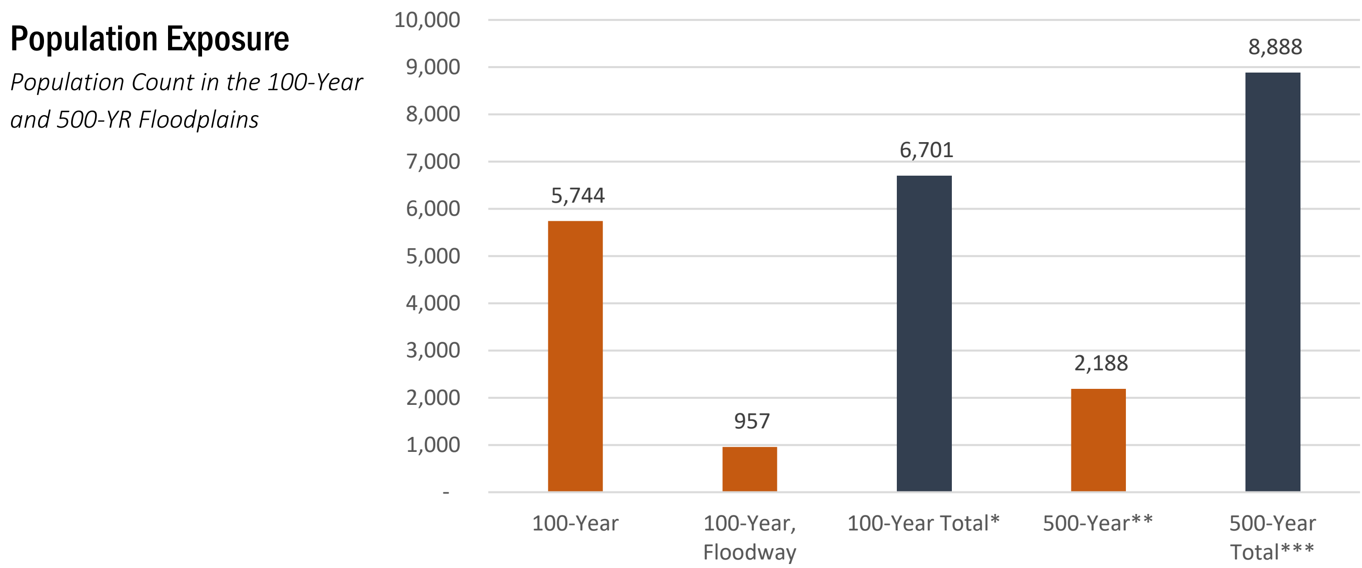
This section describes vulnerabilities in terms of population, property and infrastructure. The Level 2 HAZUS-MH protocol was used to assess the exposure to flooding in the planning area. The model used census data at the block level and FEMA floodplain data, to estimate potential flooding impacts. Where possible, the HAZUS-MH default data was enhanced using County assessor and parcel data and GIS data from county, state and federal sources. All data sources have a level of accuracy acceptable for planning purposes.

Exposed Population	Exposed Market Value ($)	Exposed Content Value ($)	Exposed Critical Facilities	Exposed Miles of Lifeline	Hazus Loss Estimation
8,888	$ 654,744,368	$ 454,541,284	253	342	$ 183,647,935
21.43% *total pop.*	19.20% *total value*	19.20% *total cost*	44.46% *total count*	5.54% *total mileage*	3.53% *inventory*

4.7.6.1 Population

Population counts of those living in the floodplain were generated by analyzing County assessor and parcel data that intersect with the 100-YR and 500-year floodplains identified on FIRMs. Using GIS, U.S. Census Bureau information was used to intersect the floodplain and an estimate of population was calculated by weighting the population within each census block and track with the percentage of flood risk area. Using this approach, it was estimated that the total exposed population is 6,701 within the 100-YR floodplain and 2,188 more within the 500-year floodplain, as shown in Figure 4-26 and Table 4-41.

Figure 4-26: Population Exposure to Flood



**Total 100-year floodplain*

***Includes only additional area outside of 100-year floodplain*

****Total 500-YR floodplain, includes 100-year floodplain*

Table 4-41: Summary Population Exposure to Flood

	Total Population
Tehama County	41,473

Flood Hazard Zone	Population Count	% of Total
100-YR	5,744	*13.85%*
100-YR, Floodway	957	*2.31%*
100-YR Total*	6,701	*16.16%*
500-Year**	2,188	*5.28%*
500-Year Total***	8,888	*21.43%*

**Total 100-year floodplain*

***Includes only additional area outside of 100-year floodplain*

****Total 500-YR floodplain, includes 100-year floodplain*

A geographic analysis of demographics, using the HAZUS-MH model and data from the U.S. Census Bureau and Dun & Bradstreet, identified populations vulnerable to the flood hazard as follows (Tehama County, 2012):

- **Economically Disadvantaged Populations**—It is estimated that 11 percent of the people within the 100-YR floodplain are economically disadvantaged, defined as having household incomes of $10,000 or less.
- **Population over 65 Years Old**—It is estimated that 9 percent of the population in the census blocks that intersect the 100-YR floodplain are over 65 years old. Approximately 10 percent of the over-65 population in the floodplain also have incomes considered to be economically disadvantaged and are considered to be extremely vulnerable.
- **Population under 16 Years Old**—It is estimated that 12 percent of the population within census blocks located in or near the 100-YR floodplain are under 16 years of age.

4.7.6.2 Structures and Parcel Value

Table 4-42 summarizes the number of parcels in the floodplain. GIS models determined that there are 3,487 parcels within the 100-YR floodplain, 290 in the 100-YR floodway and 1,007 additional parcels within the 500-year floodplain. This methodology also estimated $902 million worth of building-and-contents exposure to the 100-YR flood, representing 15.6 percent of the total assessed value of the planning area, and $207 million worth of building-and-contents exposure to the 500-year flood, representing 3.6 percent of the total assessed value.

Table 4-42: Parcels Exposed to NFIP Flood Zones

	Total Parcels	Total Market Value Exposure ($)	Total Content Value Exposure ($)	Total Value ($)
Tehama County	34,284	$ 3,409,758,850	$ 2,367,722,620	$ 5,777,481,470

Flood Hazard Zone	Improved Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
100-YR Flood	3,478	*10.1%*	$ 497,963,424	$ 368,462,946	$ 866,426,370	*15.0%*
100-YR Flood, Floodway	290	*0.8%*	$ 21,746,210	$ 13,798,263	$ 35,544,473	*0.6%*
100-YR Total*	**3,768**	**11.0%**	**$ 519,709,634**	**$ 382,261,209**	**$ 901,970,843**	**15.6%**
500-Year Flood**	1,007	*2.9%*	$ 135,034,734	$ 72,280,075	$ 207,314,809	*3.6%*
500-Year Total*	**4,775**	**13.9%**	**$ 654,744,368**	**$ 454,541,284**	**$ 1,109,285,652**	**19.2%**

**Total 100-year floodplain*

***Includes only additional area outside of 100-year floodplain*

****Total 500-YR floodplain, includes 100-year floodplain*

Note: The table above does not display loss estimation results; the table exhibits total value at risk based upon the hazard overlay and Tehama County Assessor data.

4.7.6.3 Damage Estimation

HAZUS-MH calculates losses to structures from flooding by analyzing the depth of flooding and type of structure. Using historical flood insurance claim data, HAZUS-MH estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, all non-vacant parcels with current market values were used instead of the default inventory data provided with HAZUS-MH. The analysis is summarized in Table 4-43 for the 100-YR and 500-year flood events. It is estimated that there could be up to $180.4 million of flood loss from a 100-YR flood event in the planning area and $183.6 million of flood loss from a 500-year flood event. This represents 3.47% of the total value exposed to the 100-YR flood and 3.53% of the total value exposed to the 500-year event. Table 4-44 and Figure 4-27 shows the 100-YR flood loss estimation (based on depth) in NFIP flood zones by occupancy type. Table 4-45 and Figure 4-28 shows the 500-year flood loss estimation (based on depth) in NFIP flood zones by occupancy type.

Table 4-43: Flood Loss Estimation (Based on Depth) in NFIP Flood Zones

Flood Hazard Zone	Building Damage ($)	Building Damage (% of total)	Content Damage ($)	Content Damage (% of total)	Total Estimated Damage ($)	Total Estimated Damage (% of Total Value)
100-YR	$ 127,064,467	1.6%	$ 201,604,722	2.53%	$ 328,669,189	4.13%
500-Year	$ 132,694,827	1.67%	$ 214,786,522	2.70%	$ 347,481,350	4.36%

Table 4-44: 100-YR Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Building Type	Building Damage ($)	Building Damage (% of grand total)	Content Damage ($)	Content Damage (% of grand total)	Total Damage ($)	Proportion of Loss (%)
Agricultural	$ 13,375,206	7.3%	$ 36,896,908	20.1%	$ 50,272,114	28%
Commercial	$ 1,492,688	0.8%	$ 4,143,501	2.3%	$ 5,636,189	3%
Education	$ -	0.0%	$ -	0.0%	$ -	0%
Governmental	$ 1,639	0.0%	$ 10,622	0.0%	$ 12,261	0%
Industrial	$ 700,510	0.4%	$ 1,554,408	0.8%	$ 2,254,918	1%
Religion	$ 56,849	0.0%	$ 429,758	0.2%	$ 486,607	0%
Residential	$ 79,255,617	43.2%	$ 42,479,108	23.1%	$ 121,734,725	67%
Total	**$ 94,882,509**	**53%**	**$ 85,514,305**	**47%**	**$ 180,396,814**	

*Note: *from Table 4-5 Hazus Census Block Input Values*
1- Building Replacement Costs = $3,104,786,908
2- Content Replacement Cost = $2,090,361,527
3- Total Value = $5,195,148,435

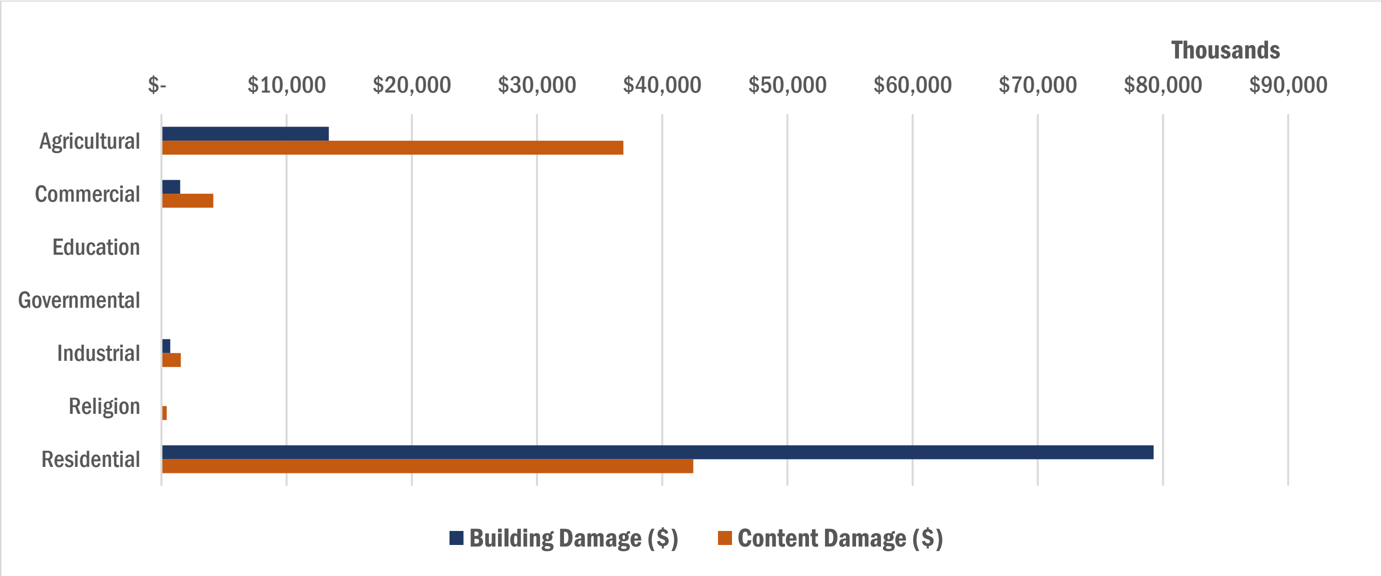


Figure 4-27: 100-YR Flood Loss Estimation by Occupancy

Table 4-45: 500-Year Flood Loss Estimation (Based on Depth) in NFIP Flood Zones by Occupancy Type

Building Type	Building Damage ($)	Building Damage (% of grand total)	Content Damage ($)	Content Damage (% of grand total)	Total Damage ($)	Proportion of Loss (%)
Agricultural	$ 13,089,062	7.1%	$ 35,826,636	19.5%	$ 48,915,698	27%
Commercial	$ 1,551,511	0.8%	$ 4,372,515	2.4%	$ 5,924,025	3%
Education	$ -	0.0%	$ -	0.0%	$ -	0%
Governmental	$ 2,502	0.0%	$ 15,800	0.0%	$ 18,301	0%
Industrial	$ 703,427	0.4%	$ 1,566,843	0.9%	$ 2,270,270	1%
Religion	$ 57,264	0.0%	$ 437,520	0.2%	$ 494,783	0%
Residential	$ 82,019,398	44.7%	$ 44,005,459	24.0%	$ 126,024,857	69%
Total	**$ 97,423,164**	**53%**	**$ 86,224,771**	**47%**	**$ 183,647,935**	

*Note: *from Table 4-5 Hazus Census Block Input Values*
1- Building Replacement Costs = $3,104,786,908
2- Content Replacement Cost = $2,090,361,527
3- Total Value = $5,195,148,435

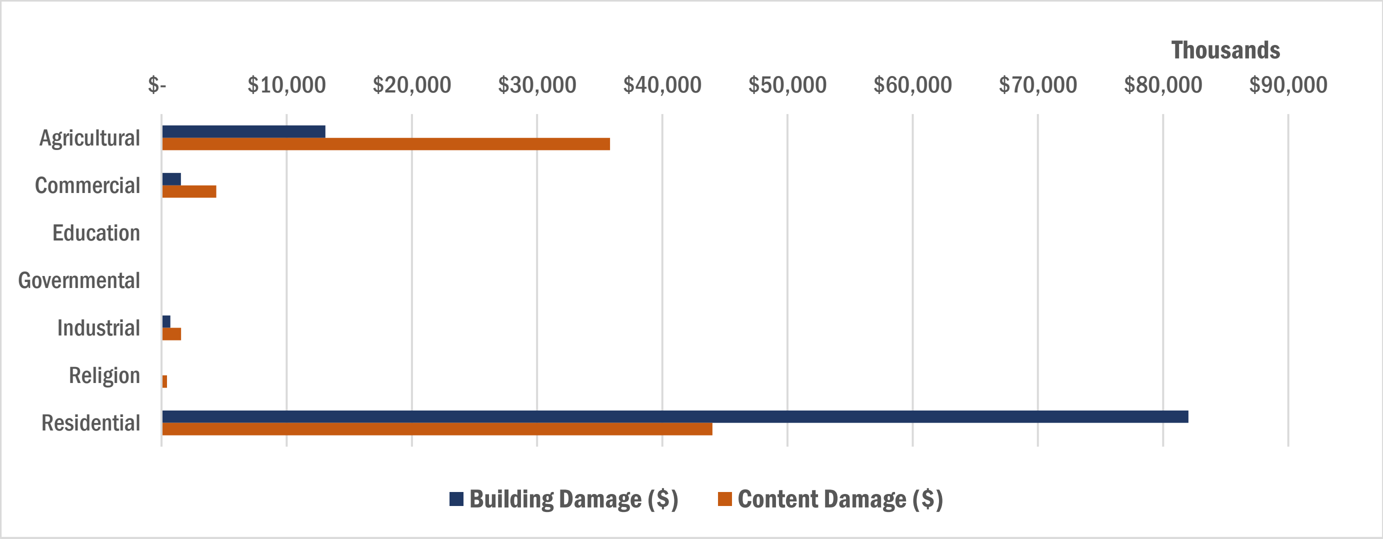


Figure 4-28: 500-YR Loss Estimation by Occupancy

Land Use in the 100-YR Floodplain

Some land uses are more vulnerable to flooding, such as single-family homes, while others are less vulnerable, such as agricultural land or parks. Table 4-46 shows the land use dictated by general zoning classifications of all parcels in the 100-YR and 500-year floodplain, including vacant parcels and those in public/open space uses, broken down for the unincorporated portion of the county. About 70 percent of the area in the 100-YR floodplain is zoned for agricultural uses. These are favorable, lower-risk uses for the floodplain. The amount of the floodplain that contains vacant, developable land is not known. This would be valuable information for gauging the future development potential of the floodplain. (2012 HMP)

Table 4-46: Land Use Within the Floodplain (Unincorporated County)

	100-YR Floodplain		500-Year Floodplain	
Land Use	Area (acres)	% of total	Area (acres)	% of total
Agriculture	59943.36	70.76%	61014.12	69.92%
Commercial	205.99	0.24%	238.62	0.27%
Floodplain	15889.38	18.76%	15955.64	18.28%
Government	2780.02	3.28%	2860.72	3.28%
Industrial	341.97	0.40%	350.79	0.40%
Natural Resource	735.58	0.87%	938.83	1.08%
Planned Development	325.21	0.38%	338.11	0.39%
Recreation	15.66	0.02%	15.71	0.02%
Total	**80237.17**	**100%**	**81712.54**	**100%**

4.7.6.4 Critical Facilities and Infrastructure

Table 4-47 summarizes the critical facilities and infrastructure in the 100-YR, 100-YR floodway and 500-year floodplains of Tehama County. Details are provided in the following sections.

Table 4-47: Critical Facility Points in the Floodplain

Infrastructure Type	100-YR Flood Zone	Floodway	100-YR Total	500-YR, Outside 100-YR	500-YR Total
Essential Facility	3	0	3	1	4
EOC	0	0	0	0	0
Fire Station	1	0	1	0	1
Government Facility	0	0	0	0	0
Hospital	0	0	0	0	0
Police Station	1	0	1	0	1
School	1	0	1	1	2
High Potential Loss	11	1	12	13	25
Residential Child Care	0	0	0	0	0
Adult Residential Care	7	1	8	5	13
Child Care	0	0	0	5	5
Foster/Home Care	0	0	0	0	0
Home Care	0	0	0	0	0
Other Care Facility	0	0	0	0	0
Elder Care	2	0	2	3	5
Dam	2	0	2	0	2
Hotel	0	0	0	0	0
Transportation and Lifeline	209	14	223	1	224
Airport	0	0	0	0	0
Bridge	208	13	221	1	222
Bus Facility	0	0	0	0	0
FCC AM Tower	0	1	1	0	1
FCC Cell Tower	0	0	0	0	0
FCC FM Tower	0	0	0	0	0
Natural Gas Station	1	0	1	0	1
Power Plant	0	0	0	0	0
Substation	0	0	0	0	0
Waste Water Facility	0	0	0	0	0
Grand Total	**223**	**15**	**238**	**15**	**253**

4.7.6.4.1 Critical Facilities Damage Estimates

HAZUS-MH 4.0 was used to estimate the flood loss potential to critical facilities exposed to the flood risk. Using depth/damage function curves to estimate the percent of damage to the building and contents of critical facilities. The data source used in this analysis is different than the data shown in the exposure analysis portrayed in Table 4-47. County insurance data was obtained and formatted for use in HAZUS for a detailed damage estimation. This county dataset has additional information including number of floors, building value, content value, and construction type that greatly enhances HAZUS results. Table 4-48 summarizes Hazus loss results for essential County facilities located within the 100-YR flood hazard areas. Table 4-49 summarized Hazus loss for high potential loss facilities located within the 100-YR flood hazard areas. Data portrayed in Table 4-49 corresponds to the critical facilities data shown in Table 4-47

Table 4-48: County Insurance Holdings with Hazus 100-YR Flood Damage Estimates

Building Site	Building Value ($1 = rental)	Content Value	Potential Building Damage ($)	Potential Content Damage ($)	Total Damage ($)
Antelope VFC	**$1**	**$331,071**	**$0**	**$37,308**	**$37,308**
Fire Station #1	$1	$331,071	$0	$37,308	$37,308
Mill Creek Park	**$149,147**	**$24,652**	**$25,790**	**$24,652**	**$50,442**
Park	$71,952	$19,438	$12,441	$19,438	$31,879
Restroom	$47,567	$1	$8,225	$1	$8,226
Well House/Storage	$29,628	$5,213	$5,123	$5,213	$10,336
Sheriff'S Department	**$2,864,236**	**$1,618,124**	**$329,676**	**$755,206**	**$1,084,883**
Sheriff'S Administration	$2,800,681	$1,362,227	$322,361	$635,775	$958,136
Storage Building	$63,555	$255,897	$7,315	$119,432	$126,747
Simpson-Finnell Park	**$136,297**	**$14,474**	**$125,194**	**$14,474**	**$139,668**
Restrooms	$80,393	$14,472	$73,844	$14,472	$88,316
Snack Bar	$39,598	$1	$36,372	$1	$36,373
Storage Building	$16,306	$1	$14,978	$1	$14,979
Tehama Co River Park	**$201,101**	**$74,945**	**$102,225**	**$74,945**	**$177,170**
Restroom	$52,819	$1	$26,849	$1	$26,850
Restroom (North)	$73,473	$1	$37,348	$1	$37,349
Restroom (South)	$74,809	$74,943	$38,027	$74,943	$112,970
Grand Total	**$3,350,782**	**$2,063,266**	**$582,885**	**$906,585**	**$1,489,470**

Table 4-49: High Potential Loss Infrastructure with Hazus 100-YR Damage Estimates

High Potential Loss Facility	Building Value	Content Value	Potential Building Damage ($)	Potential Content Damage ($)	Total Damage ($)
High Potential Loss	**$807,312**	**$403,658**	**$207,422**	**$117,149**	**$324,571**
Adult Res Facility	**$714,278**	**$357,141**	**$185,905**	**$104,988**	**$290,894**
FAYE STREET HOUSE	$86,714	$43,357	$17,458	$10,030	$27,488
LEE STREET HOUSE 1	$26,071	$13,036	$5,304	$3,043	$8,348
LEE STREET HOUSE 2	$26,071	$13,036	$5,304	$3,043	$8,348
LEE STREET HOUSE II	$26,071	$13,036	$5,304	$3,043	$8,348
LIGHTHOUSE LIVING SERVICES	$108,467	$54,234	$17,628	$10,441	$28,069
NORTH VALLEY SERVICES - LUCKNOW HOME	$300,456	$150,228	$73,437	$41,466	$114,902
PRS - MARY LANE	$140,428	$70,214	$61,470	$33,922	$95,391
Res Elder Care Facility	**$93,034**	**$46,517**	**$21,517**	**$12,161**	**$33,678**
VINTAGE ROSE INN	$93,034	$46,517	$21,517	$12,161	$33,678

4.7.6.4.2 Linear Utilities

It is important to determine who may be at risk if infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the county, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Levees can fail or be overtopped, inundating the land that they protect. Table 4-50 shows critical facilities (linear) in the floodplain.

Table 4-50: Critical Facilities (Linear) in the Floodplain

Infrastructure Type (Linear)	100-YR, Non-Floodway	100-YR, Floodway	500-YR	Total Mileage
Transportation and Lifeline	**299.8**	**13.1**	**29.0**	**342.0**
FEMA Levee	23.5	0.0	-	23.5
USACE Levee	14.2	-	-	14.2
Natural Gas Pipeline	14.8	0.4	0.3	15.5
Transmission Line	27.4	1.5	0.1	29.0
Railroad	4.7	1.0	-	5.7
Street	215.2	10.2	28.6	254.0
-Interstate	4.8	0.8	0.5	6.1
-Primary Highway	4.0	-	-	4.0
-State/County Highway	35.0	1.7	3.1	39.8
-Local Road	156.5	6.6	24.0	187.2
-Other Road	12.1	-	0.3	12.4
-4WD Road	2.7	-	-	2.7
Grand Total	**299.8**	**13.1**	**29.0**	**342.0**

Roads

The following major roads in Tehama County pass through the 100-YR floodplain and thus are exposed to flooding:

- Interstate 5
- Route 99
- Route 36
- Antelope Boulevard
- Aramayo Way
- San Benito Avenue
- Adobe Road
- South Avenue
- Edith Avenue

Some of these roads are built above the flood level, and others function as levees to prevent flooding. Still, in severe flood events these roads can be blocked or damaged, preventing access to some areas (Tehama County, 2012).

Bridges

Flooding events can significantly impact road bridges. These are important because often they provide the only ingress and egress to some neighborhoods. An analysis showed that there are 221 bridges that are in or cross over the 100-YR floodplain and 1 bridge in or crossing the 500-year floodplain.

Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers and streams.

Levees

Levees are used to control flooding in parts of the County. The county has over 13.64 miles of earthen levees and revetments managed by Tehama County Flood Control District. In addition to these District maintained levees, there are numerous private earthen berms (non-engineered) and levees (engineered) that exist throughout the County.

There are also levees on many smaller rivers, streams and creeks that protect small areas of land. Many of the levees are older and were built under earlier flood management goals. Many of these older levees are exposed to scouring and failure due to old age and construction methods (Tehama County, 2012).

4.7.7 Future Trends in Development

The County and its planning partners are equipped to handle future growth within flood hazard areas. All municipal planning partners have general plans that address frequently flooded areas in their safety elements. All partners have committed to linking their general plans to this hazard mitigation plan. This will create an opportunity for wise land use decisions as future growth impacts flood hazard areas.

Based on information presented in the Tehama County 2009-2014 Housing Element, most of the population growth in the county through 2020 is anticipated to occur in unincorporated areas. The total County population is projected to grow 17 percent, from 58,175 in 2004 to 68,323 in 2020. The unincorporated area population is projected to grow about 25 percent, from 37,865 in 2004 to 47,298 in 2020. Using the historical figure of 2.3 people per housing unit, an additional 4,000 housing units would be needed in the unincorporated area by 2020. This represents a 25 percent increase in the number of residential units and does not reflect new commercial buildings that would undoubtedly accompany the population growth. The Bowman area in the north part of the county and the Antelope area east of Red Bluff are the most populous areas. The Bowman area, along with the Gerber and Los Molinos areas, represent the fastest growing areas in the county.

All municipal planning partners are participants in the NFIP and have adopted flood damage prevention ordinances in response to its requirements. With the City of Tehama participating in the CRS program, there is incentive to adopt consistent, appropriate, higher regulatory standards in communities with the highest degree of flood risk. All municipal planning partners have committed to maintaining their good standing under the NFIP through initiatives identified in this plan. Communities participating or considering participation in the CRS program will be able to refine this commitment using CRS programs and templates as a guide.

4.7.8 Issues

The planning team has identified the following flood-related issues in Tehama County:

- Older or non-engineered levees such as Elder Creek, Deer Creek and others are subject to failure or do not meet current building practices for flood protection. Development behind privately built levees/earthen berms occurs on the valley floor. Many of these people have not purchased flood insurance because regulatory maps do not show them as being in the flood plain.
- Salt Creek and Antelope Creek and its distributaries causing flood risk to McHie Subdivision and other rural residential areas.
- Antelope Creek distributaries causing flood risk to Dairyville area and surrounding rural residential properties.
- Unmitigated repetitive loss structures exist within the county unincorporated areas.
- A significant number of NFIP claims are outside of FEMA-designated SFHAs. The determination of the causes of flooding on existing structures and the siting of new facilities, so as not to be adversely impacted by flooding or adversely impacting adjacent or neighboring properties, is problematic due to the lack of topographic data and mapping.

- Over time the transport of material from these rugged upland areas to the valley floor has resulted in the deposition of large alluvial fans and gravel reserves along the lower foothills. Sediment loading continues to be a problem in the Tehama watersheds.
- Watershed streams show rapid responses to storms, and flow levels fluctuate or flash between storm periods in a localized environment.
- Multi Residential Care and Assisted Living Facilities are located within the 100-YR Flood Plain.
- Burch Creek overflows in to Jewett Creek or west of Corning during localized rain events. Jewett Creek is the offender.
- Climate change impacts flood conditions in Tehama County. More severe weather events could compromise local drainage and flood control.
- Residents need more education about flood preparedness, flood insurance and the resources available during and after floods on a continual basis.
- Many small tributaries in the watersheds have high levels of siltation and diminished flood-carrying capacity due to vegetation (Arundo and Tamarisk) overgrowth. Debris-clearing is a challenge due to environmental permitting restrictions. The establishment of Arundo in the streams in Tehama County has seriously limited their conveyance capacity.
- Placing fill, constructing levees or berms, modifying drainage channels and streams, constructing and maintaining private and public roads, and grading property without regard or the understanding of the potential impact to drainage or the risk from flooding can create problems where none existed previously.
- Lack of well head protection plans for private wells or single individual wells providing domestic supply to single family resident.
- More studies need to be done locally to validate the accuracy of the existing flood hazard mapping produced by FEMA reflecting the true flood risk within the planning area. This is most prevalent in areas protected by levees not accredited by the FEMA mapping process such as the Antelope/ Salt Creek area and others. Flood control structures that are not recognized by FEMA include roads, railroads and other non-certified flood control structures.
- Lack of historical damage data, such as high-water marks on structures and damage reports, to measure inundation and the cost effectiveness of future mitigation projects.
- There is a lack of detailed information regarding existing drainage patterns and floodplains in areas of existing development and, in most cases, areas where future development will likely occur. As a consequence, implementation of a “no adverse impact” management policy is problematic. Even where FEMA has identified SFHAs, the BFEs are not always available.

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4.8 Slope Failure Hazard

4.8.1 General Background

A landslide is a mass of rock, earth or debris moving down a slope. Landslides may be minor or very large, and can move at slow to very high speeds. They can be initiated by storms, earthquakes, fires, volcanic eruptions or human modification of the land.

Mudslides (or mudflows or debris flows) are rivers of rock, earth, organic matter and other soil materials saturated with water. They develop in the soil overlying bedrock on sloping surfaces when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt. Water pressure in the pore spaces of the material increases to the point that the internal strength of the soil is drastically weakened. The soil's reduced resistance can then easily be overcome by gravity, changing the earth into a flowing river of mud or "slurry." A debris flow or mudflow can move rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. The slurry can travel miles from its source, growing as it descends, picking up trees, boulders, cars and anything else in its path. Although these slides behave as fluids, they pack many times the hydraulic force of water due to the mass of material included in them. Locally, they can be some of the most destructive events in nature.

All mass movements are caused by a combination of geological and climate conditions, as well as the encroaching influence of urbanization. Vulnerable natural conditions are affected by human residential, agricultural, commercial and industrial development and the infrastructure that supports it.

4.8.1.1 Regulatory Oversight

Tehama County has adopted California Building Code (CBC) 2016 Edition which establishes the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, safety to life and property from fire and other hazards attributed to the built environment, and to provide safety to fire fighters and emergency responders during emergency operations.

Chapter 18- Soils and Foundations Section 1804 of the CBC sets the requirements for Excavation, Grading and Fill. Section 1804.4 Site Grading states the ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall.

4.8.1.1.1 9.43.330 - Erosion Control

When construction activities propose to disturb areas of existing vegetation and ground cover by grading, effective erosion and sediment control measures shall be employed.

- Erosion Control Plan. Whenever a grading permit requires an erosion control plan, it shall be submitted with the grading plan as per stipulations in the grading permit. If the site or portion of the site is planned to be idle for more than forty-five days, then vegetative stabilization must be accomplished within seven days. The wet weather plan shall include a plan for the immediate (within twenty-four hours of the first forecast of a storm front) installation of emergency erosion control measures.

- Design Standards. Best management practices shall be employed. (Ord. 1901 § 1(part), 2008)

4.8.1.1.2 9.43.340 - Grading plan and inspection.

All engineered grading requires a grading plan prepared by a civil engineer prior to commencement of work.

The civil engineer who prepares a grading plan shall incorporate all recommendations from the soil engineering report and any engineering geology report into the grading plan. He/ she shall also be responsible for the professional inspection and approval of the grading within their area of technical specialty. This responsibility shall include, at a minimum, grade and drainage of the development area.

A soil engineering report shall be prepared for each grading plan prepared by a civil engineer.

The soil engineer's area of responsibility shall include, at a minimum, the professional inspection and approval concerning the preparation of ground to receive fills, testing for required compaction, stability of all finish slopes and the design of buttress fills, where required, incorporating any data supplied by an engineering geologist.

If an engineering geologist is retained for the work, their area of responsibility shall include, at a minimum, professional inspection and approval of the adequacy of natural ground for receiving fills and the stability of cut slopes with respect to geological matters, and the need for subdrains or other ground water drainage devices. He/ she shall report their findings to the soil engineer and the civil engineer for engineering analysis. If an engineering geologist is not retained, the civil engineer who prepares the grading plan shall assume the responsibilities of the engineering geologist. (Ord. 1901 § 1(part), 2008)

4.8.1.1.3 2009 Tehama County General Plan Policies

The 2009 Tehama County General Plan also includes the following policies for protecting humans and property from hazards associated with slope instability:

- The County shall require that all new development and redevelopment projects that have the potential for seismic or geological hazards, including liquefaction, landslides, and expansive soils, be subject to geotechnical evaluation prior to approval.

- The County shall maintain current information on seismic and geologic hazards.

- The County shall incorporate seismic and geologic hazards mitigation measures into County ordinances and procedures.

4.8.2 Hazard Profile

Landslides are caused by one or a combination of the following factors: change in slope of the terrain, increased load on the land, shocks and vibrations, change in water content, groundwater movement, frost action, weathering of rocks, and removing or changing the type of vegetation covering slopes. In general, landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

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

Flows and slides are commonly categorized by the form of initial ground failure. Figure 4-30 through Figure 4-32 show common types of slides. The most common is the shallow colluvial slide, occurring particularly in response to intense, short-duration storms. The largest and most destructive are deep-seated slides, although they are less common than other types.

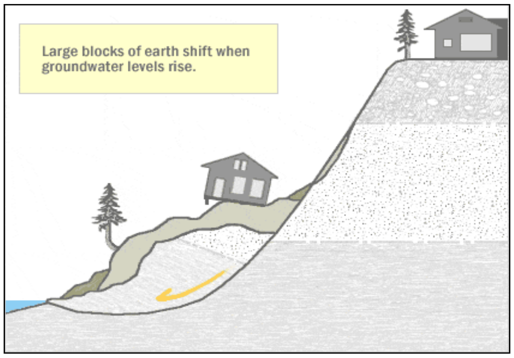

Figure 4-31. Deep Seated Slide

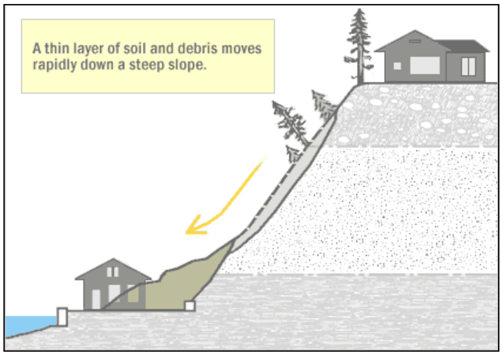

Figure 4-32. Shallow Colluvial Slide

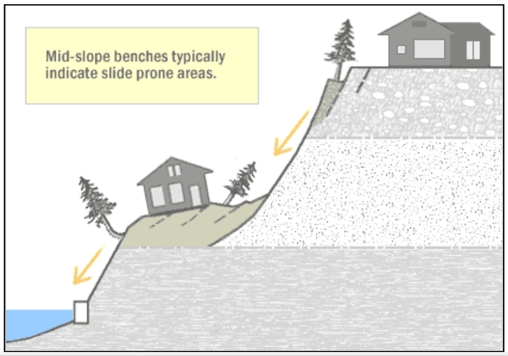

Figure 4-30: Bench Slide

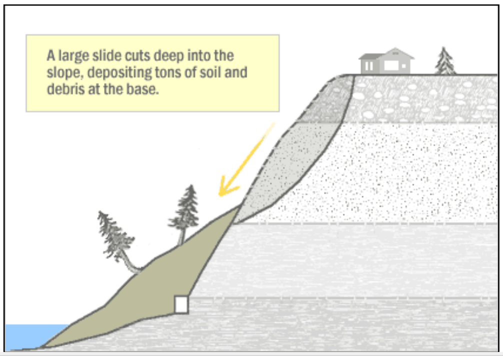

Figure 4-29: Large Slide

Slides and earth flows can pose serious hazard to property in hillside terrain. They tend to move slowly and thus rarely threaten life directly. When they move—in response to such changes as increased water content, earthquake shaking, addition of load, or removal of downslope support—they deform and tilt the ground surface. The result can be destruction of foundations, offset of roads, breaking of underground pipes, or overriding of downslope property and structures.

4.8.2.1 Past Events

There is little recorded information regarding landslides in Tehama County. According to the Spatial Hazard Events and Losses Database for the United States (SHELDUS), there have been no recorded landslide events in Tehama County since 1960. There are no records in the County of fatalities attributed to mass movement. However, deaths have occurred across the west coast as a result of slides and slope collapses.

4.8.2.2 Location

The best available predictor of where movement of slides and earth flows might occur is the location of past movements. Past landslides can be recognized by their distinctive topographic shapes, which can remain in place for thousands of years. Most landslides recognizable in this fashion range from a few acres to several square miles. Most show no evidence of recent movement and are not currently active. A small proportion of them may become active in any given year, with movements concentrated within all or part of the landslide masses or around their edges.

The recognition of ancient dormant mass movement sites is important in the identification of areas susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of groundwater flow, these dormant sites are vulnerable to construction-triggered sliding.

Figure 4-33 shows relative slope stability throughout Tehama County, indicating areas of the County that are more susceptible to landslides based on their soils and the steepness of slope. This map should be used with caution, as site-specific conditions can make some locations in low to moderate instability areas highly unstable and some locations in high instability areas less unstable.

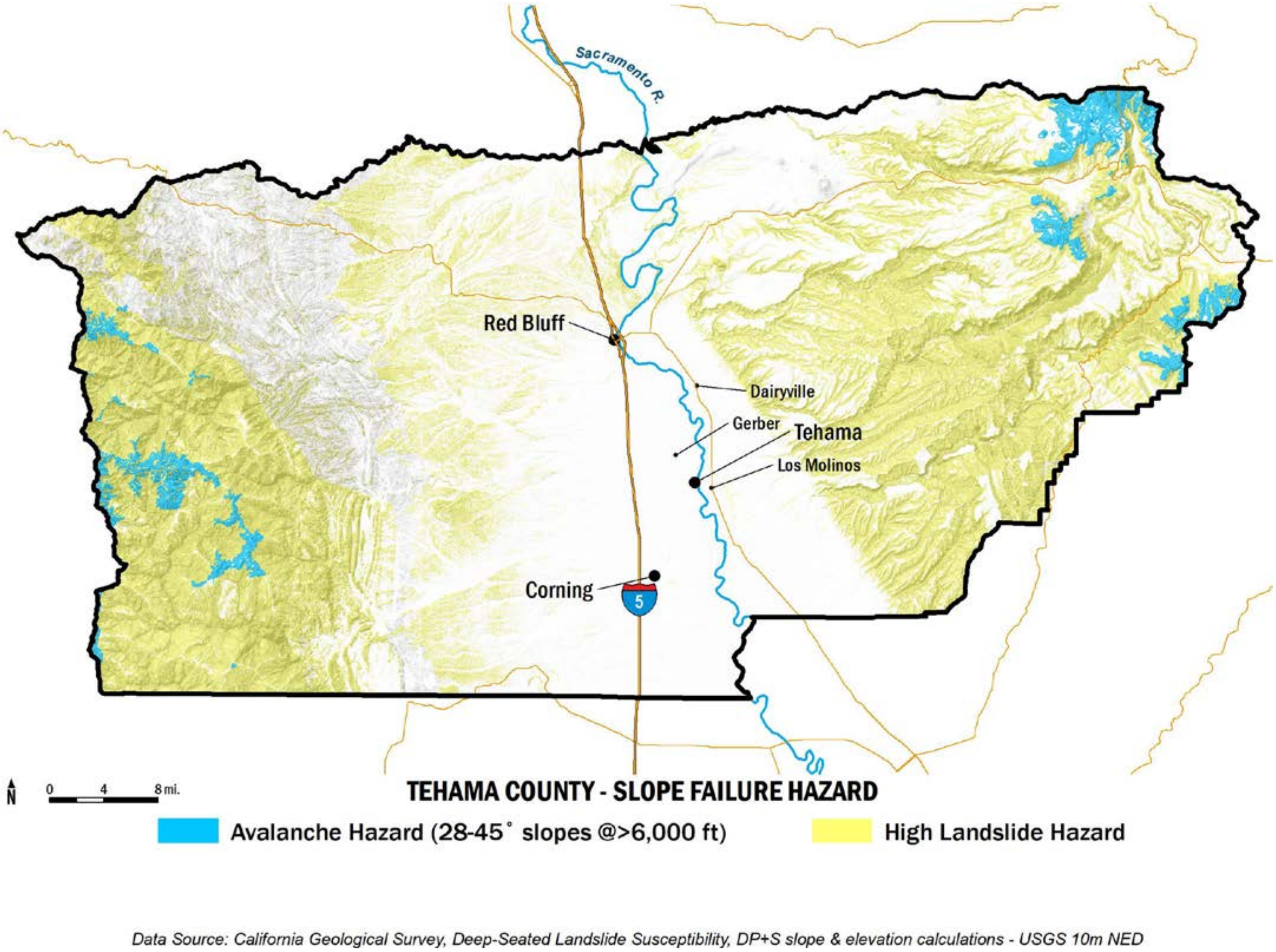

Figure 4-33: Tehama County Slope Failure Map

4.8.2.3 Frequency

Landslides are often triggered by other natural hazards such as earthquakes, heavy rain, floods or wildfires, so landslide frequency is often related to the frequency of these other hazards. In Tehama County, landslides typically occur during and after major storms, so the potential for landslides largely coincides with the potential for sequential severe storms that saturate steep, vulnerable soils. In general, landslides are most likely during periods of higher than average rainfall. The ground must be saturated prior to the onset of a major storm for significant land sliding to occur. Most local landslides occur in January after the water table has risen during the wet months of November and December. Water is involved in nearly all cases; and human influence has been identified in more than 80 percent of reported slides. (Tehama County, 2012)

4.8.2.4 Severity

Landslides destroy property and infrastructure and can take the lives of people. Slope failures in the United States result in an average of 25 lives lost per year and an annual cost to society of about $1.5 billion. According to FEMA, the December 2005 to January 2006 storm in Northern California caused in excess of $35 million in property damage across multiple counties due to landslides, mudslides and debris flows. This was about half of all damage caused by the storm. The landslides caused by the storm also caused tens of millions of dollars of damage to road infrastructure.

4.8.2.5 Warning Time

Mass movements can occur suddenly or slowly. The velocity of movement may range from a slow creep of inches per year to many feet per second, depending on slope angle, material and water content. Some methods used to monitor mass movements can provide an idea of the type of movement and the amount of time prior to failure. It is also possible to determine what areas are at risk during general time periods. Assessing the geology, vegetation and amount of predicted precipitation for an area can help in these predictions. However, there is no practical warning system for individual landslides. The current standard operating procedure is to monitor situations on a case-by-case basis, and respond after the event has occurred. Generally accepted warning signs for landslide activity include:

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

4.8.2.6 Secondary Hazards

Slope Failure can cause several types of secondary effects, such as blocking access to roads, which can isolate residents and businesses and delay emergency, commercial, public and private transportation. This could result in economic losses for businesses. Other potential problems resulting from landslides are power and communication failures. Vegetation or poles on slopes can be knocked over, resulting in possible losses to power and communication lines. Landslides also have the potential of destabilizing the foundation of structures, which may result in monetary loss for residents. They also can damage rivers or streams, potentially harming water quality, fisheries and spawning habitat.

4.8.2.6.1 Avalanches

Avalanches can occur on any snow-covered slope, and can cause death, injury and property damage. Avalanche hazard can vary with differences in terrain, weather, and snow-pack. Avalanche science is evolving, and maps of avalanche hazard covering all affected areas of the entire United States are not presently available. Ski areas, highway departments, and forecast centers may produce hazard maps and atlases. Geologic/natural hazard maps may depict avalanche hazard. Local studies of avalanche hazard may be conducted by independent consulting firms in order to meet building or planning requirements.

4.8.2.7 Climate Change Impacts

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. All of these factors would increase the probability for landslide occurrences.

4.8.3 Slope Failure Vulnerability Analysis

Slope failure exposure numbers were generated using Tehama County Assessor and parcel data. County assessor data does not include tax exempt structures, such as federal and local government buildings. All data sources have a level of accuracy acceptable for planning purposes.

Exposed Population	Exposed Market Value ($)	Exposed Content Value ($)	Exposed Critical Facilities	Exposed Miles of Lifeline
4,422	$ 357,895,363	$ 214,821,887	24	1,495
10.67%	10.50%	9.07%	4.22%	24.22%
total pop.	*total value*	*total cost*	*total count*	*total mileage*

4.8.3.1 Population

Population counts of those living within landslide hazard areas were generated by analyzing County assessor and parcel data that intersect with landslide hazard areas identified by CGS and avalanche hazards developed by the planning team. Using GIS, U.S. Census Bureau information was used to intersect slope failure hazards an estimate of population was calculated by weighting the population within each census block and track with the percentage of slope hazard areas. Using this approach, it was estimated that the total exposed population is 4,422 within potential slope failure areas and 5 permanent residents within avalanche hazards, as shown in Figure 4-34 and Table 4-51.

Population Exposure

Population Exposure to Slope Failure

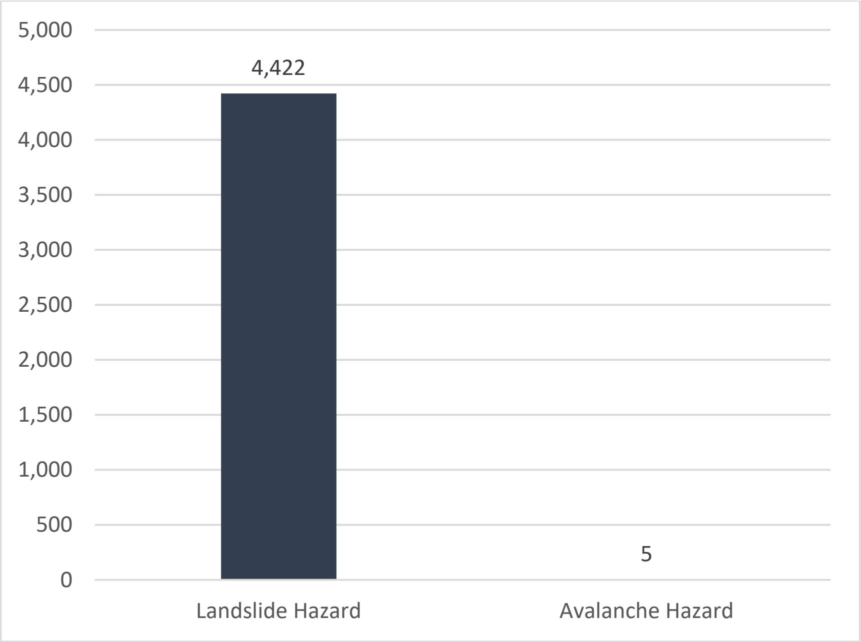

Figure 4-34: Population Exposure to Landslide and Avalanche Hazards

Table 4-51: Population Exposure to Landslide & Avalanche Hazards

	Total Population
Tehama County	41,473

Risk Type	Population Count	% of Total
Landslide	4,422	10.66%
Avalanche	5	0.01%
Total	**4,427**	**10.67%**

4.8.3.2 Property

Table 4-52 shows the number of parcels, market value exposure and content value exposure in the steep-slope risk areas. The predominant zoning classes in cities are single-family, vacant and manufactured homes.

Table 4-52: Total Parcel Exposure

	Total Parcels	Total Market Value Exposure ($)	Total Content Value Exposure ($)	Total Value ($)
Tehama County	34,284	$ 3,409,758,850	$ 2,367,722,620	$ 5,777,481,470

Risk Type	Improved Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Landslide	6,880	20.1%	$ 357,747,116	$214,747,763	$ 572,494,879	9.909%
Avalanche	43	0.1%	$ 148,247	$ 74,124	$ 222,371	0.004%
Total	**6,923**	**20.2%**	**$ 357,895,363**	**$214,821,887**	**$ 572,717,250**	**9.9%**

4.8.3.3 Critical Facilities and Infrastructure

24 critical facilities were identified as being exposed to the landslide hazard to some degree. A more in-depth analysis of mitigation measures taken by these facilities to prevent damage from mass movements should be done to determine if they could withstand impacts of a mass movement.

Several types of infrastructure are exposed to mass movements, including transportation, water and sewer and power infrastructure. Highly susceptible areas of the county include mountain and coastal roads and transportation infrastructure. At this time all infrastructure and transportation corridors identified as exposed to the landslide hazard are considered vulnerable until more information becomes available. Table 4-53 and Table 4-54 summarize the critical facilities exposed to the slope failure hazard.

Table 4-53: Critical Facility Points with Slope Failure Hazard Risk

Infrastructure Type	Landslide	Avalanche	Total Feature Count
Essential Facility	0	0	0
EOC	0	0	0
Fire Station	0	0	0
Government Facility	0	0	0
Hospital	0	0	0
Police Station	0	0	0
School	0	0	0
High Potential Loss	2	0	2
Residential Child Care	0	0	0
Adult Residential Care	0	0	0
Child Care	0	0	0
Foster/Home Care	0	0	0
Home Care	0	0	0
Foster Care	0	0	0
Elder Care	0	0	0

Infrastructure Type	Landslide	Avalanche	Total Feature Count
Dam	2	0	0
Hotel	0	0	0
Transportation and Lifeline	22	0	22
Airport	0	0	0
Bridge	11	0	0
Bus Facility	0	0	0
FCC AM Tower	0	0	0
FCC Cell Tower	3	0	0
FCC FM Tower	6	0	0
Natural Gas Station	0	0	0
Power Plant	0	0	0
Substation	2	0	0
Waste Water Facility	0	0	0
Grand Total	**24**	**-**	**24**

Table 4-54: Critical Facilities (Linear) with Slope Failure Hazard Risk

Infrastructure Type (Linear)	Landslide Hazard	Avalanche Hazard	Total Mileage
Transportation and Lifeline	**1,459.0**	**36.1**	**1,495.1**
FEMA Levee	0.4	-	0.4
USACE Levee	0.1	-	0.1
Natural Gas Pipeline	4.9	-	4.9
Transmission Line	72.1	-	72.1
Railroad	1.5	-	1.5
Street	1,380.0	36.1	1,416.2
-Interstate	1.7	-	1.7
-Primary Highway	14.1	2.7	16.8
-State/County Highway	114.6	-	114.6
-Local Road	1,162.9	33.4	1,196.3
-Other Road	23.8	23.0	46.8
-4WD Road	63.0	-	63.0
Grand Total	**1,459.0**	**36.1**	**1,495.1**

4.8.3.3.1 Lifelines

A significant amount of linear infrastructure (or lifelines) can be exposed to mass movements:

- **Roads**—Access to major roads is crucial to life-safety after a disaster event and to response and recovery operations. Landslides can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems and delays for public and private transportation. This can result in economic losses for businesses.
- **Bridges**—Landslides can significantly impact road bridges. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- **Power Lines**—Power lines are generally elevated above steep slopes; but the towers supporting them can be subject to landslides. A landslide could trigger failure of the soil underneath a tower, causing it to collapse and rip down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses.

4.8.4 Future Trends in Development

The county has experienced moderate growth between the 2000 and 2010 census, averaging a 1.23-percent annual increase in population from 2000 through 2010. (Bureau) Tehama County and its planning partners are optimistic that marginal, sustained growth will return to the county as the state and national economies strengthen.

The County and its planning partners are equipped to handle future growth within landslide hazard areas. The cities of Red Bluff and Tehama have general plans that address landslide risk areas in their safety elements. All partners have committed to linking their general plans to this hazard mitigation plan. This will create an opportunity for wise land use decisions as future growth impacts landslide hazard areas.

Additionally, the State of California has adopted the 2016 International Building Code (IBC) by reference in its California Building Standards Code. The IBC includes provisions for geotechnical analyses in steep slope areas that have soil types considered susceptible to landslide hazards. These provisions assure that new construction is built to standards that reduce the vulnerability to landslide risk.

4.8.5 Issues

Important issues associated with landslides in Tehama County include the following:

- Need for bank stabilization on the Sacramento River in multiple areas.

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4.9 Severe Weather Hazard

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. It includes thunderstorms, downbursts, tornadoes, waterspouts, snowstorms, ice storms, and dust storms.

Severe weather can be categorized into two groups: those that form over wide geographic areas are classified as general severe weather; those with a more limited geographic area are classified as localized severe weather. Severe weather, technically, is not the same as extreme weather, which refers to unusual weather events at the extremes of the historical distribution for a given area.

Three types of severe weather events typically impact Tehama County: thunderstorms, damaging winds and hail storms. These types of severe weather are described in the following sections. There have also been six recorded tornado/funnel cloud events with the County since 1950. Flooding issues associated with severe weather are discussed in Section 4.7.

4.9.1 Heavy Snows

According to the National Oceanic and Atmospheric Administration, heavy snow usually refers to

- snowfall accumulating to 4" or more in depth in 12 hours or less; or
- snowfall accumulating to 6" or more in depth in 24 hours or less (NOAA, n.d.)

Heavy snow bands are caused by a combination of moisture, front and atmospheric instability. The atmosphere has to have enough moisture in the air to produce clouds and snow. A front is needed so that air is forced to rise in the atmosphere to produce clouds and snowfall and atmospheric instability is needed to make the air rise even more quickly. (Service, n.d.)

4.9.2 Heavy Rain

Heavy precipitation refers to instances during which the amount of rain or snow experienced in a location substantially exceeds what is normal. What constitutes a period of heavy precipitation varies according to location and season. Heavy rain events in the planning area typically result in ponding of water on roadways and reduced visibility from heavy rain. This can result in travel difficulties on mountain and foothill roads.

Heavy precipitation does not necessarily mean the total amount of precipitation at a location has increased—just that precipitation is occurring in more intense events. However, changes in the intensity of precipitation, when combined with changes in the interval between precipitation events, can also lead to changes in overall precipitation totals. (Agency, n.d.)

4.9.3 Extreme Heat

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. According to the National Weather Service (NWS), among natural hazards, only the cold of winter—not lightning, hurricanes, tornados, floods, or earthquakes—takes a greater toll. 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.

4.9.4 Thunderstorms

A thunderstorm is a rain event that includes thunder and lightning. A thunderstorm is classified as "severe" when it contains one or more of the following: hail with a diameter of three-quarter inch or greater, winds gusting in excess of 50 knots (57.5 mph), or tornado.

Three factors cause thunderstorms to form: moisture, rising unstable air (air that keeps rising when disturbed), and a lifting mechanism to provide the disturbance. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise (hills or mountains can cause rising motion, as can the interaction of warm air and cold air or wet air and dry air) it will continue to rise as long as it weighs less and stays warmer than the air around it. As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool and it condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice and some of it turns into water droplets. Both have electrical charges. Ice particles usually have positive charges, and rain droplets usually have negative charges. When the charges build up enough, they are discharged in a bolt of lightning, which causes the sound waves we hear as thunder. Thunderstorms have three stages (see Figure 4-37):

- The *developing stage* of a thunderstorm is marked by a cumulus cloud that is being pushed upward by a rising column of air (updraft). The cumulus cloud soon looks like a tower (called towering cumulus) as the updraft continues to develop. There is little to no rain during this stage but occasional lightning. The developing stage lasts about 10 minutes.

- The thunderstorm enters the *mature stage* when the updraft continues to feed the storm, but precipitation begins to fall out of the storm, and a downdraft begins (a column of air pushing downward). When the downdraft and rain-cooled air spread out along the ground, they form a gust front, or a line of gusty winds. The mature stage is the most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes. The storm occasionally has a black or dark green appearance.

- Eventually, a large amount of precipitation is produced and the updraft is overcome by the downdraft beginning the *dissipating stage*. At the ground, the gust front moves out a long distance from the storm and cuts off the warm moist air that was feeding the thunderstorm. Rainfall decreases in intensity, but lightning remains a danger.

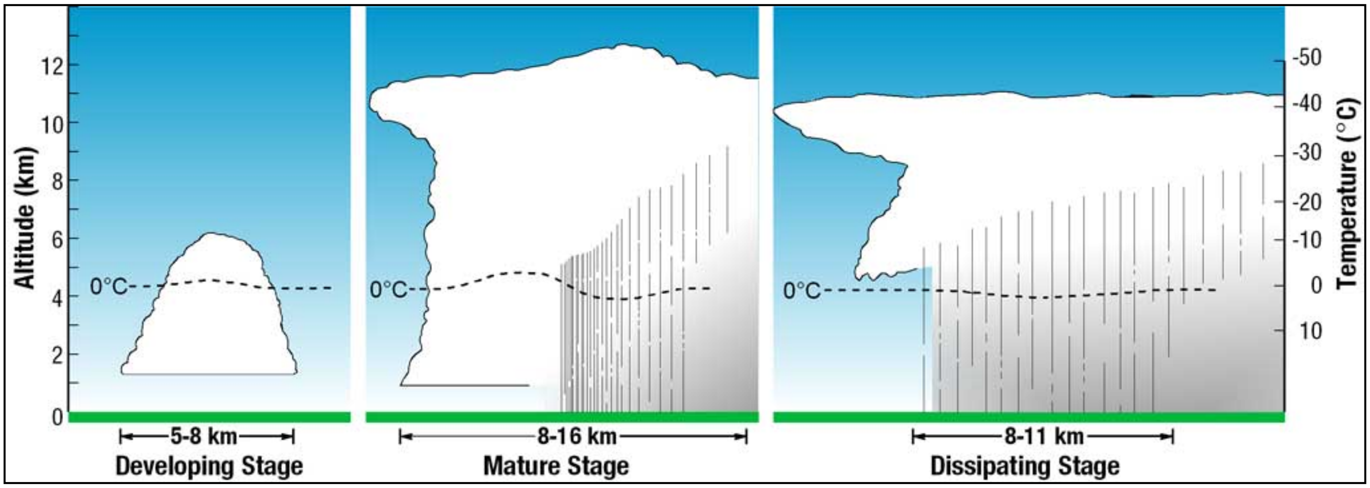

Figure 4-35. The Thunderstorm Life Cycle

There are four types of thunderstorms:

- **Single-Cell Thunderstorms—**Single-cell thunderstorms usually last 20 to 30 minutes. A true single-cell storm is rare, because the gust front of one cell often triggers the growth of another. Most single-cell storms are not usually severe, but a single-cell storm can produce a brief severe weather event. When this happens, it is called a pulse severe storm.
- **Multi-Cell Cluster Storm—**A multi-cell cluster is the most common type of thunderstorm. The multi-cell cluster consists of a group of cells, moving as one unit, with each cell in a different phase of the thunderstorm life cycle. Mature cells are usually found at the center of the cluster and dissipating cells at the downwind edge. Multi-cell cluster storms can produce moderate-size hail, flash floods and weak tornadoes. Each cell in a multi-cell cluster lasts only about 20 minutes; the multi-cell cluster itself may persist for several hours. This type of storm is usually more intense than a single cell storm.
- **Multi-Cell Squall Line—**A multi-cell line storm, or squall line, consists of a long line of storms with a continuous well-developed gust front at the leading edge. Squall lines can produce large hail, heavy rainfall, weak tornadoes, and strong downdrafts. Occasionally, a strong downburst will accelerate a portion of the squall line ahead of the rest of the line. This produces what is called a bow echo.
- **Super-Cell Storm—**A super-cell is a highly organized thunderstorm that poses a high threat to life and property. It is similar to a single-cell storm in that it has one main updraft, but the updraft is extremely strong, reaching speeds of 150 to 175 miles per hour. Super-cells are rare. The main characteristic that sets them apart from other thunderstorms is the presence of rotation. The rotating updraft of a super-cell (called a mesocyclone when visible on radar) helps the super-cell to produce extreme weather events, such as giant hail (more than 2 inches in diameter), strong downbursts of 80 miles per hour or more, and strong to violent tornadoes.

4.9.5 Damaging Winds

Damaging winds are classified as those exceeding 60 mph. Damage from such winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. There are seven types of damaging winds:

- Straight-line winds—Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- Downdrafts—A small-scale column of air that rapidly sinks toward the ground.
- Downbursts—A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.
- Microbursts—A small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.
- Gust front—A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
- Derecho—A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word “derecho” is of Spanish origin and means “straight ahead.” Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.
- Bow Echo—A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive wind damage at the ground.

4.9.6 Hail Storms

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Super-cooled water may accumulate on frozen particles near the back-side of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a super-cooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are “frozen” in place, leaving cloudy ice.

Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are “balanced” in an updraft. One can tell how many times a hailstone traveled to the top of the storm by counting its layers. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail.

4.9.7 Regulatory Oversight

There are very few formal regulations that pertain directly to severe weather events. The wet weather plan to reduce erosion after a storm is mentioned in County Ordinance 1901.

4.9.8 Hazard Profile

4.9.8.1 Past Events

Table 4-55 summarizes severe weather events in Tehama County since 2012, as recorded by the National Oceanic and Atmospheric Administration (NOAA).

Table 4-55: Severe Weather Events Impacting Planning Area Since 2012

Date	Type	Deaths or Injuries	Property Damage
1/19/2012	Winter Storm	0	None reported
Description: *A relatively weak winter storm brought six to twelve inches of snow to elevations between 5000 and 7000 feet and up to two feet of snow to elevations above 7000 feet, including 14 inches to Lassen Volcanic National Park. Winds were 20-35 mph sustained with gusts 50-70 mph over ridgetops.*			
12/25/2012	Winter Weather	0	None reported
Description: *A wave of heavy snowfall passed through northern California beginning late Christmas morning and lingering showers ended the evening of Dec. 26th. Snow amounts on Lower Lassen Peak (8250 ft) were reported to be 10 inches, and mountain valley locations such as Quincy received up to 6 inches. A spotter in Twain (3200 ft; Feather River Canyon) received 4.5 inches of new snow. Warning criteria was not met.*			
2/19/2013	Tornado	0	$20,000
Description: *The public reported a landspout tornado at approximately 1:30pm near Gerber, CA. This tornado touched down in a farmland south of Worthington Ave. and tracked from northeast to southwest, hitting the east side of a large barn and destroying the roofing structure of the eastern side. The tornado scattered the metal roof shingles and wood pieces up to 200 ft away to both the northeast and southwest. Based on damage, the NWS tornado survey rated it as an EF0 with an estimation of 74 mph. Images and video confirmed that this tornado was a landspout.*			

Date	Type	Deaths or Injuries	Property Damage
3/5/2013	Winter Storm	0	None reported
Description: *Snow began in the evening on March 5th and continued through the evening of March 6th, and reported to reach elevations locally down to 3000 ft. Lower Lassen Peak (8250 ft) reported 16 inches of snow accumulation, Harkness Flat near Chester (6200 ft) reported 9 inches of new snow, Rattlesnake near Greenville (6100 ft) reported 5 inches of new snow, and Snow Mountain near Burney (5950 ft) reported 13 inches of new snow. Reported peak winds gusted approximately between 30 and 40 mph for this area, with locally higher amounts for the ridge tops and higher elevations.*			
4/4/2013	Tornado	0	None reported
Description: *Public reported a brief tornado with visible debris cloud in an empty field south of Shasta College. Tornado duration was approximately 2 minutes. This tornado was rated an EF0 with no known damage.*			
7/1/2013	High Heat	0	None reported
Description: *High temperatures ranged from approximately 108 to 116 for the Northern Sacramento Valley for 7 consecutive days. Minimum temperatures ranged between upper 60s to 90, with majority in the 70s, overnight. Max temperature records were broken for Redding and Red Bluff during this period.*			
12/6/2013	Winter Storm	0	None reported
Description: *The cold, low elevation snow system brought snow to western Plumas and Lassen Park area for several hours. The slopes received approximately 6 to 10 inches of snow, with highest amounts over the Lassen Peak region (18-22). Quincy and Chester received 4-6 inches of snow along the east side of the crest.*			
3/28/2014	Winter Storm	0	None reported
Description: *Snow levels dropped down near 3000 ft for the far Northern Sierra Nevada/Western Plumas County area on March 29th. Harkness Flat near Chester (6200 ft) received about 14 inches of new snow. Lassen Lodge (4200 ft) received approximately 20 inches of new snow.*			
3/31/2014	Winter Weather	0	None reported
Description: *A few inches of snow fell over far Northern Sierra Nevada as a cold Pacific storm moved through the area March 31st through April 1st. Lassen Lodge (4200 ft) received around 6 inches of new snow, and Harkness Flat (6200 ft) received around 4 inches of new snow.*			
7/22/2014	Hail	0	None reported
Description: *A strong thunderstorm produced quarter size hail. The ground was covered with 2 inches of hail.*			
10/25/2014	High Winds	0	None reported
Description: *Winds gusted to 60 mph.*			
12/10/2014	Heavy Snow	0	$100,000
Description: *Winds were reported to reach as high as 50-60 mph in the valley/foothill region, and over 100 mph in the mountains. On December 22, Governor Brown declared a state of emergency for heavy rain, flooding and wind damage in counties including Tehama, Lake, Shasta, and Yolo.*			

Date	Type	Deaths or Injuries	Property Damage
12/30/2014	Strong Winds	0	$50,000
Description: *A 2 foot diameter tree was reported down on road 4 miles west of Red Bluff.*			
4/13/2015	Strong Wind	0	$1,000,000
Description: *Wind gusts estimated around 45 mph brought down trees and branches which caused numerous power outages in Shasta County and northern Tehama County.*			
7/8/2015	Hail	0	None reported
Description: *Hail as large as nickels fell.*			
10/18/2015	Heavy Rain	0	None reported
Description: *Ponding of water on roadways and reduced visibility from heavy rain caused travel difficulties on mountain and foothill roads such as Highways 4, 88 and 50.In Red Bluff, heavy rain from a thunderstorm, with 1.25 inches measured in about 30 minutes.*			
12/10/2015	High Wind	0	None reported
Description: *Windy conditions occurred over the northern Sacramento Valley over the early morning hours on December 10th, with a peak of 57 mph at Redding Airport at 1:19 am PST. The heavy rain and strong winds across Northern California brought down trees and branches which knocked out power to thousands of customers early Thursday. More than 2,000 customers in Chico lost service. There were also outages reported across Shasta and Tehama counties.*			
12/13/2015	High Wind	0	None reported
Description: *Winds gusted up to 61 mph at Redding Airport at 6:24 am PST as a strong cold front moved through. Numerous downed trees with power outages were reported in Tehama and Shasta counties.*			
1/13/2016	Thunderstorm Wind	0	$6,000
Description: *A strong cold front produced thunderstorms with hail and powerful, damaging winds. Snow in the mountains caused moderate travel impacts.*			
1/23/2016	Hail in Corning	0	$30,000
Description: *Large amounts of hail fell and accumulated, 4 to 5 inches deep on I5 and adjacent local roads. The hail was up to an inch in diameter. The hail brought very slippery conditions, causing 3 vehicles to slide into the ditch. These vehicles needed to be towed. The hail also caused long traffic delays. Snow plows were required to plow the hail off of I5.*			
1/23/2016	Hail	0	None reported
Description: *Hail fell to 2 to 3 inches deep in Corning, clogging storm drains and causing local flooding. The largest hailstones were quarter size.*			
1/23/2016	Funnel Cloud	0	None reported
Description: *Two funnel clouds were observed about 1/2 mile away from the observer. One funnel came close to the ground but he could not confirm a touchdown.*			

Date	Type	Deaths or Injuries	Property Damage
1/7/2017	Winter Weather	0	None reported
Description: *There were 3 inches of low elevation snow in Redding, at elevation 565 feet. This caused travel problems on city roads.*			
1/9/2017	Strong Wind	1 indirect death	None reported
Description: *A 24 year old man died when his car crashed into a large oak tree. The CHP thought weather may have played a factor. At the time of the incident it was cloudy, windy and raining steadily.*			
6/18/2017	Extreme Heat	0	None reported
Description: *Record number of days of triple digit heat.*			

Source: ncdc.noaa.gov

4.9.8.2 Location

Severe weather events have the potential to happen anywhere in the planning area. Communities in low-lying areas next to streams or lakes are more susceptible to flooding. Wind events are most damaging to areas that are heavily wooded. Figure 4-36, Figure 4-37, Figure 4-38 and Figure 4-39 show the distribution of average weather conditions over Tehama County and the State of California. The classes of wind power density shown in Figure 4-39 are explained in Table 4-56.

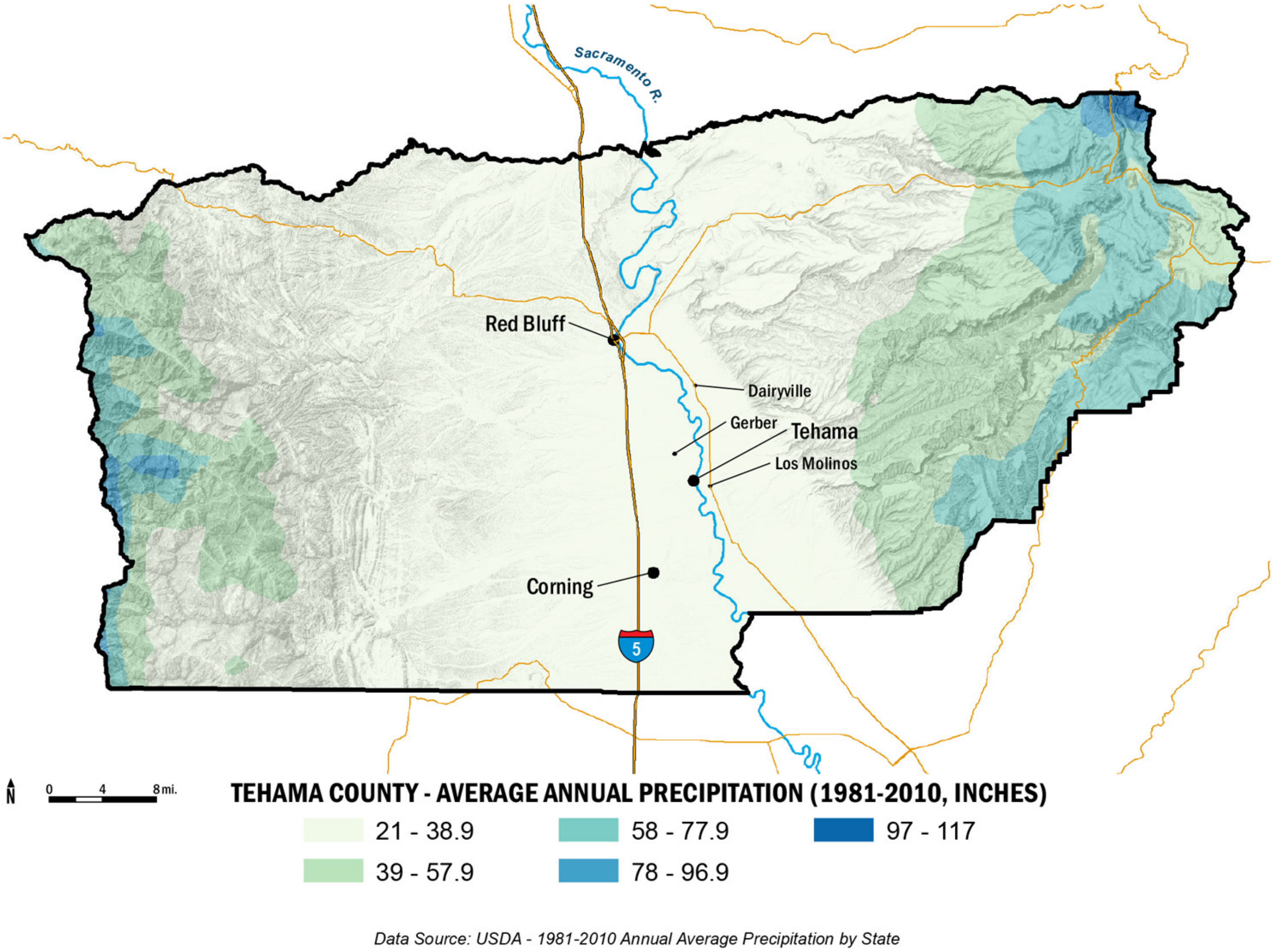

Figure 4-36: Average Annual Precipitation

Source: USDA – 1981-2010 Annual Average Precipitation by State

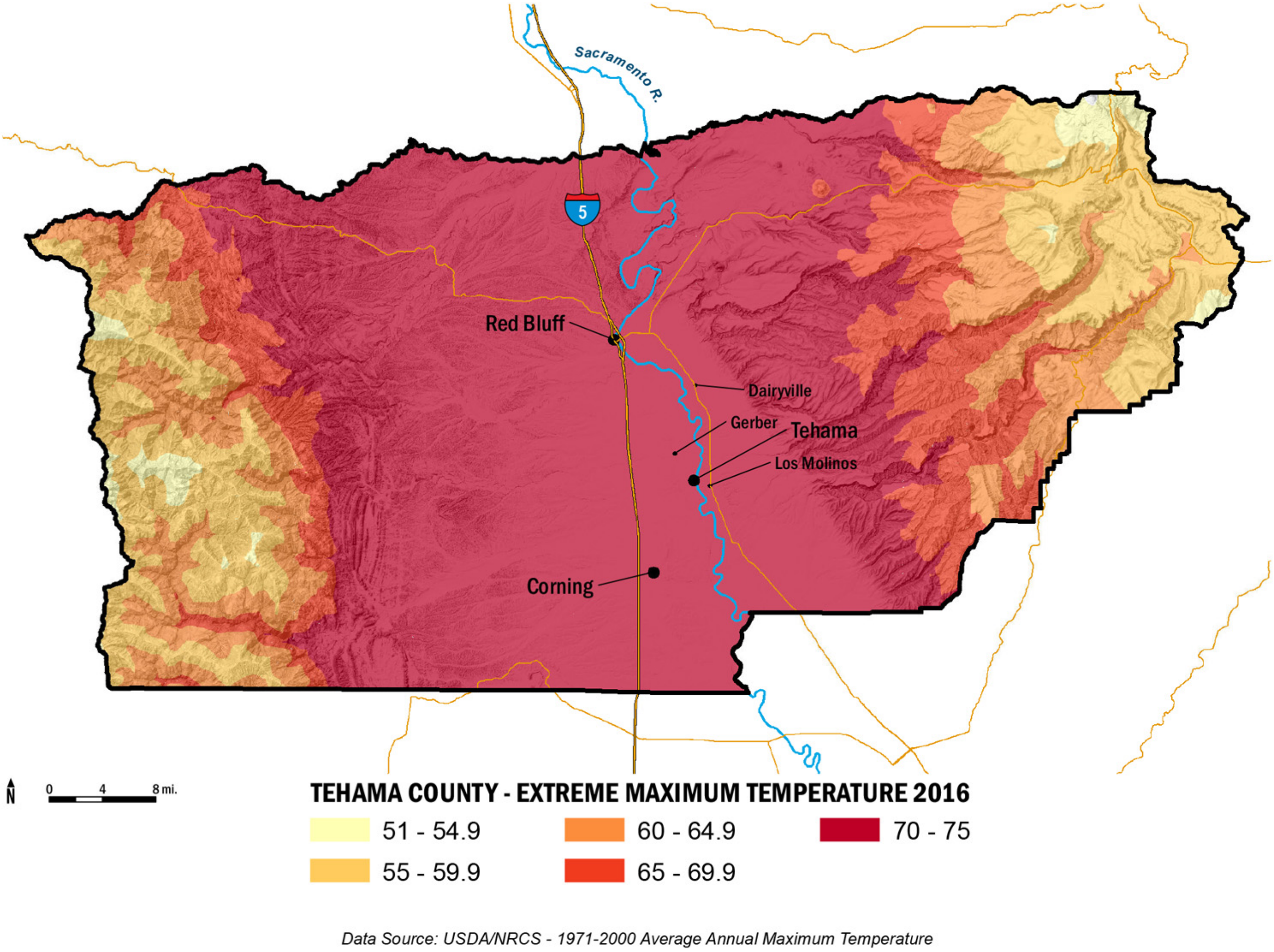

Figure 4-37: Extreme Maximum Temperature 2016

Source: USDA/NRCS- 1971-2000 Average Annual Maximum Temperature

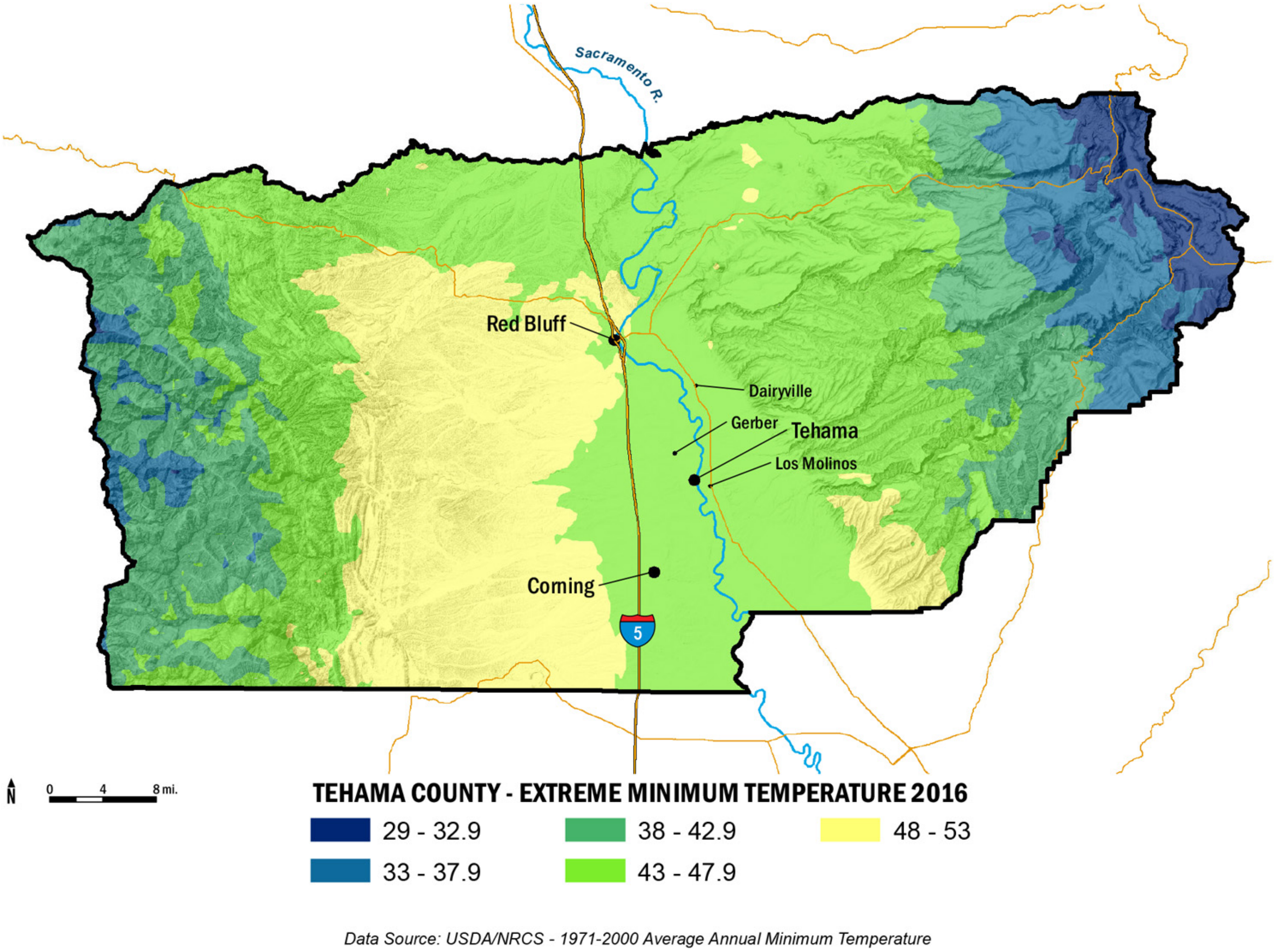

Figure 4-38: Extreme Minimum Temperature 2016

Source: USDA/NRCS- 1971-2000 Average Annual Minimum Temperature

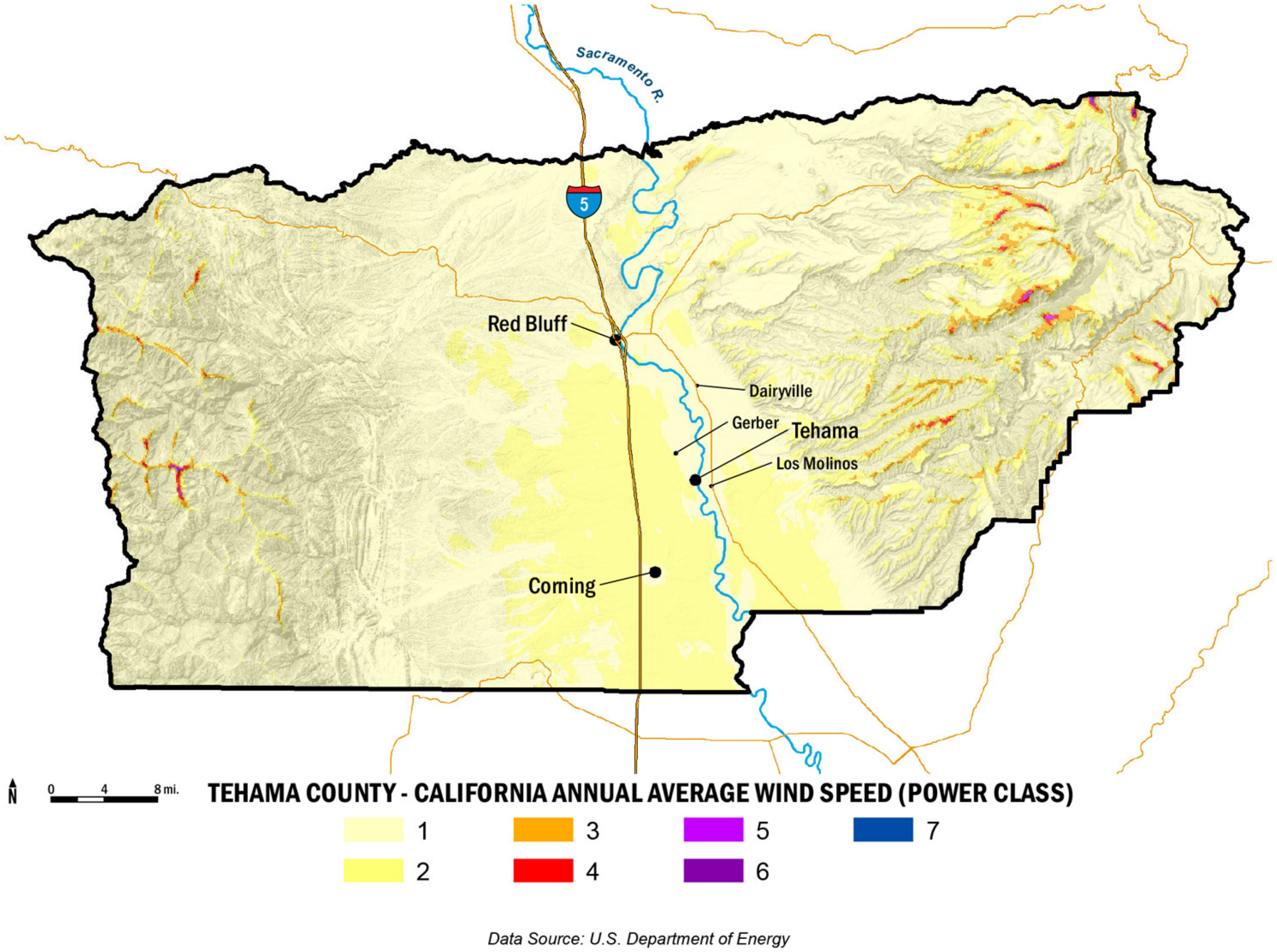

Figure 4-39: California Annual Average Wind Speed at 30 m

Source: U.S. Department of Energy

Table 4-56: Classes of Wind Power Density at 10 m and 50 m[a]

Wind Power Class	10 m (33 ft)		50 m (164 ft)	
	Wind Power Density (W/m2)	Speed[b] m/s (mph)	Wind Power Density (W/m2)	Speed[b] m/s (mph)
1	0	0	0	
	100	4.4 (9.8)	200	5.6 (12.5)
2	150	5.1 (11.5)	300	6.4 (14.3)
3	200	5.6 (12.5)	400	7.0 (15.7)
4	250	6.0 (13.4)	500	7.5 (16.8)
5	300	6.4 (14.3)	600	8.0 (17.9)
6	400	7.0 (15.7)	800	8.8 (19.7)
7	1000	9.4 (21.1)	2000	11.9 (26.6)

[a] Vertical extrapolation of wind speed based on the 1/7 power law.
[b] Mean wind speed is based on Rayleigh speed distribution of equivalent mean wind power density. Wind speed is for standard sea-level conditions. To maintain the same power density, speed increases 3%/1000 m (5%/5000 ft) elevation.

NOTE: Each wind power class should span two power densities. For example, Wind Power Class = 3 represents the Wind Power Density range between 150 W/m2 and 200 W/m2. The offset cells in the first column attempt to illustrate this concept.

4.9.8.3 Frequency

The severe weather events for Tehama County shown in Table 4-55 are often related to high winds associated with winter storms and thunderstorms. The planning area can expect to experience exposure to some type of severe weather event at least annually.

4.9.8.4 Severity

The most common problems associated with severe storms are immobility and loss of utilities. Fatalities are uncommon, but can occur. Roads may become impassable due to flooding, downed trees, ice or snow, or a landslide. Power lines may be downed due to high winds or ice accumulation, and services such as water or phone may not be able to operate without power. Lightning can cause severe damage and injury. Northern California experiences lightning caused wildfires every summer.

Windstorms can be a frequent problem in the planning area and have been known to cause damage to utilities. The predicted wind speed given in wind warnings issued by the National Weather Service is for a one-minute average; gusts may be 25 to 30 percent higher.

Tornadoes are potentially the most dangerous of local storms, but they are not common in the planning area (Between 1950 and 2013, there were 403 confirmed tornadoes in California, coming out to an average of around 6 or 7 tornadoes per year. (The Vane, 2014)). If a major tornado were to strike within the populated areas of the county, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings may be damaged or destroyed.

4.9.8.5 Warning Time

Meteorologists can often predict the likelihood of a severe storm. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time.

The Tehama County Sheriff's Office, Red Bluff Police Department and Corning Police Department use the Tehama Alert system to notify residents of a potential fire, gas leak, flood or other natural or man-caused incident in the County that would prompt an immediate evacuation or shelter in place protocols. This service is free to the public.

4.9.8.6 Secondary Hazards

The most significant secondary hazards associated with severe local storms are floods, falling and downed trees, landslides, downed power lines and wildfire. Rapidly melting snow combined with heavy rain can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fails.

4.9.8.7 Climate Change Impacts

As the world has warmed, that warming has triggered many other changes to the Earth's climate. Changes in extreme weather and climate events, such as heat waves and droughts, are the primary way that most people experience climate change. Human-induced climate change has already increased the number and strength of some of these extreme events. Over the last 50 years, much of the U.S. has seen increases in prolonged periods of excessively high temperatures, heavy downpours, and in some regions, severe floods and droughts. (Program, n.d.)

4.9.8.7.1 Heat Waves

Heat waves are periods of abnormally hot weather lasting days to weeks. The number of heat waves has been increasing in recent years. Climate change will also cause extreme heat events to happen more often. Studies show that by the end of this century, the number of days with temperatures reaching 100°F or more is projected to increase dramatically across the United States as a result of climate change. What the public now considers to be an exceptional event could become routine across much of the country. As temperatures rise and extreme heat events become longer, more severe, and more frequent, experts expect to see more health problems and deaths caused by heat. (Prevention)

4.9.8.7.2 Drought

Higher temperatures lead to increased rates of evaporation, including more loss of moisture through plant leaves. Even in areas where precipitation does not decrease, these increases in surface evaporation and loss of water from plants lead to more rapid drying of soils if the effects of higher temperatures are not offset by other changes (such as reduced wind speed or increased humidity). As soil dries out, a larger proportion of the incoming heat from the sun goes into heating the soil and adjacent air rather than evaporating its moisture, resulting in hotter summers under drier climatic conditions. High water demands place additional stress on the County's water supply.

4.9.8.7.3 Heavy Downpours

Heavy downpours are increasing nationally, especially over the last three to five decades. The heaviest rainfall events have become heavier and more frequent, and the amount of rain falling on the heaviest rain days has also increased. Since 1991, the amount of rain falling in very heavy precipitation events has been significantly above average. (Tehama County, 2012)

4.9.8.7.4 Flooding

Flooding may intensify in many U.S. regions, even in areas where total precipitation is projected to decline. Floods are caused or amplified by both weather- and human-related factors. Major weather factors include heavy or prolonged precipitation, snowmelt, thunderstorms, storm surges from hurricanes, and ice or debris jams. Human factors include structural failures of dams and levees, altered drainage, and land-cover alterations (such as pavement).

4.9.8.7.5 Winter Storms

Winter storms have increased in frequency and intensity since the 1950s, and their tracks have shifted northward over the United States. Other trends in severe storms, including the intensity and frequency of tornadoes, hail, and damaging thunderstorm winds, are uncertain and are being studied intensively. There has been a sizable upward trend in the number of storms causing large financial and other losses. However, there are societal contributions to this trend, such as increases in population and wealth. (Tehama County, 2012)

4.9.9 Severe Weather Vulnerability Analysis

4.9.9.1 Population

It can be assumed that the entire planning area is exposed to some extent to severe weather events. Certain areas are more exposed due to geographic location and local weather patterns. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out, while populations in low-lying areas are at risk for possible flooding.

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern. These populations face isolation and exposure during severe weather events and could suffer more secondary effects of the hazard.

4.9.9.2 Property

All property is vulnerable during severe weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those in higher elevations and on ridges may be more prone to wind damage. Those that are located under or near overhead lines or near large trees may be vulnerable to falling ice or may be damaged in the event of a collapse.

4.9.9.3 Critical Facilities and Infrastructure

All critical facilities exposed to flooding are also likely exposed to severe weather. Additional facilities on higher ground may also be exposed to wind damage or damage from falling trees. The most common problems associated with severe weather are loss of utilities. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water and sewer systems may not function. Roads may become impassable due to ice or snow or from secondary hazards such as landslides.

4.9.9.3.1 Lifelines

Incapacity and loss of roads are the primary transportation failures resulting from severe weather, mostly associated with secondary hazards. Landslides caused by heavy prolonged rains can block roads. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Snowstorms in higher elevations can significantly impact the transportation system and the availability of public safety services. Of particular concern are roads providing access to isolated areas and to the elderly.

Prolonged obstruction of major routes due to landslides, snow, debris or floodwaters can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region.

Severe windstorms, downed trees, and ice can create serious impacts on power and above-ground communication lines. Freezing of power and communication lines can cause them to break, disrupting electricity and communication. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

4.9.10 Future Trends in Development

All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The planning partners have adopted the International Building Code in response to California mandates. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in general plans within the planning area also address many of the secondary impacts (flood and landslide) of the severe weather hazard. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe weather.

4.9.11 Issues

Important issues associated with a severe weather in the Tehama County planning area include the following:

- Older building stock in the planning area do not meet code standards. These structures could be highly vulnerable to severe weather events such as windstorms.
- Risk of power supply interruption due to severe storms.
- Lack of backup power generation at critical facilities.
- Road closures (both rural roads and state HWYs to isolated communities and Interstate-5, I.e. HWY 99, 36).
- Communication issues occur during weather events such as the phones going down. Back-Up power at communication towers is needed.
- Many large trees result in damages from storms (high winds). There are currently issues with tree trimmer local capacities.
- Isolated and vulnerable population centers exist throughout the County. I.e. Rancho Tehama, Manton, Pondarosa Sky Ranch, Lake California and others.

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4.10 Wildfire Hazard

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson.

Wildfires are costly, compromising watersheds, open space, timber, range, recreational opportunities, wildlife habitats, endangered species, historic and cultural assets, wild and scenic rivers, other scenic assets and local economies, as well as putting lives and property at risk.

Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure. Vulnerability to flooding increases due to the destruction of watersheds. The potential for significant damage to life and property exists in areas designated as “wildland urban interface (WUI) areas,” where development is adjacent to densely vegetated areas.

On average, 10,000 wildfires burn half a million acres in California annually. While the number of acres burned fluctuates from year to year, a trend that has remained constant is the rise in wildfire-related losses. The challenge is to reduce wildfire losses within a framework of California’s diverse ecosystems. (Tehama County, 2012)

4.10.1 Local Conditions Related to Wildfire

How a fire behaves primarily depends on the following:

- **Fuel Type**—Fuel refers to all combustible material available to burn in a given land area. Fuel types in Tehama County include timber, timber with grass understory, grass, brush, oak woodland and desert sage and juniper stands. Each fuel has its own burning characteristics based on moisture content, volume, live-to-dead vegetation ratio, size, arrangement and genetic makeup.

  Grass burns rapidly with a short period of intense, maximum heat output. Brush has a long sustained high heat output, making it more difficult to control. Non-compacted fine fuel such as grass spreads fire rapidly since more of its surface can be heated at one time. Compacted fuel such as pine litter burns more slowly because heat and air only reach the top of the fuel.

- **Fuel Loading**—Fuel loading is measured in tons per acre. Grass is considered a light fuel with approximately three-quarters of a ton per acre. Thick brush, a heavy fuel, can have a density of over 21 tons per acre.

- **Fuel Arrangement**—Fuel arrangement is linked to how readily fuel burns and a fire spreads. Fine fuels that have not been compacted, such as grass, spread fire rapidly since more of the fuel’s surface can be heated at one time. Compacted fuels, such as pine litter, burn more slowly because heat and air only reach the top of the fuel. Vertical arrangement refers to the continuity of fuel from the forest floor to the tree canopy. Fire burning in grass or pine needles near the ground may spread to brush, snags and low tree branches, and from there to the crowns of trees. Continuous burnable fuel from the ground to the crown is called “ladder fuel.” Crown or canopy closure refers to the density of a forest created by treetops. It is important in the lateral progression of fire from tree to tree through the forest canopy.

Figure 4-40. Wildfire-Prone Landscapes in Tehama County

- **Weather**—Weather conditions that influence fire behavior include temperature, humidity, wind, precipitation, and atmospheric stability. When the temperature is high, humidity is low, wind is increasing from the east, and there has been little or no precipitation so vegetation is dry, conditions are favorable for severe wildfires. These conditions occur more frequently inland where temperatures are higher and fog is less prevalent. During summer, Tehama County's abundant vegetation dries out and becomes hazardous fuel. That fuel combined with seasonal winds—hot and dry from north to south—can produce extreme fire danger.

  Precipitation in Northern California is usually at its lowest from July to September. Thunderstorm activity, which typically begins in June with wet storms, turns dry with little or no precipitation reaching the ground as the season progresses into July and August. Thunderstorms with dry lightning are more prevalent in the eastern portion of the county. July and August are when local winds (slope winds) predominate, with the Pacific jet stream weak and well to the north.

- **Terrain**—Terrain includes slope and elevation. The terrain of a region influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind; potential barriers to fire spread, such as highways and lakes; and elevation and slope of land forms (fire spreads more easily uphill than downhill).

- **Time of Day**—A fire's peak burning period generally is between 1 p.m. and 6 p.m.

4.10.2 Wildfire Protection Responsibility in California

Local, state, tribal, and federal organizations all have legal and financial responsibility for wildfire protection. In many instances, two fire organizations have dual primary responsibility on the same parcel of land—one for wildfire protection and the other for structural or "improvement" fire protection. To address wildfire jurisdictional responsibilities, the California state legislature in 1981 adopted Public Resource Code Section 4291.5 and Health and Safety Code Section 13108.5 establishing the following responsibility areas:

- **Federal Responsibility Areas (FRAs)—**FRAs are fire-prone wildland areas that are owned or managed by a federal agency such as the U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Department of Defense. Primary financial and rule-making jurisdictional authority rests with the federal land agency. In many instances, FRAs are interspersed with private land ownership or leases. Fire protection for developed private property is usually not the responsibility of the federal land management agency; structural protection responsibility is that of a local government agency.

- **State Responsibility Areas (SRAs)**—SRAs are lands in California where the California Department of Forestry and Fire Protection (CAL FIRE) has legal and financial responsibility for wildfire protection and where CAL FIRE administers fire hazard classifications and building standard regulations. SRAs are defined as lands that meet the following criteria:

  - Are county unincorporated areas
  - Are not federally owned
  - Have wildland vegetation cover rather than agricultural or ornamental plants
  - Row crops/ seasonal crops
  - Have watershed and/or range/forage value

  SRA boundaries are those adopted by the Board of Forestry and Fire Protection which are reviewed and updated every 5 years. Where SRAs contain built environment or development, the responsibility for fire protection of those improvements (non-wildland) is that of a local government agency.

- **Local Responsibility Areas (LRAs)—**LRAs include land in cities, cultivated agriculture lands and non-flammable areas in unincorporated areas, and lands that do not meet the criteria for SRA or FRA. LRA fire protection is typically provided by city fire departments, fire protection districts, and counties, or by CAL FIRE under contract to local governments. LRAs may include flammable vegetation and WUI areas where the financial and jurisdictional responsibility for improvement and wildfire protection is that of a local government agency.

Senate Bill SB 1241 (2012) is a bill requiring local governments in State Responsibility Areas (SRAs) and Very High Fire Hazard Severity Zones (VHFHSZ) to:

- Update their general plan safety elements (and all elements of a general plan, whether mandatory or optional, must be consistent with one another) to recognize specific wildfire risks in such areas,
- Adopt special findings when approving subdivisions in such areas, and
- Use wildfire safety guidelines and California Environmental Quality Act (CEQA) initial study wildfire hazards checklist updates issued by the Governor's Office of Planning and Research (OPR) when those become available.

For further information on the details and implications of implementation of SB 1241 see Chapter 5, Section 5.4.4.1 of the 2013 California State Enhanced Multi-Hazard Mitigation Plan. (SHMP 2013)

4.10.3 Regulatory Oversight

The 2016 California Building Code (adopted by the County) Chapter 7a includes materials and construction methods for exterior wildfire exposure and standards of quality for fire-resistant buildings.

4.10.3.1 CDF Fire Clearance Requirements

As required by Public Resources Code Section 4291, the County of Tehama Department of Building and Safety requires County Fire and Road Clearances for the following:

- Single Family Residences
- Additions
- Manufactured Home-Soft Set Foundation
- Manufactured Home-Permanent Foundation (New Or Replacement)
- Ag Exempt Permits
- Outbuildings (Barn, Shop, Shed, Garage)
- Commercial
- Antennae Towers
- Temporary Structures
- Enclosed Porches
- EPA Facilities
- Conversions (If Applicable)

4.10.3.2 Setback Requirements

As required by Public Resources Code Section 4291, the following setbacks are required for Structure Defensible Space (Tehama County Ordinance 2023, Section 914.071 and 4291)

- All parcels one (1) acre and larger within Tehama County shall provide a minimum 30 foot setback for building and all accessory buildings from all property lines and/or the center of a road.
- For parcels less than one acre within Tehama County, local jurisdictions shall provide for the same practical effect.

4.10.3.3 Tehama County Fire Safe Regulations

The Tehama County Fire Safe Regulations (Chapter 9.14) constitute the basic wildland fire protection standards of the County of Tehama, which are intended to be equal to the minimum standards of the California Department of Forestry and Fire Protection ("CAL FIRE") in accordance with California Code of Regulations, Title 14, Section 1270.03.

These regulations have been prepared and adopted for the purpose of establishing minimum wildfire protection standards in conjunction with building, construction and development in the county. The future design and construction of structures, subdivisions and developments in the county shall provide for basic emergency access and perimeter wildfire protection measures as specified. These measures shall provide for emergency access; signing and building numbering; private water supply reserves for emergency fire use; and vegetation modification.

(Ord. 1537 § 1(part), 1991)

4.10.3.4 Residential Burn Permits

As of May 1st, 2017, the Tehama Glenn Unit of CAL FIRE and the Tehama County Fire Department (TCFD) require residential burn permits in the unincorporated areas of Tehama County, except in the Capay Fire Districts, and will be required until the burn suspension goes into effect.

It is recommended that residents check with their local fire officials for burning restrictions within the Corning city limits. All residential burning has been banned within the city limits of Red Bluff.

4.10.3.5 County Residential Development

The County Residential Development requirements include the following addressing wildfire safety:

- **Disposal of Flammable Vegetation and Fuels.** Disposal, including chipping, burning or removal to a landfill site of flammable vegetation and fuels caused by site development and construction, and fuel modification shall be completed prior to completion of road construction or final inspection of a building permit
- **Waste accumulation prohibited.** Combustible waste material creating a fire hazard shall not be allowed to accumulate in buildings or structures or upon premises.
- **Fire Break.** A fire break of at least one-hundred (100) feet wide or to the property line whichever is nearer shall be provided around all structures.

4.10.3.6 Tehama County Fire Management Planning Zones

The 2016 Unit Strategic Fire Plan Tehama-Glenn Unit documents the current and historical assessments of the fire situation within the Unit's area of responsibility, and efforts taken to protect it. The document identifies strategic areas for pre-fire planning and fuels treatment as defined by the people who live and work with high wildfire risk areas. The plan established 4 battalions- Battalion I - IV.

- **Battalion I** (East) lies in the northeast corner of Tehama County. The Battalion runs from the eastern foothills on the east side of the Sacramento Valley to the Lassen National Forest boundary on the east, and from the Butte County line in the south to the Shasta County line in the north.

  Fuels within Battalion I consist of grass and oak-woodlands in the lower foothills with increasing brush, pine, and mixed conifer forests as the foothills rise to mountains in the east. These grass fuels in the foothills and canyons have historically carried fast spreading, wind driven, high intensity fires with a moderate to high resistance to control due to access problems.

  Fires occurring in the grass, oak-woodland, brush mix, and timber present the greatest resistance to control and, when they occur, account for the greatest damage to natural resources and structures. Lightning strikes often cause multiple fires and are often difficult to access.

  Assets at risk within Battalion I include extensive timber, rangelands, watershed, associated fisheries, and several rural communities including hundreds of isolated structures. The communities of Payne's Creek, Manton, Ponderosa Sky Ranch, and Mineral have historically suffered damage to homes and property during periodic fires in these areas. Larger fires within the Battalion have caused widespread damage to communities, range lands and fisheries and cost millions of dollars to suppress.

- **Battalion II (administered by Battalion 2512)** lies primarily within the Sacramento Valley floor area of Tehama County and covers a large portion of Tehama County's Local Response Area (LRA). The Battalion consists of the communities of Bend, Antelope, Dairyville, Los Molinos, Tehama, Proberta, El Camino and Vina. The SRA area within the battalion transitions from the valley floor along the Interstate 5 corridor into the rolling hills and steep drainages in the Southeastern portions of Tehama County. Some of the more notable landmarks are the Deer Creek drainage and western portions of the Mill Creek drainage.

  The predominant fuel type within the battalion is grass and oak woodland; however, as the topography transitions into the steeper east side drainages, chaparral and other native brushes become extensive. As you transition into the far eastern portion of the battalion smaller stands of timber become evident. The battalion has a wide variety of fuel types that can challenge fire suppression efforts during the hot summer days. Another fire suppression challenge in Battalion II can be proximity to water sources. Because of this fact, a 10,000 gallon water tank, used for fire suppression efforts has been in place for years on Denny Land and a new heliwell system (a large portable water tank that can remotely be deployed) is now available for helicopters in remote areas.

  Weather and access are big factors relating to fire spread within the battalion. It is not uncommon to have temperatures over 100° Fahrenheit, relative humidity in the low teens and strong North winds during summertime periods. On top of these challenges, access to most areas East of Highway 99E is extremely limited and slow due to very rocky, rugged conditions. The Campbell Fire burned 131,500 acres in 1990 and is one of the larger fires in

California history. The fire burned in the foothills East of Vina and suppression efforts were hampered by hot and dry conditions and rugged, inaccessible terrain.

The most common fire causes within the battalion are equipment use/mechanical and debris pile escapes; however accidental human caused, arson, lightning and undetermined cause fires are not uncommon. A large percentage of the fires within the battalion occur along the heavily traveled roadways such as Interstate 5, State Highway 36 and State Highway 99.

- **Battalion lll (administered by Battalion 2513)** lies in the northwest portion of Tehama County and includes the communities of Lake California, Bowman, Dibble Creek, R-Wildhorse Ranch, Ridgeway and Red Bank. The Battalion runs from the I-5 corridor and west Red Bluff area to the western border with Trinity and Mendocino National forests, and the Yolly Bolly Wilderness Area. It runs from the Shasta County line in the North to the Red Bank area in the south. Values at risk include a large number of residential and associated structures on large lot or ranchette settings. Livestock grazing and recreation are important economically within the Battalion. The loss of infrastructure such as high voltage electrical lines and underground natural gas lines not only affects Tehama-Glenn Unit, but the entire state.

  Fuels within Battalion III consist of grass and oak-woodlands in the valley and lower foothills. The mid slopes transition into heavy brush of chemise, manzanita and grey pines until reaching the mixed conifer forests of Beegum Peak and Tomhead Mountain at approximately 4500' to 6000' elevation. Large ranches and structures are found throughout the mountainous areas.

- **Battalion IV (administered by Battalion 2514)** encompasses the southern portion of Tehama County including the Local Responsibility Area (LRA) along the Interstate 5 corridor and all the State Responsibility Area (SRA) of Glenn County. The SRA boundary lies west of Interstate 5 to the Mendocino National Forest, south to the Glenn-Colusa County line, and north to Elder Creek in Tehama County. Communities within the battalion include Richfield, Corning, Rancho Tehama, Flournoy, Henleyville, Paskenta, Chrome, Grindstone Rancheria, Stonyford, and Elk Creek. Outside of the larger communities, the population is dispersed through rural residences and ranchlands.

  Predominate vegetation in the battalion consists of grassland, oak-woodland mixture, and chaparral. Blue Oak, Live Oak and chaparral are the primary fuel types with a mix of Foothill Pine in higher elevations. Manzanita and Chemise are the primary chaparral in the area with dense patches present on the slopes and ridges below the Mendocino National Forest. Large annual grass crops intermixing with the chaparral cause the greatest fire suppression hazard in regards to fuels in the battalion. The light fuels carry fire rapidly and are receptive to spotting activity.

  Likewise, grass is an exceptional carrier of fire into the brush and brush canopy depending on fuel height and thickness. The most common fire causes within the battalion are equipment use/mechanical and debris pile escapes. Historically, fires in the State Responsibility Area (SRA) occur along traveled county roads, at rural ranchlands and within the larger populated Rancho Tehama community. Arson and accidental human caused fires are not uncommon in the area. Lightning levels on the west side of the battalion are another contributor to fire activity within the battalion.

  Besides the communities and residences located in the battalion, other assets in the battalion are at risk from fire. A majority of the battalion is rural ranch land with both grazing and agricultural field and farmland. There is a high value placed on the annual grasses in the area due to livestock grazing. Likewise, the infrastructure on the ranch lands such as barns, fences, feeders, and equipment are vital to the ranching operation. Also located in the battalion are the water reservoirs, Black Butte Lake and Stony Gorge. Both Black Butte and Stony Gorge provide summertime water and camping recreation to the public. (Unit Strategic Fire Plan Tehama-Glenn Unit, 2016)

4.10.4 Hazard Profile

The 2013 California State Hazard Mitigation Plan provides the following description of wildfire hazard and risk:

> *"The diversity of WUI settings and disagreement about alternative mitigation strategies has led to confusion and different methods of defining and mapping WUI areas. One major disagreement has been caused by terms such as "hazard" and "risk" being used interchangeably. Hazard is the physical condition that can lead to damage to a particular asset or resource. The term fire hazard is related to those physical conditions related to fire and its ability to cause damage, specifically how often a fire burns a given locale and what the fire is like when it burns (its fire behavior). Thus, fire hazard only refers to the potential characteristics of the fire itself. Risk is the likelihood of a fire occurring at a given site (burn probability) and the associated mechanisms of fire behavior that cause damage to assets and resources (fire behavior)."*

Risk refers to the likelihood of a hazard and the scale of damage it is expected to produce. There are different risks for various assets/resources subjected to the same hazard. For instance, a wildfire may cause damage to soils but not cause damage to a large tree. Consequently, risk assessments include hazard, but must also include characterization of the assets/resources.

4.10.4.1 Past Events

Table 4-57 lists the wildfires in Tehama County since the 2012 Tehama County Hazard Mitigation was adopted.

Table 4-57: Wildfire Events in Tehama County

Date	Event Name	Cause
10/8/17	Freeway Fire	Under Investigation
10/3/17	36 Fire	Undetermined
8/26/17	Vestal Fire	Vehicle
8/10/17	Paskenta Fire	Lightning
7/28/17	Live Fire	Equipment
7/8/17	Benson Fire	Electrical
6/24/17	Paskenta Fire	Equipment
6/18/17	Bolla Fire	Electrical

Date	Event Name	Cause
6/4/17	Spring Fire	Misc. / Other
9/13/16	Hog Fire	Powerlines
8/3/16	Baker Fire	Undetermined
7/25/16	Collier Fire	Powerlines
7/1/16	Flores Fire	Vehicle
6/30/16	Colyear Fire	Powerlines
6/21/16	Paskenta Fire	Undetermined
6/11/16	Hoag Fire	Undetermined
8/8/15	36 Fire	Electrical
7/4/15	Black Fire	Undetermined
6/17/15	Fork Fire	Campfire
6/13/14	Tehama Fire	Undetermined
1/2/14	Campbell Fire	Undetermined
9/15/13	Tehama Fire	Undetermined
8/23/13	Deer Fire	Misc. / Other, Mylar Balloon into Powerline
7/19/13	Paskenta Fire	Electrical
7/4/13	Vina Fire	Lightning
5/1/13	Panther Fire	Undetermined
8/18/12	Ponderosa Fire	Lightning
8/13/12	Mill Fire	Electrical
7/16/12	Cody Fire	Equipment
7/7/12	Butte Fire	Equipment
6/19/12	Skyline Fire	Undetermined

Source: firetracker.scpr.org and cdfdata.fire.ca.gov

According to CAL FIRE, the five year average (October 2012- October 2017) of number of fires throughout the state was 4,191 which burned an average of 200,224 acres per year. These statistics include all wildfires responded by CAL FIRE in both the State Responsibility Area, as well as the Local Responsibility Area under contract with the department, plus all large wildfires in State Responsibility Area protected by CAL FIRE's contract counties. Tehama County has an extensive fire history due to the abundance of fuel sources combined with the climate and topography of the planning area. Figure 4-41 shows the causes of fires in Tehama County from 2010-2014.

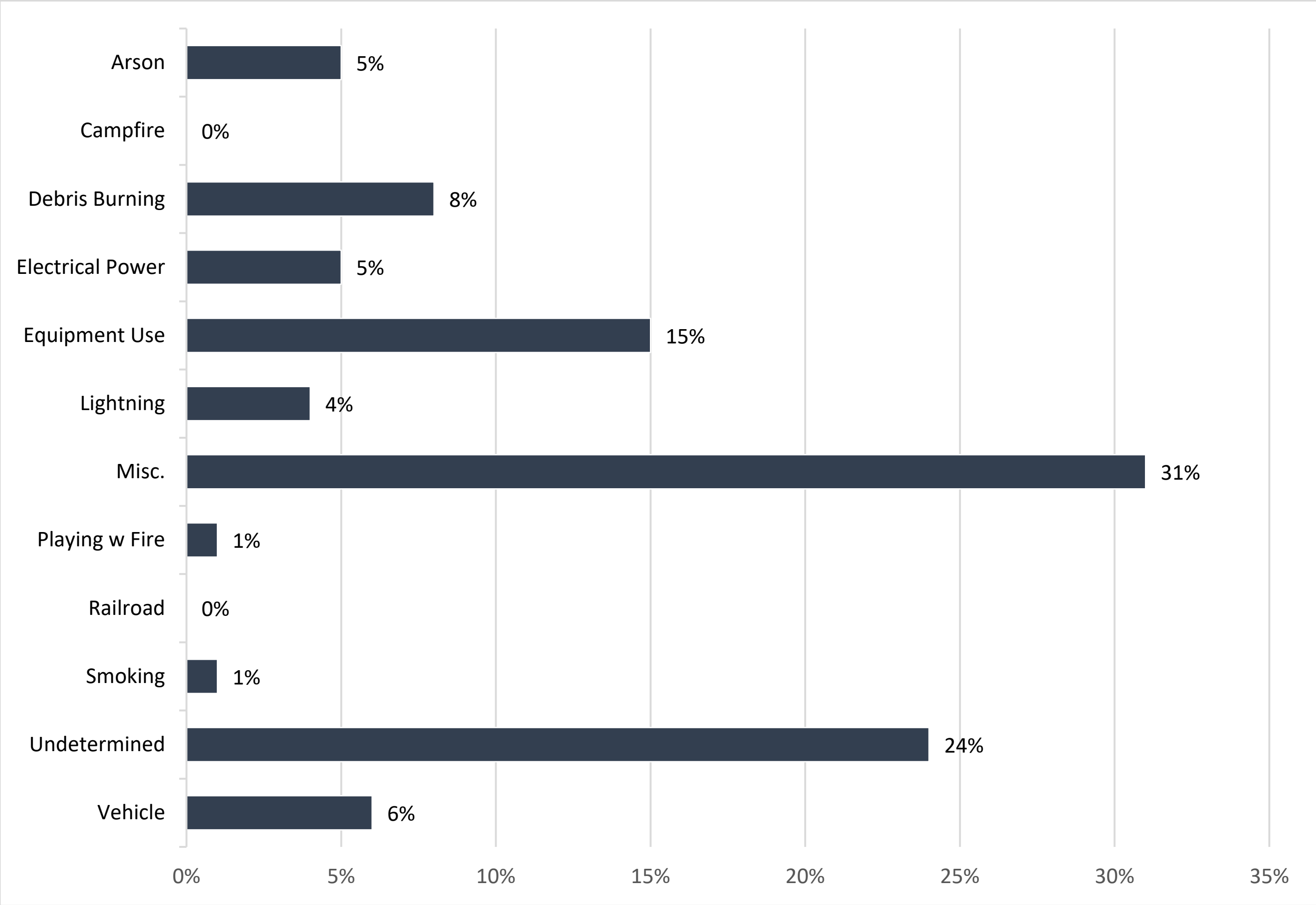


Figure 4-41: 5 Year Fire Causes from 2010-2014

Source: 2016 Unit Strategic Fire Plan Tehama-Glenn Unit

4.10.4.2 Location

CAL FIRE maps areas of significant fire hazards based on factors such as fuel, weather and terrain. Taking these factors into consideration, a fire hazard severity scale has been devised that characterizes zones by the number of days of moderate, high and extreme fire hazard. These zones, referred to as Fire Hazard Severity Zones (FHSZ), define the application of various mitigation strategies to reduce risk associated with wildfires.

The FHSZ model is built from existing data and hazard constructs developed by CAL FIRE's Fire and Resource Assessment Program. The model refines the zones to characterize fire exposure mechanisms that cause ignitions to structures. The model characterizes potential fire behavior for vegetation fuels, which are by nature dynamic. Since model results are used to identify permanent engineering mitigations for structures, it is desirable that the model reflect changes in fire behavior over the length of time a structure is likely to be in place. Significant land-use changes need to be accounted for through period maintenance routines.

The model output of fire probability also is based on frequency of fire weather, ignition patterns, expected rate-of spread, and past fire history. It also accounts for flying ember production, and hazards based on the area of influence where embers are likely to land and cause ignitions. This is the principal driver of hazard in densely developed areas. A related concern in built-out areas is the relative density of vegetative fuels that can serve as sites for new spot fires within the urban core and spread to adjacent structures.

In Tehama County, approximately 1,445,521 acres are in a high or very high FHSZ. This represents over 75 percent of the area of the County. The geography, weather patterns and vegetation in the planning area provide ideal conditions for recurring wildfires. Figure 4-42 shows the FHSZ map for Tehama County. This map is the basis for this wildfire risk assessment. Figure 4-43 shows the location of the Community Wildfire Protection Plan (CWPP) Planning Units.

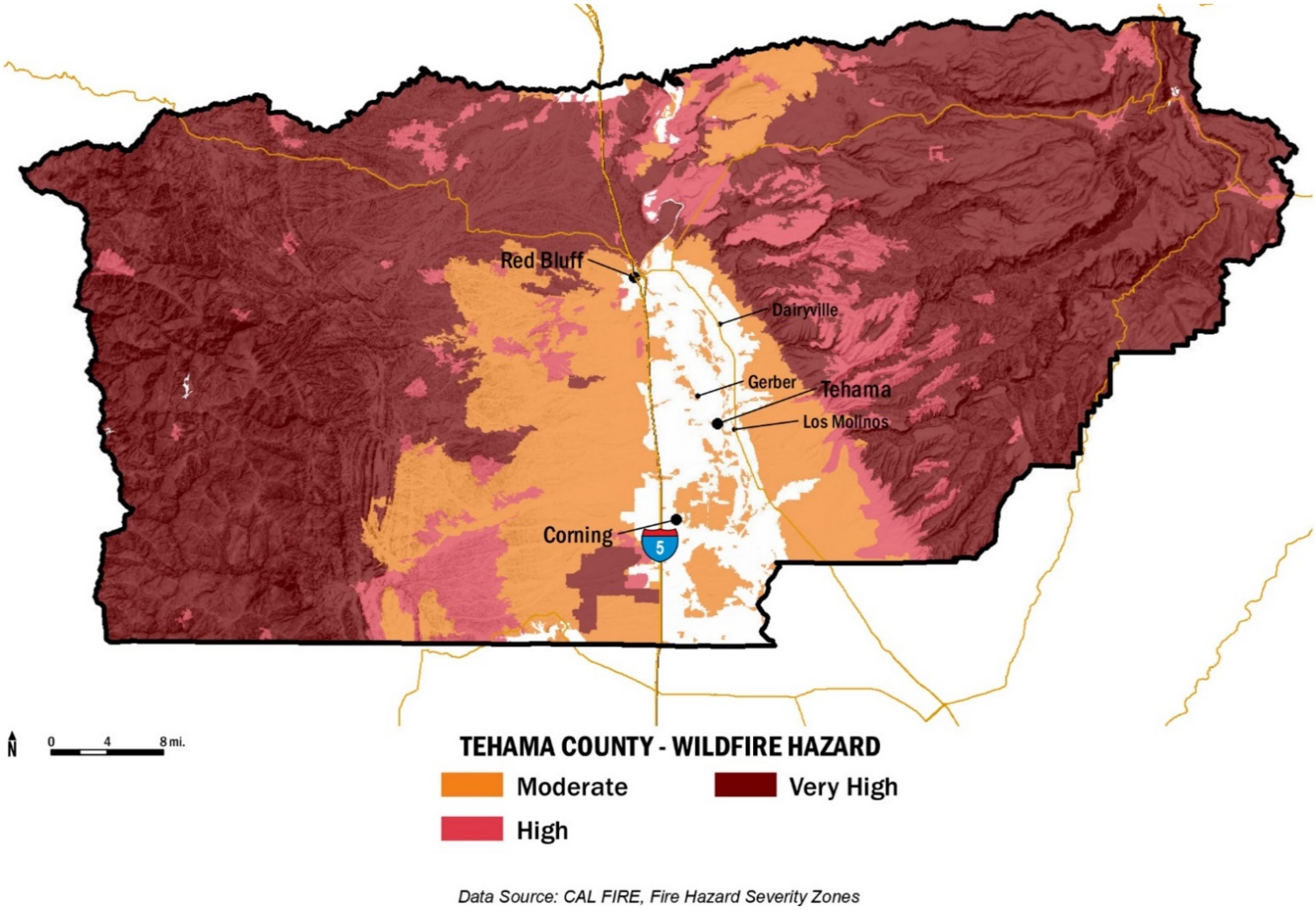
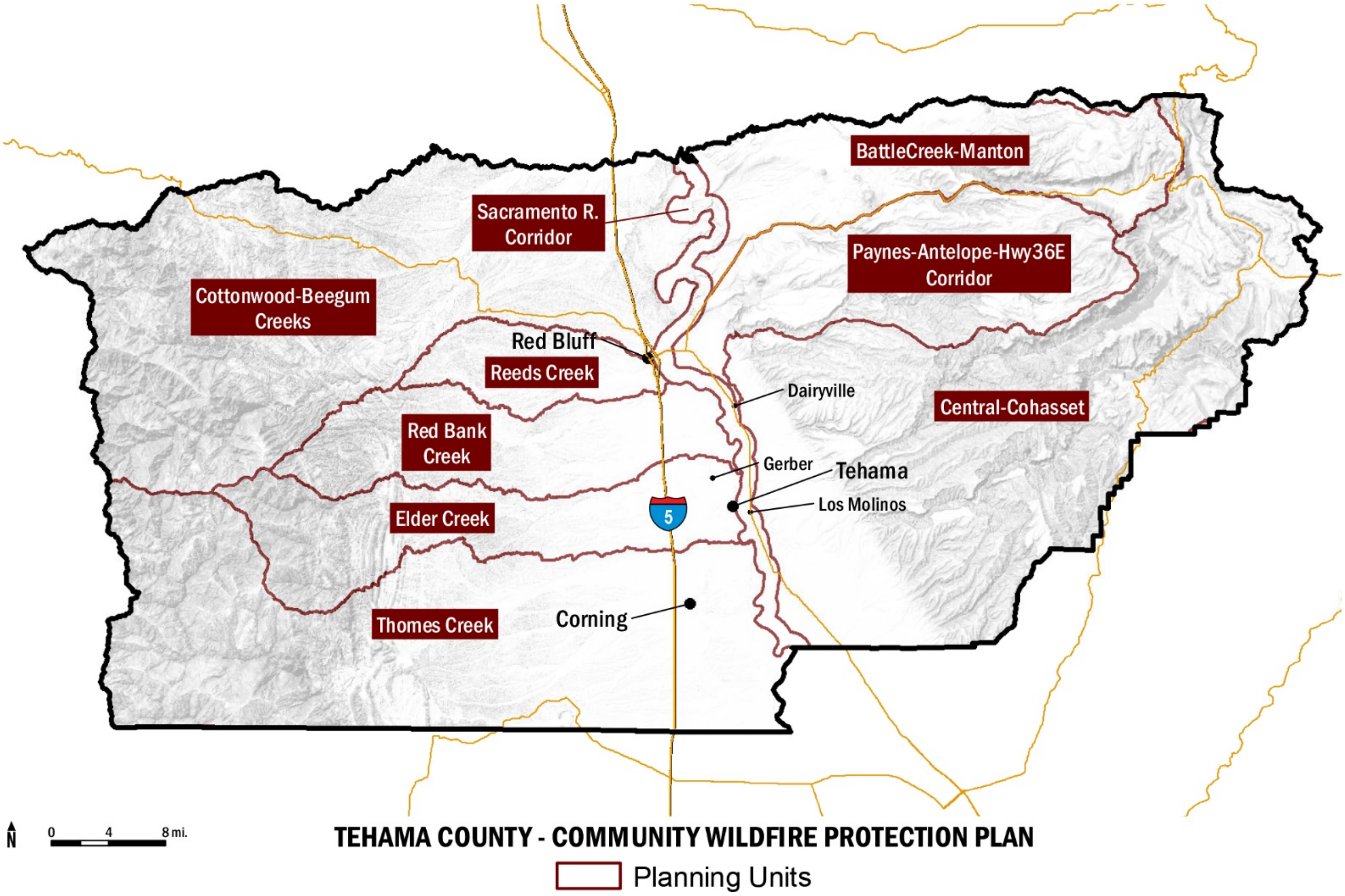


Figure 4-42: Wildfire Severity Zones



Data Source: Tehama County RCD

Figure 4-43: CWPP Planning Units[5]

4.10.4.3 Frequency

As shown in Table 4-57, the majority of wildfires in Tehama County have taken place during summer months (typically June through August). Frequency of wildfire events may be exacerbated by increasingly drier conditions caused by climate change. Fire risk will also continue to grow as more people build in WUI areas, which increases fuel loads and the risk of human-caused fires.

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[5] The purpose of the CWPP is to provide stakeholders and those living in the Tehama's boundaries with an overview of the wildland fire risks, hazards, and values within the planning area; recommend possible courses of action to reduce the impacts of wildfire in the planned area; and to share an action plan. The three main components of a CWPP are 1) collaboration with all stakeholders throughout the CWPP process, 2) identification and prioritization of hazardous fuel reduction areas, and 3) addressing the treatment of structural ignitability within the CWPP area. The Tehama County Resource Conservation District authored the Tehama East and Tehama West CWPP. Read more at: http://www.tehamacountyrcd.org

USGS LANDFIRE (Landscape Fire and Resource Management Planning Tools), is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations. Historical fire regimes, intervals, and vegetation conditions are mapped using the Vegetation Dynamics Development Tool (VDDT). This USGS data supports fire and landscape management planning goals in the National Cohesive Wildland Fire Management Strategy, the Federal Wildland Fire Management Policy, and the Healthy Forests Restoration Act.

As part of the USGS Landfire data sets, the Mean Fire Return Interval (MFRI) layer quantifies the average period between fires under the presumed historical fire regime. MFRI is intended to describe one component of historical fire regime characteristics in the context of the broader historical time period represented by the LANDFIRE Biophysical Settings (BPS) layer and BPS Model documentation.

MFRI is derived from the vegetation and disturbance dynamics model VDDT (Vegetation Dynamics Development Tool) (LF_1.0.0 CONUS only used the vegetation and disturbance dynamics model LANDSUM). This layer is created by linking the BpS Group attribute in the BpS layer with the Refresh Model Tracker (RMT) data and assigning the MFRI attribute. This geospatial product should display a reasonable approximation of MFRI, as documented in the RMT. See Figure 4-44 for predicted fire return interval for the County.

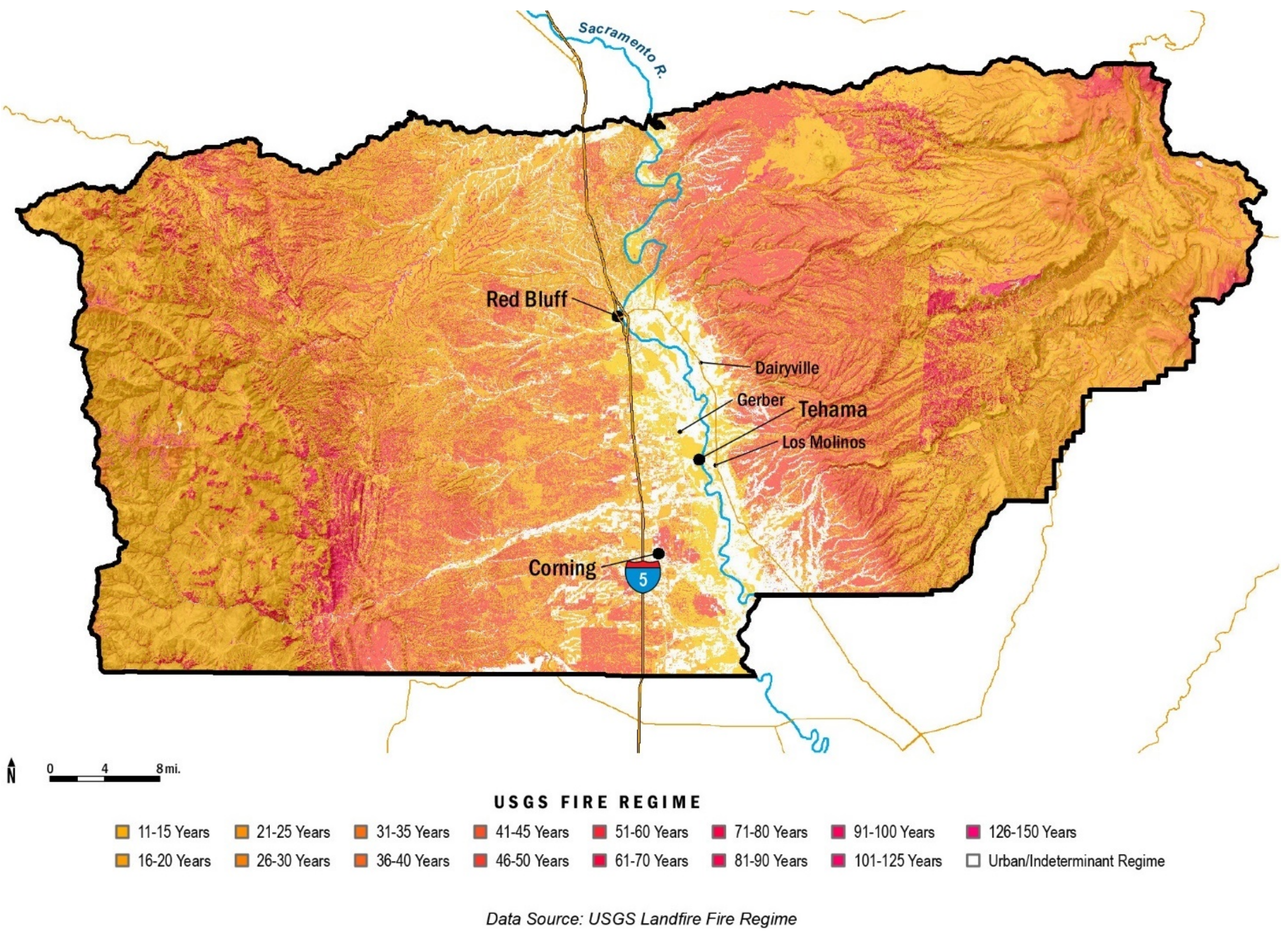


Figure 4-44: USGS Fire Regime Map for Tehama County

4.10.4.4 Severity

Tehama County has an extensive history of large and damaging fires, mostly in WUI areas, resulting in losses of property and life. Given the immediate response times to reported fires, the likelihood of injuries and casualties is minimal, but the area burned can be significant. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. In addition, wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding due to the impacts of silt in local watersheds.

4.10.4.5 Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out. Since fireworks have the ability to cause fires, extra diligence is warranted around the Fourth of July when the use of fireworks is highest. Dry seasons and droughts are factors that greatly increase fire likelihood. Dry lightning may trigger wildfires. Severe weather can be predicted, so special attention can be paid during weather events that may include lightning or wind events. Reliable National Weather Service lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

If a fire does break out and spread rapidly, residents may need to evacuate within days or hours. A fire's peak burning period generally is between 1 p.m. and 6 p.m. Once a fire has started, fire alerting is reasonably rapid in most cases. The rapid spread of cellular and two-way radio communications in recent years has further contributed to a significant improvement in warning time.

4.10.4.6 Secondary Hazards

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildfires cause the contamination of reservoirs, destroy transmission lines and contribute to flooding. They strip slopes of vegetation, exposing them to greater amounts of runoff. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire. Most wildfires burn hot and for long durations that can bake soils, especially those high in clay content, thus increasing the imperviousness of the ground. This increases the runoff generated by storm events, thus increasing the chance of flooding.

4.10.4.7 Climate Change Impacts

Fire in western ecosystems is determined by climate variability, local topography, and human intervention. Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Historically, drought patterns in the West are related to large-scale climate patterns in the Pacific and Atlantic oceans. The El Niño–Southern Oscillation in the Pacific varies on a 5- to 7-year cycle, the Pacific Decadal Oscillation varies on a 20- to 30-year cycle, and the Atlantic Multidecadal Oscillation varies on a 65- to 80-year cycle. As these large-scale ocean climate patterns vary in relation to each other, drought conditions in the U.S. shift from region to region. El Niño years bring drier conditions to the Pacific Northwest and more fires.

Climate scenarios project summer temperature increases between 2ºC and 5°C and precipitation decreases of up to 15 percent. Such conditions would exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases. Forest response to increased atmospheric carbon dioxide—the so-called “fertilization effect”—could also contribute to more tree growth and thus more fuel for fires, but the effects of carbon dioxide on mature forests are still largely unknown. High carbon dioxide levels should enhance tree recovery after fire and young forest regrowth, as long as sufficient nutrients and soil moisture are available, although the latter is in question for many parts of the western United States because of climate change.

4.10.5 Wildfire Vulnerability Analysis

Structures, above-ground infrastructure and critical facilities are all vulnerable to the wildfire hazard. Wildfire population, parcel value, critical facilities and lifeline exposure numbers were generated using Tehama County Assessor and parcel data and County Infrastructure data from multiple data stewards. County assessor data does not include tax exempt structures, such as federal and local government buildings. All data sources have a level of accuracy acceptable for planning purposes. Table 4-47 shows a snap shot of wildfire vulnerability in Tehama County.

Table 4-58: Wildfire Vulnerability Analysis Snap Shot

Exposed Population	Exposed Market Value ($)	Exposed Content Value ($)	Exposed Critical Facilities	Exposed Miles of Lifeline
23,727	$ 2,032,477,143	$ 1,280,499,659	318	5401
57.21% *total pop.*	59.61% *total value*	54.08% *total cost*	55.99% *total count*	87.51% *total mileage*

4.10.5.1 Population

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Wildfire is of greatest concern to populations residing in the moderate, high and very high fire hazard severity zones. U.S. Census Bureau block data was used to estimate populations within the CAL FIRE identified hazard zones. As seen in Figure 4-45 nearly 11,699 residents live in areas considered to be very high risk to wildfires, 3,699 reside in high risk areas and almost 8,329 reside in moderate risk areas.

Population Exposure

Population Count by Wildfire Hazard Zone

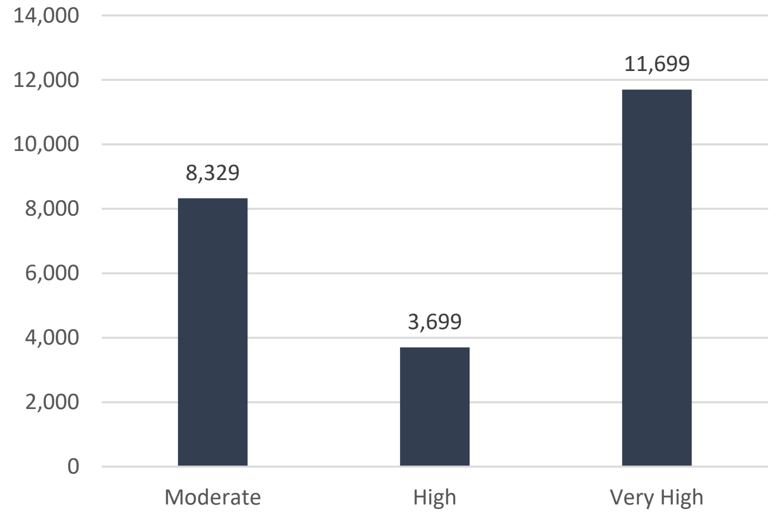
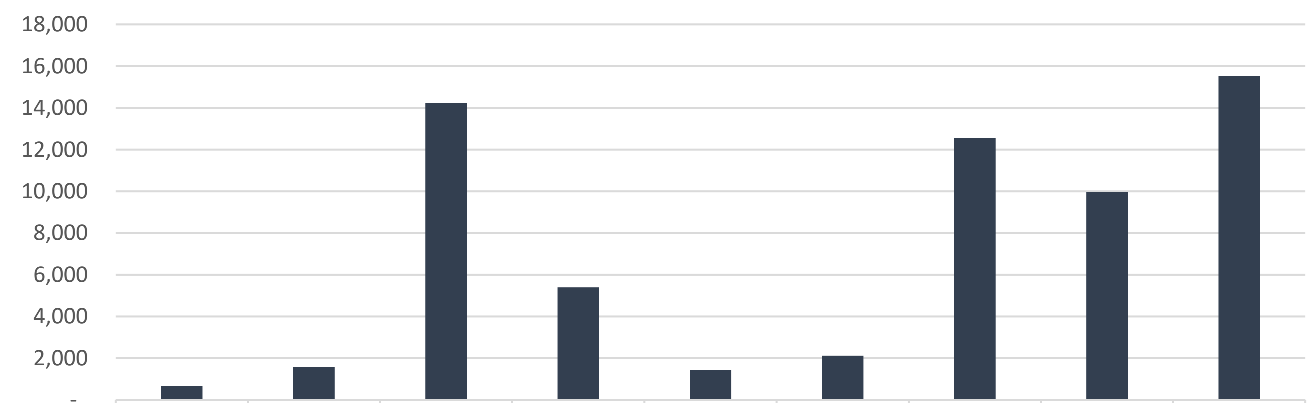


Figure 4-45: Population at risk from wildfire hazards

4.10.5.1.1 Populations in CWPP Planning Units

The Tehama County East and Tehama West Community Wildfire Protection Plan (CWPP), prepared by the RCD of Tehama County, establishes 9 planning units. Table 4-59 shows the population residing in each CWPP planning unit. Table 4-60 shows the population living in moderate, high and very high fire hazard severity zone by CWPP Planning Unit.

Table 4-59: Population Graph for CWPP Planning Units



	BattleCreek-Manton	Central-Cohasset	Cottonwood-Beegum Creeks	Elder Creek	Paynes-Antelope-Hwy36E Corridor	Red Bank Creek	Reeds Creek	Sacramento River Corridor	Thomes Creek
Population	657	1,564	14,237	5,398	1,433	2,119	12,563	9,962	15,523

Source: Tehama East and Tehama West Community Wildfire Protection Plan Update 2017

Table 4-60: Population within CWPP Planning Units

Fire Hazard Severity Hazard Zone by CWPP Planning Unit	Population	% of Total (per Planning Unit)
BattleCreek-Manton	657	
Moderate	29	*4%*
High	61	*9%*
Very High	564	*86%*
Central-Cohasset	1,564	
Moderate	462	*30%*
High	63	*4%*
Very High	21	*1%*
Cottonwood-Beegum Creeks	14,237	
Moderate	1,728	*12%*
High	1,951	*14%*
Very High	8,598	*60%*
Elder Creek	5,398	
Moderate	577	*11%*
High	73	*1%*
Very High	1,446	*27%*
Paynes-Antelope-Hwy36E Corridor	1,433	
Moderate	161	*11%*
High	5	*0%*
Very High	357	*25%*
Red Bank Creek	2,119	
Moderate	991	*47%*
High	455	*21%*
Very High	60	*3%*
Reeds Creek	12,563	
Moderate	3,335	*27%*
High	1,255	*10%*
Very High	371	*3%*
Sacramento River Corridor	9,962	
Moderate	1,336	*13%*
High	578	*6%*
Very High	209	*2%*
Thomes Creek	15,523	
Moderate	3,342	*22%*
High	193	*1%*
Very High	128	*1%*

Source: Tehama East and Tehama West Community Wildfire Protection Plan Update 2017

4.10.5.2 Property

The County's parcel layer was used as the basis for the inventory of improved residential parcels. In some cases, a parcel will be within in multiple fire threat zones. GIS was used to create centroids, or points, to represent the center of each parcel polygon – this is assumed to be the location of the structure for analysis purposes. The centroids were then overlaid with the fire threat layer to determine the risk for each structure. The fire threat zone in which the centroid was located was assigned to the entire parcel. This methodology assumed that every parcel with a square footage value greater than zero was developed in some way. Only improved parcels were analyzed. Table 4-61 exhibits the portions of Tehama County that have significant assets at risk to wildfire in the moderate, high and very high fire severity zones.

Table 4-61: Residential Buildings and Content within Cal Fire Wildfire Severity Zones

	Total Parcels	Total Market Value Exposure ($)	Total Content Value Exposure ($)	Total Value ($)
Tehama County	34,284	$ 3,409,758,850	$ 2,367,722,620	$ 5,777,481,470

Fire Hazard Severity Hazard Zone	Improved Parcel Count	% of Total	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total
Very High	14,219	*41.5%*	$ 929,655,081	$ 542,256,520	$ 1,471,911,601	*25.4767%*
High	4,542	*13.2%*	$ 421,030,644	$ 245,662,793	$ 666,693,437	*11.5395%*
Moderate	6,152	*17.9%*	$ 681,791,418	$ 492,580,346	$ 1,174,371,764	*20.3267%*
Total	**24,913**	**73%**	**$ 2,032,477,143**	**$ 1,280,499,659**	**$ 3,312,976,802**	**57%**

4.10.5.2.1 Property Value Exposure within CWPP Planning Units

Property damage from wildfires can be severe and can significantly alter entire communities. Table 4-62 displays the number of homes and associated values in the very high, high and moderate wildfire hazard zones within the CWPP Planning Units. All 9 CWPP planning units have exposure to wildfire hazards to some degree.

Table 4-62: Property Values within CWPP Planning Units

Fire Hazard Severity Hazard Zone by CWPP Planning Unit	Improved Parcel Count	% of Total (per Planning Unit)	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total (per Planning Unit)
BattleCreek-Manton	1,547		$ 101,739,847	$ 74,736,037	$ 176,475,884	
Moderate	95	*6%*	$ 28,817,123	$ 28,529,497	$ 57,346,620	*32%*
High	132	*9%*	$ 3,132,396	$ 2,108,268	$ 5,240,664	*3%*
Very High	1,315	*85%*	$ 69,624,254	$ 43,959,246	$ 113,583,500	*64%*
Central-Cohasset	2,753		$ 184,880,088	$ 146,558,988	$ 331,439,076	
Moderate	477	*17%*	$ 44,515,697	$ 35,736,575	$ 80,252,272	*24%*
High	388	*25%*	$ 14,686,541	$ 11,332,779	$ 26,019,320	*8%*
Very High	1,255	*81%*	$ 29,533,551	$ 20,331,169	$ 49,864,720	*15%*
Cottonwood-Beegum Creeks	11,395		$ 1,192,700,907	$ 683,982,815	$ 1,876,683,722	
Moderate	823	*7%*	$ 107,372,304	$ 60,477,781	$ 167,850,085	*9%*
High	2,547	*22%*	$ 282,052,099	$ 158,920,939	$ 440,973,038	*23%*
Very High	7,052	*62%*	$ 679,389,767	$ 381,034,059	$ 1,060,423,826	*57%*

Fire Hazard Severity Hazard Zone by CWPP Planning Unit	Improved Parcel Count	% of Total (per Planning Unit)	Market Value Exposure ($)	Content Value Exposure ($)	Total Exposure ($)	% of Total (per Planning Unit)
Elder Creek	4,980		$ 285,787,366	$ 194,815,586	$ 480,602,952	
Moderate	519	*10%*	$ 39,840,180	$ 31,688,623	$ 71,528,803	*15%*
High	99	*2%*	$ 3,608,083	$ 2,188,528	$ 5,796,611	*1%*
Very High	2,534	*51%*	$ 69,775,468	$ 39,485,104	$ 109,260,572	*23%*
Paynes-Antelope-Hwy36E Corridor	1,488		$ 113,116,787	$ 83,484,942	$ 196,601,729	
Moderate	60	*4%*	$ 5,246,057	$ 4,692,671	$ 9,938,728	*5%*
High	63	*4%*	$ 2,535,905	$ 2,416,178	$ 4,952,083	*3%*
Very High	794	*53%*	$ 18,300,420	$ 13,008,309	$ 31,308,729	*16%*
Red Bank Creek	1,776		$ 342,551,077	$ 331,620,772	$ 674,171,849	
Moderate	718	*40%*	$ 104,146,908	$ 90,993,334	$ 195,140,242	*29%*
High	238	*13%*	$ 19,686,071	$ 14,214,150	$ 33,900,221	*5%*
Very High	327	*18%*	$ 11,463,909	$ 10,962,767	$ 22,426,676	*3%*
Reeds Creek	4,940		$ 627,019,123	$ 414,397,404	$ 1,041,416,527	
Moderate	1,528	*31%*	$ 176,021,397	$ 102,726,738	$ 278,748,135	*27%*
High	588	*12%*	$ 68,693,250	$ 35,141,322	$ 103,834,572	*10%*
Very High	286	*6%*	$ 34,624,939	$ 21,365,847	$ 55,990,786	*5%*
Sacramento River Corridor	4,716		$ 681,941,199	$ 455,662,228	$ 1,137,603,427	
Moderate	693	*15%*	$ 94,276,115	$ 50,777,983	$ 145,054,098	*13%*
High	549	*12%*	$ 74,767,378	$ 40,692,114	$ 115,459,492	*10%*
Very High	71	*2%*	$ 7,792,581	$ 4,679,139	$ 12,471,720	*1%*
Thomes Creek	8,716		$ 990,576,373	$ 734,282,808	$ 1,724,859,181	
Moderate	2,633	*30%*	$ 243,846,303	$ 177,754,921	$ 421,601,224	*24%*
High	336	*4%*	$ 25,552,808	$ 22,600,248	$ 48,153,056	*3%*
Very High	604	*7%*	$ 11,414,013	$ 9,499,928	$ 20,913,941	*1%*

4.10.5.3 Critical Facilities and Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events. In the event of wildfire, there would likely be little damage to most infrastructure. Most roads and railroads would be without damage except in the worst scenarios. Power lines are the most at risk from wildfire because most poles are made of wood and are susceptible to burning. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed. Many bridges in areas of high to moderate fire risk are important because they provide the only ingress and egress to large areas and in some cases to isolated neighborhoods.

Critical facilities data were overlain with fire hazard severity zone data to determine the type and number of facilities within each risk classification. Table 4-63 and Table 4-64 list the critical facilities in the moderate, high and very high wildfire hazard zones for Tehama County.

Table 4-63: Critical Facility Exposure to Wildfire

Infrastructure Type	Moderate	High	Very High	Total Feature Count
Essential Facility	11	5	13	29
EOC	1	0	0	0
Fire Station	4	2	6	0
Government Facility	2	0	0	0
Hospital	0	0	0	0
Police Station	0	0	0	0
School	4	3	7	0
High Potential Loss	9	7	5	21
Residential Child Care	0	0	0	0
Adult Residential Care	7	2	1	0
Child Care	0	0	1	0
Foster/Home Care	0	0	0	0
Home Care	0	0	0	0
Other Care Facility	0	0	0	0
Elder Care	1	3	0	0
Dam	1	2	2	0
Hotel	0	0	1	0
Transportation and Lifeline	155	25	88	268
Airport	0	0	0	0
Bridge	142	24	71	0
Bus Facility	0	0	0	0
FCC AM Tower	1	0	0	0
FCC Cell Tower	0	0	6	0
FCC FM Tower	0	0	9	0
Natural Gas Station	8	0	1	0
Power Plant	0	0	0	0
Substation	4	0	1	0
Waste Water Facility	0	1	0	0
Grand Total	**175**	**37**	**106**	**318**

Table 4-64: Lifelines with Wildfire Risk

Infrastructure Type (Linear)	Moderate	High	Very High	Total Mileage
Transportation and Lifeline	**1,221.3**	**618.8**	**3,561.3**	**5,401.5**
FEMA Levee	6.3	-	-	6.3
USACE Levee	4.8	-	-	4.8
Natural Gas Pipeline	87.7	12.6	40.7	141.0
Transmission Line	180.3	63.9	138.9	383.1
Railroad	12.6	0.6	17.8	31.0
Street	929.6	541.7	3,363.9	4,835.3
-Interstate	14.1	9.2	13.6	36.9
-Primary Highway	8.1	9.5	54.8	72.4
-State/County Highway	189.3	52.8	325.8	567.9
-Local Road	672.6	412.9	2,687.5	3,773.0
-Other Road	36.3	14.7	66.2	117.1
-4WD Road	9.2	42.7	216.1	268.0
Grand Total	**1,221.3**	**618.8**	**3,561.3**	**5,401.5**

Many ecosystems are adapted to historical patterns of fire occurrence. These patterns, called “fire regimes,” include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

4.10.6 Future Trends in Development

California has over 600 recognized ecotypes. Human impact on the land has forever changed many of these ecotypes, and as greater numbers of people come into contact with the land, the changes become more profound. The full spectrum of fire management issues are represented in the Tehama County planning area: WUI issues, mechanical thinning treatments, wildfire response and fire suppression, and prescribed fire as a land management tool. Human intervention is neither wholly the problem nor wholly the solution to the fire situation. Fire hazard planning is complicated by the fire environment of each ecosystem, the complexities brought by people, and the need for sufficient resources to address fire issues specific to each ecosystem. Despite the best efforts of fire service professionals, resource managers and other stakeholders, large, damaging, costly fires will continue.

The highly urbanized portions of the planning area have little or no wildfire risk exposure. Urbanization tends to alter the natural fire regime, and can create the potential for the expansion of urbanized areas into wildland areas. The expansion of the wildland urban interface can be managed with strong land use and building codes. The planning area is well equipped with these tools and this planning process has asked each planning partner to assess its capabilities with regards to the tools. As Tehama County experiences future growth, it is anticipated that the exposure to this hazard will remain as assessed or even decrease over time due to these capabilities.

4.10.7 Issues

The major issues for wildfire in Tehama County are the following:

- The need for public education and outreach will become greater as new residents move into the area who may not be familiar with the wildfire risk in the County. As climate change continues and conditions become drier, this will be even more relevant.
- High potential loss / essential facilities are located within high and very high wildfire severity zones: Manton, Plum Creek, Reeds Creek, Elkins and Flournoy schools and others.
- High wildfire risk within the Reeds Creek CWPP Planning Unit involving areas of Reed Creek and Pine Creek Rd). This includes populations and structures at risk near the wildland urban interface near Red Bluff. Red Bluff areas of concern including areas near S. Jackson Street, Monroe Ave @ Walton Ave, and Monroe Ave @ HWY 36.
- Heavy Vegetation on Railroad property near north side of the City of Red Bluff.
- Lack of vegetation management activities. Factors may include a lack of funding/ resources for property owners or an aging population who may be physically unable to perform mitigation actions.
- The Tehama West Watershed faces the growing problem of expansion of residential development into increasingly remote and historically fire prone areas (Wildland Urban Interface aka WUI). These areas usually fall outside the boundaries of local fire districts and in State Responsibility Areas (SRA) that are handled by Cal Fire. This adds a new complication to standard wildland firefighting tactics.
- High wildfire risk within the Paynes-Antelope Hwy 36E Corridor CWPP Planning Unit. This includes populations and structures at risk near Dales, Paynes Creek, Ponderosa Sky Ranch Area, Lyman Springs, Jelly’s Ferry Road and Surrey Village.
- High wildfire risk within the Sacramento River Corridor. This includes populations and structures at risk near the communities of Surrey Village, Lake California and riparian areas of East Sand Slough near Antelope Blvd. Limited emergency access and multiple evacuation routes.
- High wildfire risk within the Cottonwood- Beegum CWPP Planning Unit. This includes populations and structures at risk near the Bowman Area.
- High wildfire risk within the Battle Creek- Manton CWPP Planning Unit. This includes populations and structures at risk near the Manton area.
- High wildfire risk within the Elder Creek CWPP Planning Unit. This includes populations and structures at risk near the Rancho Tehama area.

4.11 Other Hazards of Interest

The hazards profiled in Sections 4.4 through 4.10 are those that present significant risks within the Tehama County planning area. One additional hazard, volcanoes, was identified by the steering committee as having some potential to impact the planning area, but at a much lower risk level than the hazards of concern. Volcanoes are identified as a hazard of interest. A short profile is included in the following section. No formal risk assessment was performed, and no mitigation initiatives have been developed to address volcanoes. However, all planning partners for this plan should be aware of this hazard and should take steps to reduce the risks it presents whenever it is practical to do so.

4.11.1 Volcanoes

At least ten volcanic eruptions have taken place in California in the past 1,000 years—most recent is the Lassen Peak eruption of 1914 to 1917 in Northern California—and future volcanic eruptions are inevitable. Based on the record of volcanism over the last millennium, the probability of another eruption occurring in California in the next 30 years is about 26%, which is similar to the 30-year forecast for a magnitude 6.7 or greater earthquake on the San Andreas Fault in the San Francisco Bay area (22% probability) and in the Los Angeles region (19% probability).

Lassen Peak (approximately 60 miles north east of the City of Red Bluff) was rated by USGS as one of the 3 volcanoes in the state having Very High Threat Potential. Lassen Peak erupted most recently from 1914-1917 which is very recent in geological history. If Lassen Peak were to erupt again, the impacts to Tehama County before, during, and after the eruption would be very significant. (Survey, 2017)

Several hazards will likely accompany a future eruption of Lassen volcano. Heightened seismicity and ground deformation will probably precede the next eruption. Most likely is an effusive eruption with incandescent lava fountains rising a few to hundreds of meters (tens to hundreds of feet) in the air. A mound of volcanic cinder would gradually build around the vent and slow-moving lava flows could impact areas a few kilometers away. Future explosive eruptions, similar to Lassen Peak or the larger Chaos Crags, are also possible.

The areas of highest hazard in the region of Lassen Volcanic National Park are those that could potentially be affected by pyroclastic flows and mudflows. These areas are those in the immediate vicinity and downhill from likely eruption sites. Fallout of ash will affect areas downwind at the time of an eruption. Within the hazard zones, relative hazard is gradational, decreasing away from the location of potential vents. (USGS, n.d.)

4.12 Planning Area Risk Ranking

4.12.1 Hazard Prioritization

The Planning Committee's hazard prioritization process combines historical data, local knowledge, and consensus opinions to produce values that allow identified hazards to be ranked against one another. The criteria below was used to evaluate hazards and identify the highest risk hazard in Tehama County. The results of the prioritization process are shown in Table 4-65.

Probability

What is the likelihood of a hazard event occurring in a given year?

Unlikely- less than 1% annual probability

Possible- between 1 & 10% annual probability

Likely- between 10 &100% annual probability

Highly likely- 100% annual probability

Impact

In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?

Minor- very few injuries, if any. Only minor property damage & minimal disruption on quality of life. Temporary shutdown of critical facilities.

Limited- minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.

Critical- multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.

Catastrophic- high number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.

Table 4-65: Prioritized Hazard Assessment Matrix

		Impact			
		Catastrophic	**Critical**	**Limited**	**Minor**
Probability	**Highly Likely**				
	Likely		Wildfire	Drought, Flood	
	Possible			Severe Weather	Geohazards (Earthquake, Slope Failure)
	Unlikely			Dam Failure	

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Section 5. Mitigation Strategy

The intent of the mitigation strategy is to provide the County with a guidebook to future hazard mitigation administration. The mitigation strategy is intended to reduce vulnerabilities outlined in the previous section with a prescription of policies and physical projects. This will assist County staff to achieve compatibility with existing planning mechanisms, and ensures that mitigation activities provide specific roles and resources for implementation success. The mitigation strategy represents the key outcomes of the MJHMP planning process. The hazard mitigation planning process conducted by the Planning Committee is a typical problem-solving methodology:

- **Estimate the impacts** (See Vulnerability Assessment);
- **Describe the problem** (See Problem Statements);
- **Assess what resources exist to lessen impacts and problem** (See Capability Assessment,);
- **Develop Goals and Objectives to address the problems** (See Goals and Objectives)
- **Determine what can be done, and develop actions that are appropriate for the community** (See Mitigation Action Matrix).

5.1 Mitigation Alternatives

During July 2017, the MJHMP Planning Committee participated in the development and review of mitigation actions with a wide range of alternatives. To narrow mitigation alternatives for inclusion, FEMA's six broad categories of mitigation alternatives were used. Each FEMA category is described below. The MJHMP Planning Committee developed several mitigation alternatives for implementation under each mitigation category.

PREVENTION (PRV):

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning ordinances;
- Building codes;
- Open space preservation;
- Floodplain regulations;
- Stormwater management regulations;
- Drainage system maintenance;
- Capital improvements programming; and
- Riverine / fault zone setbacks.

PRV ALTERNATIVES:

1) Evaluate the County's regulations that manage flood risk / stormwater conveyance and consider additional standards to help prevent flood problems from increasing. These include:
   - Practicing Water Sensitive Urban Design such as the incorporation of curb cuts into bioswales to control runoff.
   - Enhanced stormwater regulations to reduce stormwater runoff, especially for new development
2) Vegetation management in fire prone areas.
3) Develop an insurance incentive program for homeowners in Wildland Urban Interface (WUI) areas in collaboration with insurance companies and the Tehama County Fire Department
4) Develop contractual agreements with private companies for debris clean up after a severe storm.

PROPERTY PROTECTION (PPRO):

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Critical facilities protection;
- Retrofitting (e.g., seismic design techniques, etc.);
- Insurance.

PPRO ALTERNATIVES:

1) Consider promoting and supporting voluntary property protection measures through several activities, ranging from financial incentives to full funding. Examples include Earthquake Brace + Bolt, The California Residential Mitigation Program and California Air Resources Board Air Pollution Incentives, Grants and Credit Programs.
2) Promote earthquake insurance for properties with a focus on older structures built before 1980.
3) Evaluate public owned facilities and critical facilities for property protection measures.
4) Perform seismic review (both structural and non-structural) on County buildings and County owned critical facilities.
5) Provide automatic shutoff valves for utility infrastructure.
6) Review County owned buildings for seismic risk.
7) Identify and mitigate privately owned unreinforced masonry buildings within the County.

PUBLIC EDUCATION AND AWARENESS (PE&A):

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects including neighborhood and community outreach;
- Speaker series / demonstration events;
- Hazard mapping;

- Real estate disclosures;
- Materials Library;
- School children educational programs; and
- Hazard expositions.

PE&A ALTERNATIVES:

1) Enhancing the County's Public Information Program to include both the public and private sectors.
2) Education and outreach measures to ensure the community understands **their** role in protecting **themselves** in a disaster event.
    - Mitigation measures for residents at the home (i.e. stabilizing through vegetation)
    - Safety precautions for all types of hazards, but especially earthquakes, wildfires, and drought.
    - Knowing where emergency evacuation routes and shelters are located.
    - Family and emergency preparedness measures.
3) Enhance public outreach program to include all hazards. Appropriate ways to spread information are:
    - Websites and social media
    - Mailings to everyone, in utility bills or otherwise
    - News releases or newspaper articles
    - Newsletters
    - Displays, particularly at special events
    - Handouts, flyers and other materials, which can be distributed at special events and presentations

NATURAL RESOURCE PROTECTION (NRP):

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management;
- Vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.);
- Erosion and sediment control;
- Wetland and habitat preservation and restoration;

NRP ALTERNATIVES:

1) Inform Tehama County Board of Supervisors about the hazard mitigation benefits of restoring natural drainage features, wetlands and other natural areas.
2) Develop restoration and protection techniques using water sensitive urban design, landslide areas and high risk wild land fire areas.

3) Enhance public education and outreach efforts to inform the public about the need to protect hillsides from erosion. (i.e. stabilizing through vegetation) Enhance public education and outreach efforts to inform the public about capturing stormwater and using it for landscape features.
4) Work with property owners to replant native vegetation after a fire.
5) Land use and/or other regulatory control of undeveloped properties in flood zones.

EMERGENCY SERVICES (ES):

Although not typically considered a "mitigation" technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems;
- Construction of evacuation routes;
- Sandbag staging for flood protection; and
- Installing temporary shutters on buildings for wind protection.

ES ALTERNATIVES:

1) Consider StormReady certification.
2) Provide alert and notification to residents for flood risk
3) Training for County Staff

STRUCTURAL PROJECTS (SP):

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Stormwater diversions / detention / retention infrastructure;
- Utility Upgrades
- Seismic Retrofits

SP ALTERNATIVES:

1) Protecting utilities from EQ damage. Not the County's responsibility but private utility industry.
2) Constructing backup utility infrastructure in the event of a natural disaster.
3) Check the condition of the County's utility infrastructure.
4) Upgrade or seismically retrofit transportation infrastructure including overpasses, underpasses, and other transportation infrastructure vulnerable to seismic events.

5) Identify or construct alternative routes for emergency access throughout the County. Provide shoring and bank stabilization near roadways to prevent further erosion.

6) Work with private property owners to reduce runoff.

7) Provide County infrastructure to slow the movement of water.

5.2 Identifying the Problem

As part of the mitigation actions identification process, the MJHMP Planning Committee identified issues and/or weaknesses as a result of the risk assessment and vulnerability analysis. By combining common issues and weaknesses developed by the Planning Committee, the realm of resources needed for mitigating each can be understood. Community issues and weaknesses are presented by individual hazard in Table 5-1. Projects or actions have been developed to mitigate each problem identified. See Section 5.5 for related County Wide mitigation actions, or related mitigation actions for each participating jurisdiction in Volume 2 of this plan.

Table 5-1: Problem Statements by Hazard

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Dam Failure	DF-01	There is often limited warning time for dam failure. These events are frequently associated with construction methodology and or severe weather, which limits predictability of dam failure and compounds flood risk. Protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.	ES, PE&A	RB-06-2018, TC-23-2018, CoT-24-2018	x		x	x
Dam Failure	DF-02	Mapping that estimates inundation depths for federally regulated dams is already required and available; however, mapping for non-federal-regulated dams is needed to better assess the risk associated with failure of these facilities. Also, access to inundation zones is not readily available to residents area wide.	ES	TC-24-2018, RB-06-2018, TC-23-2018	x		x	x
Dam Failure	DF-04	Depending upon the scenario, a Shasta Dam uncontrolled release due to reservoir levels / reservoir would inundate the entire City of Tehama and beyond.	ES	CoT-24-2018, TC-23-2018				x
Drought	DR-01	The need for identification and development of alternative water supplies.	SP	TC-32-2018	x			

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Drought	DR-02	Lack of recharge to stabilize the groundwater supply.	SP, PRV	TC-27-2018, TC-28-2018, CC-24-2018	x	x		
Drought	DR-03	The probability of increased drought frequencies and durations due to climate change.	PRV	CoT-25-2018, RB-07-2018, TC-27-2018, TC-28-2018, CC-23-2018	x	x	x	x
Drought	DR-04	The lack of promotion of active water conservation during drought and non-drought periods.	PRV, PE&A	CoT-18-2012, RB-08-2018, TC-26-2018	x	x	x	x
Drought	DR-05	Illegal groundwater use and water diverted from streams contribute to water wells going dry during periods of drought. Related expenses include re-drilling and head replacement.	PPRO	TC-29-2018	x			
Drought	DR-06	There is a lack of available resources to evaluate private wells and water quality issues and/ or dry well reporting. No mapping currently exists of dry wells or groundwater, water tables or aquifers.	PRV, NRC	CC-23-2018, TC-29-2018, TC-28-2018	x	x		
Drought	DR-07	Lowering of ground water within basins in and near Corning resulting in expensive water well and waterline repairs/improvements.	NRC	CC-23-2018		x		
Drought	DR-08	Water supply contingency issues during dry years for communities surrounding City of Corning i.e. Paskenta and others without consistent or reliable domestic supplies.	NRC, PRV	CC-24-2018		x		
Earthquake	EQ-01	More information is needed on the exposure and performance of soft-story construction within the planning area. There are many undocumented unreinforced masonry buildings.	PPRO	CC-21-2018, CC-22-2018, CoT-16-2012, RB-04-2018, RB-05-2018		x	x	x
Earthquake	EQ-02	Gas fires after earthquake events.	PPRO	CoT-17-2012				x

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Earthquake	EQ-03	Low probability of liquefaction within the planning area is evident from data collection efforts. Having this information developed would significantly enhance seismic risk assessment.	PPRO	TC-34-2018	x			x
Flood	FL-01	Older or non-engineered levees such as Elder Creek, Deer Creek and others are subject to failure or do not meet current building practices for flood protection. Development behind privately built levees/earthen berms occurs on the valley floor. Many of these people have not purchased flood insurance because regulatory maps do not show them as being in the flood plain.	SP	TC-10-2018	x			
Flood	FL-02	Climate change impacts flood conditions in Tehama County. More severe weather events could compromise local drainage and flood control.	SP	CC-10-2012, CoT-06-2012, CoT-07-2012, CoT-08-2012, CoT-09-2012, CoT-20-2018, RB-03-2018, RB-09-2012, CC-08-2012, CC-09-2012, CC-12-2012, CC-16-2018, TC-22-2018	x	x	x	x
Flood	FL-03	Residents need more education about flood preparedness, flood insurance and the resources available during and after floods on a continual basis.	PEA	CC-02-2012, CoT-03-2012, CoT-04-2012, CoT-11-2012, CoT-12-2012, CoT-14-2012, RB-03-2012, TC-06-2018	x		x	x

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Flood	FL-04	Placing fill, constructing levees or berms, modifying drainage channels and streams, constructing and maintaining private and public roads, and grading property without regard or the understanding of the potential impact to drainage or the risk from flooding can create problems where none existed previously.	**PPRO, NRC**	CC-04-2018, CoT-01-2018, TC-12-2018	x			x
Flood	FL-06	Lack of well head protection plans for private wells or single individual wells providing domestic supply to single family resident.	**NRP**	CoT-22-2018, TC-14-2018	x			x
Flood	FL-07	More studies need to be done locally to validate the accuracy of the existing flood hazard mapping produced by FEMA reflecting the true flood risk within the planning area. This is most prevalent in areas protected by levees not accredited by the FEMA mapping process such as the Antelope/ Salt Creek area and others. Flood control structures that are not recognized by FEMA include roads, railroads and other non-certified flood control structures.	**PRV**	TC-08-2018, CC-17-2018	x	x		
Flood	FL-08	Lack of historical damage data, such as high-water marks on structures and damage reports, to measure inundation and the cost-effectiveness of future mitigation projects.	**PRV**	TC-11-2018, CoT-04-2012, CC-17-2018	x	x		
Flood	FL-09	There is a lack of detailed information regarding existing drainage patterns and floodplains in areas of existing development and, in most cases, areas where future development will likely occur. As a consequence, implementation of a “no adverse impact” management policy is problematic. Even where FEMA has identified SFHAs, the BFEs are not always available.	**PRV**	TC-08-2018	x			
Flood	FL-10	Salt Creek and Antelope Creek distributaries causing flood risk to McHie Subdivision and other rural residential areas.	**SP, PPRO**	TC-15-2018, TC-16-2018	x			

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Flood	FL-11	Antelope Creek distributaries causing flood risk to Daryville area and surrounding rural residential properties.	SP	TC-17-2018	x			
Flood	FL-12	Unmitigated repetitive loss structures exist within the county unincorporated areas	SP, PPRO	TC-09-2018	x			
Flood	FL-13	A significant number of NFIP claims are outside of FEMA-designated SFHAs. The determination of the causes of flooding on existing structures and the siting of new facilities, so as not to be adversely impacted by flooding or adversely impacting adjacent or neighboring properties, is problematic due to the lack of topographic data and mapping.	PRV	CC-01-2018, CC-14-2012, CC-17-2018, TC-09-2018	x	x		
Flood	FL-15	Over time the transport of material from these rugged upland areas to the valley floor has resulted in the deposition of large alluvial fans and gravel reserves along the lower foothills. Sediment loading continues to be a problem in the Tehama watersheds.	NRP	TC-18-2018	x			
Flood	FL-16	Watershed streams show rapid responses to storms, and flow levels fluctuate or flash between storm periods in a localized environment.	SP	CC-08-2012, CC-09-2012, CC-12-2012, CC-13-2012, CC-16-2018, RB-06-2012, TC-22-2018, CC-10-2012	x	x	x	
Flood	FL-17	Multi Residential Care and Assisted Living Facilities are located within the 100-YR Flood Plain.	PPRO	CC-14-2012, RB-03-2012		x	x	
Flood	FL-19	Burch Creek overflows in to Jewett Creek west of town during localized rain events.	SP	CC-06-2012, TC-18-2018	x	x		
Flood	FL-20	Flooding / drainage when creeks are full can be a problem.	SP	CC-08-2012, CC-09-2012, CC-10-2012		x		

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Flood	FL-21	Flooding in Corning is typically caused by high-intensity, short-duration (1 to 3 hours) storms concentrated on a stream reach with already saturated soil.	PRV	CC-08-2012, CC-09-2012, CC-10-2012, CC-12-2012, CC-16-2018		x		
Flood	FL-22	Multiple high loss potential facilities are located in the 100-YR Flood zone include a childcare facility and others.	PPRO	CC-15-2018, CoT-04-2012, TC-22-2018		x		
Flood	FL-23	Dry wells citywide are failing to keep up with localized storms. These include dry wells at La Mesa Ct. Rio Bravo Ct., Rio Vista Ct., Rio Del Rey Ct., and others…	SP	CC-16-2018		x		
Flood	FL-24	Limited volumes / capacity issues at Jewett Creek and South Pacific? Railroad Bridge.	SP	CC-05-2018, CC-07-2012		x		
Flood	FL-25	Breaches of levees near Gerber and private levees on a farm north of the City have flooded areas of the city in the past. Gerber levees are constructed as 50 year levees but are currently at 50% capacity due to silt.	SP	CoT-05-2012				x
Flood	FL-26	Only 50% of the homes carry flood insurance. The City needs help developing a strategy/ crafting a message to expand the base of flood insurance.	PRV	CoT-02-2012				x
Flood	FL-27	Local drainage issues damage roadways. Roadway construction and design needs to address sheet flooding within the City.	SP	CoT-20-2018				x

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Flood	FL-28	Critical infrastructure in the City faces flood risk, including City Hall, the Head Start School Facility and others.	PPRO (Non-Structural)	CoT-13-2012				x
Flood	FL-29	The greatest concentration of repetitive-loss properties is within the City of Tehama; however, this community was involved in an "elevation" project sponsored by the USACE and State Reclamation Board. Within the city there were 125 houses below the USACE 100-YR BFE for the Sacramento River. The cost to elevate homes in the city has ranged from $60,000 to $100,000. (2006 Tehama County Flood Mitigation Plan)	PPRO, PRV	CoT-10-2012				x
Flood	FL-30	Many small tributaries in the watersheds have high levels of siltation and diminished flood-carrying capacity due to vegetation (due to Arundo and Tamarisk) overgrowth. Debris-clearing is a challenge due to environmental permitting restrictions from Fish and Game/Fish and Wildlife. The establishment of Arundo in the streams in Tehama County has seriously limited their conveyance capacity.	PRV	TC-13-2018, CC-05-2018, CoT-06-2012, RB-02-2018	x	x	x	x
Flood	FL-31	Approximately 10% of the population lives in the 100-YR or 500-YR flood plain.	PPRO	CC-11-2012		x		
Flood	FL-32	Localized flooding on North Street between Edith and Toomes Avenue	SP	CC-26-2018		x		
Flood	FL-33	Localized flooding on Edith Avenue between Colusa and Solano Streets	SP	CC-27-2018		x		

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Flood	FL-34	Localized flooding on Fig Lane & Chicago between RR tracks and West Street (including flooding from Woodson Bridge at 6th Street)	**SP**	CC-28-2018		x		
Flood	FL-35	During high flows, the Sacramento River's overflow channel near Jellys Ferry Rd. and Saron Fruit Colony Rd. becomes inundated, keeping people from accessing the western area via Saron Fruit Colony Road.	**SP, PE&A**	TC-35-2018	x			
Severe Storm	SS-01	Older building stock in the planning area do not meet code standards. These structures could be highly vulnerable to severe weather events such as windstorms.	**PPRO**	TC-30-2018, TC-33-2018	x	x	x	x
Severe Storm	SS-02	Risk of power supply interruption due to severe storms.	**ES**	CC-18-2012, CC-19-2012, CoT-23-2018, TC-19-2018	x	x		x
Severe Storm	SS-03	Lack of backup power generation at critical facilities.	**ES**	TC-20-2018, CC-18-2012, CC-19-2012, CoT-23-2018	x	x		x
Severe Storm	SS-04	Road closures (both rural roads and state HWYs to isolated communities and Interstate-5, I.e. HWY 99, 36).	**PE&A ES**	TC-21-2018	x			
Severe Storm	SS-05	Communication issues occur during weather events such as the phones going down. Back-Up power at communication towers is needed.	**ES**	TC-19-2018, TC-20-2018, CoT-23-2018	x	x		x

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Severe Storm	SS-06	Many large trees result in damages from storms (high winds). There are currently issues with tree trimmer local capacities.	**PRV**	CC-20-2018, CoT-15-2012, RB-11-2018, TC-30-2018	x	x	x	x
Severe Storm	SS-07	Isolated and vulnerable population centers exist throughout the County. I.e. Rancho Tehama, Manton, Pondarosa Sky Ranch, Lake California and others.	**PE&A**	TC-21-2018	x			
Slope Failure	SF-01	There are existing homes and businesses along the west bank of the Sacramento River that are at risk to erosion and landslides due to river channel migration.	**PPRO**	CoT-26-2018, RB-02-2012, TC-25-2018			x	x
Slope Failure	SF-02	Slope stability issues are present along Rio Street and the river bend as well as Antelope Bridge and other areas along the Sacramento River.	**SP**	RB-02-2012			x	
Wildfire	WF-01	The need for public education and outreach will become greater as new residents move into the area who may not be familiar with the wildfire risk in the County. As climate change continues and conditions become drier, this will be even more relevant.	**PE&A, PRV**	TC-31-2018	x			
Wildfire	WF-02	Lack of vegetation management activities. Factors may include a lack of funding/ resources for property owners or an aging population who may be physically unable to perform mitigation actions.	**PPRO**	CoT-19-2012, TC-03-2018	x			X

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Wildfire	WF-04	The Tehama West Watershed faces the growing problem of expansion of residential development into increasingly remote and historically fire prone areas (Wildland Urban Interface aka WUI). These areas usually fall outside the boundaries of local fire districts and in State Responsibility Areas (SRA) that are handled by CalFire. This adds a new complication to standard wildland firefighting tactics.	**PRV, PPRO**	TC-02-2018, TC-04-2018, TC-05-2018, TC-25-2018, TC-31-2018	x			
Wildfire	WF-05	High wildfire risk within the Paynes-Antelope Hwy 36E Corridor CWPP Planning Unit. This includes populations and structures at risk near Dales, Paynes Creek, Ponderosa Sky Ranch Area, Lyman Springs, Jelly's Ferry Rd and Surrey Village.	**PPRO**	TC-02-2018	x			
Wildfire	WF-06	High wildfire risk within the Sacramento River Corridor. This includes populations and structures at risk near the communities of Surrey Village, Lake California and riparian areas of East Sand Slough near Antelope Blvd. Limited emergency access and multiple evacuation routes.	**PPRO**	TC-02-2018	x			
Wildfire	WF-07	High wildfire risk within the Cottonwood Beegum CWPP Planning Unit. This includes populations and structures at risk near the Bowman Area.	**PPRO**	TC-02-2018	x			
Wildfire	WF-08	High wildfire risk within the Battle Creek-Manton CWPP Planning Unit. This includes populations and structures at risk near the Manton area.	**PPRO**	TC-02-2018	x			

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Wildfire	WF-09	High wildfire risk within the Elder Creek CWPP Planning Unit. This includes populations and structures at risk near the Rancho Tehama area.	PPRO	TC-02-2018	x			
Wildfire	WF-10	High potential loss / essential facilities are located within high and very high wildfire severity zones: Manton, Plum Creek, Reeds Creek, Elkins and Flournoy schools and others.	PPRO	RB-08-2012, TC-04-2018	x		x	
Wildfire	WF-11	Corning's periodically arid climate, combined with extensive areas of grass and brush-covered open space and variable topography, create an ever-present threat of wild land fire. Extreme weather conditions, such as high temperatures, low humidity, and strong winds may cause an ordinary fire to expand into one of massive proportions. A high fuel load, resulting from years of accumulation, contributes to the problem. (2012 Corning Hazard Mitigation Plan)	PRV, PE&A	CC-25-2018		x		
Wildfire	WF-12	Abandoned orchards within the City of Corning boundaries and surrounding area/ sphere of influence increase the risk of fires.	PPRO	CC-25-2018		x		
Wildfire	WF-13	Portions WUI areas are not covered by Fire Hydrants or have exposure due fire department response times.	ES	RB-09-2018, RB-10-2018			x	

Hazard	Problem No.	Problem Description	Mitigation Alternative	Mitigation Action No.	County Wide	City of Corning	City of Red Bluff	City Of Tehama
Wildfire	WF-14	High wildfire risk within the Reeds Creek CWPP Planning Unit. This includes populations and structures at risk near the wildland urban interface near Red Bluff. Red Bluff areas of concern including areas near S. Jackson Street, Monroe Ave @ Walton Ave, and Monroe Ave @ HWY 36.	PPRO	RB-08-2012			x	
Wildfire	WF-15	Heavy Vegetation on Railroad property near northside of City.	PPRO	CoT-21-2018				x

5.3 Capabilities Assessment

The mitigation strategy includes an assessment of the County's planning and regulatory, administrative/technical and fiscal capabilities to augment known issues and weaknesses from identified natural hazards.

5.3.1 Local Planning and Regulatory Mitigation Capabilities

The information in Table 5-2 is used to construct mitigation actions aligned with existing planning and regulatory capabilities of the County. Planning and regulatory tools typically used by local jurisdictions to implement hazard mitigation activities are building codes, zoning regulations, floodplain management policies, and other municipal planning documents.

Table 5-2: Planning and Regulatory Mitigation Capabilities Summary

Hazard	Plan/Program/ Regulation	Responsible Agency	Comments
Multi-Hazard	Tehama County / California Building Code 2016 Edition	Building Dept.	The County has adopted the California Building Code 2016 Edition. The California Building codes protect buildings to the extent possible from natural occurring hazards.
Multi-Hazard	Tehama County General Plan Safety Element	Planning Department	The General Plan was updated in 2009. During the next update cycle, the approved local hazard mitigation plan will be adopted into the Safety Element of the General Plan.

Hazard	Plan/Program/ Regulation	Responsible Agency	Comments
Wildfire	Tehama East and Tehama West Community Wildfire Protection Plan Update 2017	Resource Conservation District of Tehama County	Much work has been completed for the 2018 update. Approximately 80% of the projects developed in the original Tehama East CWPP and roughly 40% of those described in the Tehama West Fire Plan have been implemented since the two plans were first approved by the Tehama County Board of Supervisors, Cal Fire, and the RCDTC's Board of Directors in 2008.
Flood/ Drought	2008 Tehama West Watershed Management Plan	Tehama County Flood Control and Water Conservation District	This plan prioritizes management actions to improve watershed conditions.
Flood/ Drought	Coordinated AB 3030 Groundwater Management Plan 2012	Tehama County Flood Control and Water Conservation District	The primary purpose of the Plan is to sustain groundwater levels that balance long-term extraction and replenishment. Annual recovery of spring groundwater levels after the previous summer season of more intensive groundwater extraction and following each winter season will be used to assess annual groundwater recharge.
Wildfire	2016 Unit Strategic Fire Plan	Tehama-Glenn Unit	The overall goal of the Tehama-Glenn Unit Fire Plan is to reduce fire suppression costs and losses from wildland fires within the Unit by protecting assets at risk through focused pre-fire management prescriptions and increased initial attack success.
Flood/ Drought	Water Inventory and Analysis September 2003	Tehama County Flood Control and Water Conservation District	The purpose of the Water Inventory and Analysis project is to provide: 1) a supplementary tool for water management; 2) a reference and educational tool; and 3) a stepping-stone toward full implementation of Tehama County's AB 3030 Groundwater Management Plan.
Wildfire	Tehama Wildlife Area Vegetation and Fuels Management Plan	Tehama County Resource Conservation District	The plan was revised 5-18-2011.

Hazard	Plan/Program/ Regulation	Responsible Agency	Comments
Flood	Tehama County Flood Mitigation Plan 2006	Tehama County Flood Control and Water Conservation District	The District initiated the preparation of this FMP to assess flood hazards and establish strategies to reduce flood hazards and repetitive losses within the County.
Multi-Hazard	Tehama County 2017 Emergency Operations Plan	Tehama County Sheriff's Department	The Plan was adopted in 2017.
Wildfire	Tehama County Fire Clearance Requirements	CAL FIRE / Tehama County Fire	Established fire and road clearances.
Wildfire	Tehama County Ordinance 1537, Section 914.071, PLC 4291	CAL FIRE / Tehama County Fire	Setback for Structure Defensible Space.
Wildfire	Tehama County Residential Development	CAL FIRE / Tehama County Fire	Set requirements for wildfire safety.
Flood	National Flood Insurance Program (NFIP)	Tehama County Flood Control and Water Conservation District	NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. As a participating member of the NFIP, the County has 945 policy owners.
Climate Change	The Sustainable Communities and Climate Protection Act of 2008	California Air Resources Board	Looks to reduce GHG emissions through coordinated transportation and land use planning with the goal of more sustainable communities. Regional targets are established for GHG emissions reductions from passenger vehicle use by the sustainable communities' strategy (SCS) established by each metropolitan planning organization (MPO).
Dam Failure	California Division of Safety of Dams	California's Division of Safety of Dams	Monitors the dam safety program at the state level.

Hazard	Plan/Program/ Regulation	Responsible Agency	Comments
Dam Failure	U.S. Army Corps of Engineers (USACE) Dam Safety Program	USACE	Performs safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act.
Dam Failure	Federal Energy Regulatory Commission (FERC) Dam Safety Program	FERC	The FERC cooperates with a large number of federal and state agencies to ensure and promote dam safety and, more recently, homeland security.
Drought	Statewide Emergency Water Conservation Regulations	State of California	2014 Emergency water conservation regulations.
Drought	2014 Sustainable Groundwater Management Act	State of California	The Tehama County Groundwater Sustainability Agency (GSA) was recognized by DWR as the exclusive GSA for all portions of the alluvial groundwater subbasins located within Tehama County. The GSA will develop a Groundwater Sustainability Plan that will be complainant with the regulation and detail actions needed to sustainability manage the groundwater resources within the County.
Drought	2012 Tehama County Groundwater Management Plan	Tehama County Flood Control and Water Conservation District	The purpose of this plan is to sustain groundwater levels that balance long-term extraction and replenishment.
Drought	California Water Plan	State of California	Strategic plan elements including a vision, mission, goals, guiding principles, and recommendations for current water conditions, challenges and activities.
Flood	Floodplain Management Regulations	Tehama County Building and Safety Department	Tehama County adopted Floodplain Management Regulations (Code Chapter 15.52) effective July 1, 1999. The purpose of the regulations is to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas.

Hazard	Plan/Program/ Regulation	Responsible Agency	Comments
Slope Failure	County Ordinance 9.43.330 - Erosion Control	Tehama County Building and Safety Department	Erosion control plan and design standards.
Slope Failure	County Ordinance 9.43.340 - Grading plan and inspection	Tehama County Building and Safety Department	All engineered grading requires a grading plan prepared by a civil engineer prior to commencement of work. A soil engineering report shall be prepared for each grading plan prepared by a civil engineer.
Drought	County Ordinance 2006- Groundwater Aquifer Protection Ordinance	Tehama County Environmental Health	Ordinance 2006 was adopted in response to the 2014 drought (which lasted until 2017). The Ordinance requires a permit for extraction of groundwater use off-parcel.

5.3.2 Administrative and Technical Capabilities

Table 5-3 lists the County's administrative and technical capabilities.

Table 5-3: Tehama County Administrative and Technical Capabilities

Staff/Personnel Resources	Dept. / Agency	Comments
Planners (with land use / land development knowledge)	Planning Department	
Planners or engineers (with natural and/or human caused hazards knowledge)	Public Works Dept., Engineering Division; Utilities Dept., Planning Department	
Engineers or professionals trained in building and/or infrastructure construction practices (includes building inspectors)	Public Works Dept.; Operations and Maintenance	
Floodplain Management	Tehama County Flood Control, Water Conservation District, Tehama County Floodplain Administrator, Certified Floodplain Manager staff from Participating Jurisdictions	To expand these capabilities, training can be provided to staff to provide outreach to communities on mitigation activities people can perform on their homes and businesses.

Staff/Personnel Resources	Dept. / Agency	Comments
Land / Building surveyors	N/A	
Personnel skilled in Geographic Information Systems (GIS) and/or FEMA's HAZUS program	Tehama County Public Works and Tehama County Transportation Commission staff	
Grant writers or fiscal staff to handle large/complex grants	Tehama City Tehama County Public Works Tehama County Flood Control Tehama County RCD	
Construction Equipment	Public Works Dept.	
Emergency Management Personnel	Tehama County Sherriff, California Highway Patrol	To expand these capabilities, training can be provided to staff to provide outreach to communities on mitigation activities people can perform on their homes and businesses.
Care and Sheltering	American Red Cross of Northeastern California (3609 Bechelli Lane, Unit I Redding, CA 96099)	Care and sheltering during extreme heat conditions, will provide sheltering and support services for fire victims.

5.3.3 Fiscal Capabilities

This section identifies the financial tools or resources that the County could potentially use to help fund mitigation activities. Fiscal capabilities include County-specific as well as State and Federal resources.

5.3.3.1 Local Fiscal Resources

Table 5-4 provides summary local fiscal capabilities. There are several governmental funds and revenue raising activities that can be allocated for hazard mitigation activities.

Table 5-4: Local Fiscal Capabilities Table

Financial Resources	Dept. / Agency	Comments
General Fund Revenue	Tehama County Board of Supervisors	$27,813,564 *recommended revenue appropriations.* To expand this capability, new income sources can be created to fund mitigation projects.

Financial Resources	Dept. / Agency	Comments
Public Safety Fund	Tehama County Board of Supervisors	$10,310,116 *estimated program revenues*
Public Works Road Fund	Tehama County Board of Supervisors	*Unknown, but will continue to decrease*
State and County Community Development Dept. Block Grants (CDBG)	California Dept. of Housing and Community Development Dept. (HCD)	Programs Include: Community Development (CD) Economic Development (ED) Disaster Recovery Initiative (DRI) Neighborhood Stabilization Program (NSP)
Self-Help Home Improvement Project (SHHIP)	SHHIP	In the last year SHHIP weatherized and/or repaired 1,800 homes and assisted 1,500 residents with utility payments. Mutual Self-Help Program has helped over 140 families build their own homes.

5.3.3.2 State and Federal Fiscal Resources

To augment local resources, Table 5-5 provides a list of potential funding programs and resources provided by State and Federal agencies and programs which can be used for local hazard mitigation activities.

Table 5-5: State and Federal Fiscal Resources

Agency / Grant Name	Potential Programs/Grants
California DWR Proposition 50/84: **Integrated Regional Water Management (IRWM) Program.**	***DWR has a number of IRWM grant program funding opportunities. Current IRWM grant programs include planning, implementation, and storm water flood management.*** http://www.water.ca.gov/irwm/grants/index.cfm Proposition 84, the Safe Drinking Water, Water Quality, and Supply, Flood Control, River and Coastal Protection Bond Act, which provides $1,000,000,000 (P.R.C. §75001-75130) for IRWM Planning and Implementation. CA Dept. of Water Resources' Flood Emergency Response Projects are posted on the webpage at: http://www.water.ca.gov/floodmgmt/hafoo/fob/floodER/
California Housing and Community Development (HCD) Emergency Solutions Grant (ESG) Program	***To fund projects that serve homeless individuals and families with supportive services, emergency shelter/transitional housing, assisting persons at risk of becoming homeless with homelessness prevention assistance, and providing permanent housing to the homeless population. The Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act of 2009 places new emphasis on assisting people to quickly regain stability in permanent housing after experiencing a housing crisis and/or homelessness.*** http://www.hcd.ca.gov/fa/esg/index.html
CalTrans Division of Local Assistance / Safe Routes to School Program	California Dept. of Transportation. Federal funding administered via Caltrans. Local 10% match is the minimum requirement. http://www.dot.ca.gov/hq/LocalPrograms/saferoutes/saferoutes.htm Active transportation grant program. Creating mobility and connectivity. Prioritize projects, and preparation of PED for active transportation projects.
Property Assessed Clean Energy (PACE) Programs	PACE financing allows property owners to fund energy efficiency, water efficiency and renewable energy projects with little or no up-front costs. With PACE, residential and commercial property owners living within a participating district can finance up to 100% of their project and pay it back over time as a voluntary property tax assessment through their existing property tax bill.

Agency / Grant Name	Potential Programs/Grants
U.S. Dept. of Energy / Energy Efficiency and Conservation Block Grant Program	***Provides funding for weatherization of structures and development of building codes/ordinances to ensure energy efficiency and restoration of older homes.*** http://www1.eere.energy.gov/wip/eecbg.html
Dept. of Homeland Security (DHS) / FEMA Grants	For more information on current grants visit: http://www.fema.gov/grants Grants Under DHS include: EMPG: Good for Equipment and Back Up Generators Etc… HMGP
Cal OES / Proposition 1B Grants Programs	The Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006, approved by the voters as Proposition 1B at the November 7, 2006 general election, authorizes the issuance of nineteen billion nine hundred twenty five million dollars ($19,925,000,000) in general obligation bonds for specified purposes, including grants for transit system safety, security, and disaster response projects. http://www.caloes.ca.gov/cal-oes-divisions/grants-management/homeland-security-prop-1b-grant-programs/proposition-1b-grant
California Proposition 1: the Water Bond (AB 1471)	Authorize $7.545 billion in general obligation bonds for state water supply infrastructure projects, such as public water system improvements, surface and groundwater storage, drinking water protection, water recycling and advanced water treatment technology, water supply management and conveyance, wastewater treatment, drought relief, emergency water supplies, and ecosystem and watershed protection and restoration. The State Water Resources Control Board (State Water Board) will administer Proposition 1 funds for five programs. The estimated implementation schedule for each is outlined in Five Categories: ▪ Small Community Wastewater ▪ Water Recycling ▪ Drinking Water ▪ Stormwater ▪ Groundwater Sustainability http://www.waterboards.ca.gov/water_issues/programs/grants_loans/proposition1.shtml

Agency / Grant Name	Potential Programs/Grants
Assistance to Firefighters Grant Program (AFG); Fire Prevention and Safety (FP&S)	The primary goal of the FP&S Grants is to enhance the safety of the public and firefighters with respect to fire and fire-related hazards. The Grant Programs Directorate administers the FP&S Grants as part of the AFG Program. FP&S Grants are offered to support projects in two activity areas: 1). Fire Prevention and Safety (FP&S) Activity Activities designed to reach high-risk target groups and mitigate the incidence of death and injuries caused by fire and fire-related hazards. 2). Research and Development (R&D) Activity To learn more about how to prepare to apply for a project under this activity, please see the FP&S Research and Development Grant Application Get Ready Guide. https://www.fema.gov/fire-prevention-safety-grants
HazMat Emergency Preparedness Grant	The purpose of this grant program is to increase effectiveness in safely and efficiently handling hazardous materials accidents and incidents; enhance implementation of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA); and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations. http://www.caloes.ca.gov/cal-oes-divisions/fire-rescue/hazardous-materials/hazmat-emergency-preparedness-grant
CERT Program Manager Course	The purpose of this Community Emergency Response Team (CERT) Program Manager course is to prepare CERT Program Managers for the tasks required to establish and sustain an active local CERT program. http://www.californiavolunteers.org/index.php/CERT/PM/
The California Residential Mitigation Program	The California Residential Mitigation Program (CRMP) was established to carry out mitigation programs to assist California homeowners who wish to seismically retrofit their houses. http://www.californiaresidentialmitigationprogram.com/
Earthquake Brace + Bolt (EBB)	EBB was developed to help homeowners lessen the potential for damage to their houses during an earthquake by offering eligible homeowners up to a $3,000 incentive to seismically retrofit their homes. https://www.earthquakebracebolt.com/

Agency / Grant Name	Potential Programs/Grants
California Air Resources Board Air Pollution Incentives, Grants and Credit Programs	These programs have hundreds of millions of dollars in grants available over the next several years to reduce emissions from on- and off-road vehicles and equipment. https://www.arb.ca.gov/ba/fininfo.htm

5.4 Guiding Principle, Goals and Objectives

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). The steering committee established a guiding principle, a set of goals and measurable objectives for this plan, based on data from the preliminary risk assessment and the results of the public involvement strategy.

Goals and objectives discussed in this section help describe what actions should occur, using increasingly narrow descriptors. Long-term goals are developed which can be accomplished by objectives. To achieve the stated objectives, "mitigation actions" provide specific measurable descriptors on how to accomplish the objective. The goals, objectives, and actions form the basis for the development of a Mitigation Action Strategy and specific mitigation projects to be considered for implementation. The process consists of 1) setting goals and objectives, 2) considering mitigation alternatives, 3) identifying strategies or "actions", and 4) developing a prioritized action plan resulting in a mitigation strategy.

The guiding principle, goals, objectives and actions in this plan all support each other. Goals were selected to support the guiding principle. Objectives were selected that met multiple goals. Actions were prioritized based on their ability to achieve multiple objectives.

5.4.1 Guiding Principle

A guiding principle focuses the range of objectives and actions to be considered. This is not a goal because it does not describe a hazard mitigation outcome, and it is broader than a hazard-specific objective. The guiding principle for the Tehama County 2018 Multi-Jurisdictional Hazard Mitigation Plan Update is as follows:

"Through mitigation, reduce the vulnerability to natural hazards in order to protect the health, safety, welfare and economy of the residents and communities."

5.4.2 Goals

The effectiveness of a mitigation strategy is assessed by determining how well the goals of the strategy are achieved. The following are the goals for this plan:

Goal #1: Enable residents to mitigate the impacts of hazards and disasters.

Goal #2: Improve coordination of stakeholders to reduce risk through mitigation planning on a continual basis.

Goal #3: Implement long-term, cost-effective, mitigation activities for the current and future built environment.

5.4.3 Objectives

Each selected objective meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities. The objectives are as follows:

1. ***Educate the public on the risk from natural hazards.***
2. ***Support and encourage mitigation measures for homeowners and business owners in high-risk areas.***
3. ***Maintain and make available maps of identified risk areas, and improve early warning emergency response systems.***
4. ***Increase resilience of infrastructure and critical facilities.***
5. ***Establish partnerships among government, businesses and communities to implement mitigation activities***
6. ***Consider the impacts of natural hazards for future development.***

5.5 County Wide Mitigation Actions

Based upon planning committee priorities, risk assessment results, and mitigation alternatives, mitigation actions were developed. Most importantly, the newly developed mitigation actions acknowledge updated risk assessment information outlined in Section 4. Mitigation actions presented in Table 5-6 establishes 35 possible mitigation actions. Some mitigation actions support ongoing County activities, while other actions are intended to be completed when funding is available. Regardless, mitigation actions will be part of an annual review.

5.5.1 Prioritization of Mitigation Actions

Common failures of a mitigation plan involve the prioritization of mitigation actions for future implementation. Implementing the identified mitigation can be overwhelming for any local jurisdiction, especially with limited staffing and fiscal resources. To ensure that Tehama County's MJHMP reflects a reality of what the County can do with its available resources, mitigation actions are prioritized with benefit cost review, public input, and MJHMP Planning Committee agreement. This method assists the County to direct resources appropriately during particular planning windows.

5.5.1.1 Cost / Benefit Review

The action plan must be prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The cost / benefit analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects. Cost ratings were defined as follows:

- **High—**Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
- **Medium—**The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- **Low—**The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Benefit ratings were defined as follows:

- **High—**Project will provide an immediate reduction of risk exposure for life and property.
- **Medium—**Project will have a long-term impact on the reduction of risk exposure for life and property, or project will not provide an immediate reduction in the risk exposure for property.
- **Low—**Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For many of the strategies identified in this action plan, the partners may seek financial assistance under the HMGP or PDM programs, both of which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For projects not seeking financial assistance from grant programs that require detailed analysis, the partners reserve the right to define “benefits” according to parameters that meet the goals and objectives of this plan.

5.5.1.2 Public Input

A 17 question community survey was distributed to the public, yielding 77 survey responses and useful insight into the community’s perception of natural hazards affecting Tehama County. Specific question responses heavily influenced the prioritization of mitigation actions, including:

- 81.8% of survey respondents believe their property is at risk from a natural hazard disaster and 46.9% of those residents think their greatest risk is from flooding.
- The majority of respondents (22.1 %) said they would be willing to spend $1,000- $4,999 at one time to protect their home, while 20.8% said they’d be willing to spend $5,000- $9,999 and another 20.8% said they were not sure how much they would be willing to spend.
- 60.6% of respondents said insurance premium discounts would encourage them to protect their homes against natural hazards.

The complete survey results can be found in Appendix B.

5.5.2 Mitigation Action Plan

Based upon the Planning Committee consensus, Table 5-6 lists each priority mitigation action. For Priority mitigation actions Implementation plans are made available in the Action Planner Annex. Implementation plans in Action Planner Annex identify the responsible party, time frame, potential funding source, implementation steps and resources needed for implementation. For this Plan, time frames are defined as follows:

- Short Term- 1-3 years
- Mid Term- 3-5 years
- Long Term- 5 years or more

The detail in the Action Planners meet the regulatory requirements of FEMA and DMA 2000. The actions detailed in Table 5-6 contain both new action items developed for this Plan Update as well as old actions that were yet to be completed from the 2012 plan. The action numbers indicate whether the action is new or from the 2012 plan. A sample of the action number nomenclature is presented in Figure 5-1.

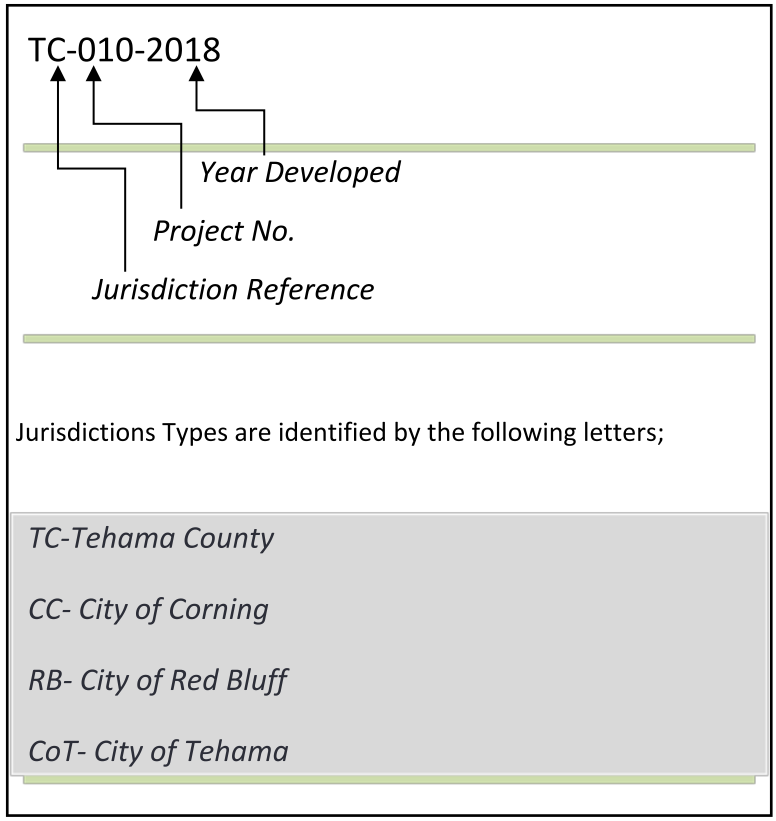

Figure 5-1: Mitigation Action Number Key.

Section 2, What's New, contains the details for each 2012 mitigation action and indicates whether a given action item has been completed, deleted, or deferred.

The Action Planner Annex (Annex A), includes the mitigation implementation strategy for all County "priority actions". The jurisdictional specific sections in Volume 2 also include Action Planner Annexes for each respective participating jurisdiction. For Priority mitigation actions, the Action Planner Annex identifies the responsible party, time frame, potential funding source, implementation steps and resources needed for implementation. The detail in the Action Planners meet the regulatory requirements of FEMA and DMA 2000.

Important to note: The Planning Committee realizes that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions, and edit existing actions as necessary as long as they conform to the overall goals of the plan.

Table 5-6: County Wide Mitigation Action Tracker

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
TC-02-2018	Wildfire	Continue to review and implement CWPP Mitigation Actions with HMGP.	PRV	Tehama County RCD / CAL FIRE Tehama Glenn Unit	HMGP / Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Medium / High	Implementation has been occurring for several years and this is an on-going action.	Y
TC-03-2018	Wildfire	Implement fuel reduction measures around Critical Facilities such as schools and other gathering facilities.	PRV, PPRO	CAL FIRE Tehama Glenn Unit	PA Post Disaster Mitigation Funding.	Short Term	Medium / High	Community Wildfire Protection Plans (CWPPs).	
TC-04-2018	Wildfire	Develop defensible space program for disabled / unable residents.	PRV	CAL FIRE Tehama Glenn Unit / Tehama RCD	HMGP / Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Medium / High	Community Wildfire Protection Plans (CWPPs).	Y
TC-05-2018	Wildfire	Construct / expand water supply for hydrants in rural residential areas.	SP	Tehama County Public Works	Assistance to Firefighters Grant Program (AFG); Fire Prevention and Safety (FP&S)	Short Term	High / High	Water/ Flood Management Plans	
TC-06-2018	Flood	Make gauge information readily available on water levels and educate public on readings i.e. what does gauge elevations mean in a localized area.	SP	Tehama County Flood Control and Water Resources	HMGP / Pre-Disaster Mitigation Grant Program (PDM)	Short Term	low / High	Water/ Flood Management Plans	
TC-07-2018	Flood	Continue outreach program to provide information needed to increase awareness and modify actions to reduce flood damage, encourage flood insurance coverage and protect natural functions of floodplains.	PPRO	Tehama County Flood Control and Water Resources	County Personnel Time	Short Term	HIGH / High	Implementation has been occurring for several years and this is an on-going action.	
TC-08-2018	Flood	Develop flood hazard areas beyond FEMA regulatory flood zones.	PRV	Tehama County Flood Control and Water Resources	DWR	Short Term	Medium / High	Water/ Flood Management Plans	
TC-09-2018	Flood	Map RL Properties and conduct RL Area Analysis	PE&A	Tehama County Flood Control and Water Resources	FMA	Short Term	HIGH / High	Water/ Flood Management Plans	
TC-10-2018	Flood	Rehab and improve Deer Creek and Elder Creek levees to provide 100-YR flood protection.	PRV, PPRO	Tehama County Flood Control and Water Resources	FMA	Mid Term	Low / Low	Water/ Flood Management Plans	
TC-11-2018	Flood	Formally survey high water marks to establish historic flooding depths.	PRV	Tehama County Flood Control and Water Resources	Staff Time, General Fund	Short Term	Low / Low	Water/ Flood Management Plans	Y

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
TC-12-2018	Flood	Inform Residents of impacts that could be caused by re-routing drainage features and importing fill into floodplains. I.e. No Adverse Impact concept for neighbors and other adjacent properties.	SP, PRV, PPRO	Tehama County Flood Control and Water Resources	General Fund	Short Term	Low / High	Water/ Flood Management Plans	
TC-13-2018	Flood	Continue to encourage residents to clear vegetation and maintain drainage / tributaries.	SP, PRV, PPRO	Tehama County Flood Control and Water Resources	General Fund	Short Term	Low / High	Implementation has been occurring for several years and this is an on-going action.	
TC-14-2018	Flood	Provide assistance to residents for flood proofing wellheads in areas of known flood risk.	PRV, PPRO	Tehama County Flood Control and Water Resources	EPA and DWR	Short Term	High / High	Water/ Flood Management Plans	
TC-15-2018	Flood	Construct or improve flood control infrastructure to protect residents and property surrounding Salt Creek.	PE&A	Tehama County Flood Control and Water Resources	Flood Mitigation Assistance Grant Program (FMA)	Short Term	High / High	Water/ Flood Management Plans	Y
TC-16-2018	Flood	Construct HWY 36 as an armored levee to remove flood risk from neighborhood on east side of 36.	SP, PRV	Tehama County Flood Control and Water Resources	Flood Mitigation Assistance Grant Program (FMA)	Long Term	High / High	Water/ Flood Management Plans	
TC-17-2018	Flood	Construct flood control infrastructure to protect residents and property surrounding Antelope Creek in the Dairyville Area.	PRV, PPRO	Tehama County Flood Control and Water Resources	Flood Mitigation Assistance Grant Program (FMA)	Short Term	High / High	Water/ Flood Management Plans	Y
TC-18-2018	Flood	Conduct drainage improvements to Jewett Creek between Kirkwood and Margarette Road.	PRV	Tehama County Flood Control and Water Resources	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	Medium / High	Water/ Flood Management Plans	
TC-19-2018	Severe Storm	Construct Back Up power infrastructure for Critical Facilities including Public Works and shelters identified on County Sheltering Plan	SP	Tehama County Public Works	EMPG, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Medium / High	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	Y
TC-20-2018	Severe Storm	Construct / enhance communication and networking at Red Bluff Community Center.	ES	Tehama County Public Works	General Fund	Short Term	Medium / Medium	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	
TC-21-2018	Severe Storm	Provide isolated populations with evacuation and emergency plans online.	SP	Tehama County Planning Department	General Fund	Short Term	Low / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	Y

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
TC-22-2018	Flood	Install gauges on flashy and creeks and provide real-time data to county website.	PE&A	Tehama County Flood Control and Water Resources	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Low / Low	Water/ Flood Management Plans	Y
TC-23-2018	Dam Failure	Integrate dam inundation zones into reverse 911 / Everbridge / Tehama Alert system.	PRV	Tehama County Flood Control and Water Resources	General Fund	Short Term	Low / Medium	EOP / EAPs	Y
TC-24-2018	Dam Failure	Map non-regulated dams.	PRV, PPRO	Tehama County Flood Control and Water Resources	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	High / Low	Water/ Flood Management Plans	
TC-26-2018	Drought	Continue to develop and promote water conservation programs.	PRV, PE&A, NRP	Tehama County Flood Control and Water Resources	General Fund	Short Term	Medium / Low	Implementation has been occurring for several years and this is an on-going action.	
TC-27-2018	Drought	Construct passive aquifer recharge facilities / infrastructure	SP	Tehama County Flood Control and Water Resources	Hazard Mitigation Grant Program (HMGP)	Mid Term	High / High	Water/ Flood Management Plans	
TC-28-2018	Drought	Construct additional monitoring wells for ground water monitoring	SP	Tehama County Flood Control and Water Resources	General Fund	Mid Term	High / low	Water/ Flood Management Plans	
TC-29-2018	Drought	Provide more information to residents on ground water and the effects of wells on water futures.	PE&A	Tehama County Flood Control and Water Resources	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Low / medium	Water/ Flood Management Plans	
TC-30-2018	Severe Storm	Educate residents on the possibilities of high winds when substantial improvements are conducted.	PE&A	Tehama County Building and Safety	General Fund	Short Term	Low / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	
TC-31-2018	Wildfire	Increased or enhanced real estate disclosures for wildfire risk in Tehama County	PE&A, PRV, PPRO	Tehama County Building and Safety	General Fund	Short Term	Low / Low	Community Wildfire Protection Plans (CWPPs).	
TC-32-2018	Drought	Identify communities that may have water shortages in drought years and identify potential solutions.	PRV, NRP	Tehama County Flood Control and Water Resources	General Fund	Short Term	Low / low	Water/ Flood Management Plans	
TC-33-2018	Severe Storm	Assist Residential Care Facilities to have staff trained on evacuation procedures.	PRV	Tehama County Public Guardian/ Administrator, Tehama County Health Services Agency	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Low / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
TC-34-2018	Earthquake	Conduct liquefaction mapping efforts to enhance seismic risk assessments.	PRV	Tehama County Public Works	General Fund	Short Term	Medium/ High	Building/ Development Codes and Zoning Ordinances	
TC-35-2018	Flood	Install permanent "Turn Around, Don't Drown" signs along Saron Fruit Colony Road and Jellys Ferry Road.	PE&A	Tehama County Public Works	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	

Table 5-7: City of Corning Mitigation Action Tracker

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
CC-01-2018	Flood	Develop the ability to document damage and high-water marks within the City of Corning. This will provide historical flooding in areas beyond the SFHA.	PRV	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Short Term	Medium / Low	Water/ Flood Management Plans	
CC-02-2012	Flood	Public Outreach Program (Develop and maintain public awareness education for protecting private property from all hazard's effects.)	PE&A	City of Corning Public Works	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	HIGH / High	Water/ Flood Management Plans	
CC-03-2012	All Hazard	Upgrade City Council Chambers Electrical and Communication systems to accommodate Emergency Response Center (EOC).	SP, PRV	City of Corning Public Works	General Fund	Short Term	Low / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	
CC-04-2018	Flood	Inform Residents of impacts that could be caused by re-routing drainage features. I.e. No Adverse Impact concept for neighbors and other adjacent properties.	PE&A	City of Corning Public Information	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	
CC-05-2018	Flood	Develop blanket maintenance and operation agreement with MOU with Cal Fish Game for maintenance. Identify stream beds and other drainage corridors for debris removal.	PRV, NRP	City of Corning Public Works	General Fund	Short Term	Low / High	Water/ Flood Management Plans	Y
CC-06-2012	Flood	Conduct a study of solution options and regulatory studies for increasing drain capacity under the railroad bridge at Jewett Creek and the Railroad Bridge.	SP, PRV	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA), Hazard Mitigation Grant Program (HMGP)	Short Term	Low / High	Water/ Flood Management Plans	Y
CC-07-2012	Flood	Continue drainage cleaning at the Jewett Creek Bridge (Kirkwood Road).	PRV	City of Corning Public Works	General Fund	Short Term	High / High	Implementation has been occurring for several years and this is an on-going action.	
CC-08-2012	Flood	Conduct a study of solution options to fix the flooding issues at Blackburn Moon Drain.	SP, PRV	City of Corning Public Works	General Fund, Flood Mitigation Assistance Program (FMA)	Short Term	High / High	Water/ Flood Management Plans	

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
CC-09-2012	Flood	Redesign and replace 2 small pipes previously installed to replace a collapsed culvert on Third Street.	SP	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Short Term	High / High	Water/ Flood Management Plans	
CC-10-2012	Flood	Upgrade / Reconstruct portions of Storm Drain System to include Blackburn and Third Street Culverts.	SP	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	High / High	Water/ Flood Management Plans	Y
CC-11-2012	Flood	Elevate Home Program (Develop a program to assist citizens in elevating their homes which are located in the SFHA)	PPRO, PRV	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	Medium / High	Water/ Flood Management Plans	
CC-12-2012	Flood	Conduct a feasibility study to mitigate drainage / flood hazard at 2104 SOLANO ST. in the flood drainage area then create a retention basin.	PPRO, PRV, SP	City of Corning Public Works	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	Y
CC-13-2012	Flood	Trash Pumps (additional 1-6 inch) (Purchase one additional 6 inch Trash Pump mounted on trailer for mobility. The Trash Pump would be used to augment an existing pump used for the removal excessive water and debris from flooded storm drains.) In addition to Trash Pump, purchase five (5) Discharge Suction Hoses (Purchase five 400 ft. discharge suction hoses for pumps used to discharge flood water.)	PRV	City of Corning Public Works	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	
CC-14-2012	Flood	Property Development Program (Develop City ordinances to address future housing developments in hazard prone areas, beyond 100 YR floodplain.)	PRV, PPRO	City of Corning Planning Consultant	General Fund	Short Term	Medium / High	Water/ Flood Management Plans	
CC-15-2018	Flood	Double check site conditions and SFHA elevation vs. building first floor elevation at Centennial High School. Inform, Corning PD of flood risk at High School for emergency operations.	PRV	City of Corning Public Works	General Fund	Short Term	Medium / Medium	Water/ Flood Management Plans	
CC-16-2018	Flood	Upgrade / Replace or Construct new drainage infrastructure for undersized dry wells across the city.	SP	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	Low / Low	Water/ Flood Management Plans	Y
CC-17-2018	Flood	Develop the ability to document damage and high-water marks within the City of Corning. This will provide historical flooding in areas beyond the SFHA.	PRV	City of Corning Public Works	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	
CC-18-2012	Severe Storm	Public Works Corporate Yard Generator (Procure a 30KW generator to operate Public Works Maintenance Operations Yard during a loss of utility service.)	PRV	City of Corning Public Works	General Fund	Short Term	Low / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
CC-19-2012	Severe Storm	50KW Mobile Generator with trailer (Procure a 50KW generator mounted on a trailer would provide backup electricity for pumping gas, flood control; pump stations, storm and emergency backup power for an evacuation shelter.)	PRV	City of Corning Public Works	General Fund	Short Term	Low / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	
CC-20-2018	Severe Storm	Develop hazard tree replacement / care program.	PRV, PPRO	City of Corning Public Works	General Fund	Short Term	Low / High	Tehama County General Plan	
CC-21-2018	Earthquake	Develop Seismic Upgrade Program for local business / gathering facilities that were built before benchmark years.	PRV	City of Corning Building and Safety	General Fund, Hazard Mitigation Grant Program (HMGP)	Short Term	Low / Low	County Building/ Development Codes and Zoning Ordinances	
CC-22-2018	Earthquake	Construct Seismic Upgrades to city owned infrastructure.	PPRO	City of Corning Public Works, City of Corning Building and Safety	General Fund, Hazard Mitigation Grant Program (HMGP)	Long Term	High / High	County Building/ Development Codes and Zoning Ordinances	
CC-23-2018	Drought	Construct or install groundwater monitoring wells or upgrade existing water wells to monitor aquifer levels and water quality.	NRP, PRV	City of Corning Public Works	General Fund	Mid Term	High / High	Water/ Flood Management Plans	
CC-24-2018	Drought	Develop alternative sources/additional wells for water supply for (Corning) residents	PRV	City of Corning Public Works	General Fund	Long Term	High / High	Water/ Flood Management Plans	
CC-25-2018	Wildfire	Continue to enforce the Burning Regulations and Weed Abatement (set by Chapter 8.12 and 8.14 of the City's municipal code) .	PRV	City of Corning Code Enforcement	General Fund	Short Term	Low / High	Implementation has been occurring for several years and this is an on-going action.	
CC-26-2018	Flood	Construct Storm drain improvements on Toomes Avenue between Blackburn Avenue to Jewitt Creek; private property	SP	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	Low / Medium	Water/ Flood Management Plans	**Y**
CC-27-2018	Flood	Construct Storm drain improvements on Edith Avenue from Blackburn Avenue to Jewett Creek; private property and local businesses	SP	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	Medium / Low	Water/ Flood Management Plans	**Y**
CC-28-2018	Flood	Construct Storm drain improvements to reduce localized flooding on Fig Lane & Chicago between RR tracks and West Street (including flooding from Woodson Bridge at 6th Street)	SP	City of Corning Public Works	Flood Mitigation Assistance Grant Program (FMA)	Mid Term	HIGH / High	Water/ Flood Management Plans	**Y**

Table 5-8: City of Red Bluff Mitigation Actions

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
RB-01-2018	Flood	Continue outreach program to provide information needed to increase awareness and modify actions to reduce flood damage, encourage flood insurance coverage and protect natural functions of floodplains.	**PE&A**	City of Red Bluff Public Works	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	**LOW/LOW**	Implementation has been occurring for several years and this is an on-going action.	**1**
RB-02-2012	Slope Failure	Install hillside stabilization and river bank armoring, rip-rap or gabion improvements on Red Bluff Hill and in the Sacramento River from Union Street along Rio Street north of Cedar Street to Hickory Street south of Cedar Street along Rio Street to prevent future mudslides/landslides, property slumping, road failure and infrastructure collapse.	**SP**	City of Red Bluff Public Works	Hazard Mitigation Grant Program (HMGP)	Mid Term	**HIGH/LOW**		
RB-02-2018	Flood	Work with Cal DFW to develop programmatic permit to remove vegetation and to conducted regular maintenance in stream channels.	**PRV**	City of Red Bluff Public Works	General Fund	Short Term	**LOW/HIGH**	Water/ Flood Management Plans	**7**
RB-03-2012	Flood	Ensure that new development is designed to reduce or eliminate flood damage by requiring lots and rights-of-way to be laid out for the provisions of approved sewer and drainage facilities, providing on-site detention facilities as required.	**PRV, PPRO**	City of Red Bluff Planning Department	General Fund	Mid Term	**LOW/LOW**	Building/ Development Codes and Zoning Ordinances	
RB-03-2018	Flood	Reduce potential inflow & infiltration issues in City infrastructure due to more frequent and heavy rain events as a result of Climate Change.	**SP, PRV**	City of Red Bluff Public Works	Flood Mitigation Assistance Program (FMA)	Mid Term	**MEDIUM/MEDIUM**	Water/ Flood Management Plans	**5**
RB-04-2012	Flood	Make sandbags available to residents in anticipation of severe rainstorms or known flood events, deliver materials to critical infrastructure and provide public information on where these materials are stored and how to obtain them.	**PRV**	City of Red Bluff Public Works	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	**LOW/LOW**	Water/ Flood Management Plans	**6**
RB-04-2018	Earthquake	Construct Seismic Upgrades to city owned infrastructure not meeting current seismic standards.	**SP, PRV**	City of Red Bluff Public Works	Hazard Mitigation Grant Program (HMGP)	Long Term	**HIGH/LOW**	Building/ Development Codes and Zoning Ordinances	**9**
RB-05-2018	Earthquake	Develop Seismic Upgrade Program for local business / gathering facilities that were built before benchmark years.	**PRV**	City of Red Bluff Building Department	General Fund	Mid Term	**MEDIUM/LOW**	Building/ Development Codes and Zoning Ordinances	**4**
RB-06-2012	Flood	Clear drainage facilities of trash, debris, overgrown vegetation, dead and downed trees and shrubs prior to rainy season.	**PRV**	City of Red Bluff Public Works	General Fund	Short Term	**LOW/MEDIUM**	Water/ Flood Management Plans	**2**
RB-06-2018	Dam Failure	Educate public on evacuation procedures for dam failure and other hazards.	**PE&A**	City of Red Bluff Public Works	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	**LOW / MEDIUM**	General Plan Update	

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
RB-07-2018	Drought	Construct new ground water recharge facilities / drainage facilities to offset drought years and to recharge ground water aquifers.	SP, PRV	City of Red Bluff Public Works	General Fund	Long Term	HIGH/MEDIUM	Water/ Flood Management Plans	
RB-08-2012	Wildfire	Clear fuels/overgrowth/dead and downed vegetation in City / school district owned properties.	PRV	City of Red Bluff Fire Department	General Fund	Short Term	LOW/LOW	Community Wildfire Protection Plans (CWPPs).	8
RB-08-2018	Drought	Develop and promote water conservation programs.	NRP, PRV	City of Red Bluff Public Works- Water Department	General Fund	Short Term	LOW/MEDIUM	Water/ Flood Management Plans	9
RB-09-2012	Flood	Retrofit and maintain existing storm drain system to insure full capacity is utilized.	SP	City of Red Bluff Public Works	General Fund	Short Term	MEDIUM/ MEDIUM	Water/ Flood Management Plans	
RB-09-2018	Wildfire	Extend/ add domestic water fire lines to areas of known wildland fire risk.	SP, ES	City of Red Bluff Fire Department, City of Red Bluff Public Works	General Fund, Hazard Mitigation Grant Program (HMGP)	Mid Term	HIGH/LOW	Community Wildfire Protection Plans (CWPPs).	2
RB-10-2018	WIldfire	Construct new Fire Station near southern end of Red Bluff to decrease response times and suppress potential wildland fires in open grasslands near airport.	SP	City of Red Bluff Fire Department	Hazard Mitigation Grant Program (HMGP)	Long Term	HIGH/ LOW	Community Wildfire Protection Plans (CWPPs).	
RB-11-2018	Severe Storm	Create a hazard tree maintenance and replacement program for aging street trees.	PRV	City of Red Bluff Public Works	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term		General Plan Update	

Table 5-9: City of Tehama Mitigation Actions

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
CoT-01-2018	Flood	Refer development proposals that impact flood protection to other agencies as applicable, including Army Corps, FEMA. Require drainage plans.	PRV	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	
CoT-02-2012	Flood	Continue outreach program to provide information needed to increase awareness and modify actions to reduce flood damage, encourage flood insurance coverage and protect natural functions of floodplains. Seek CRS classification improvements i.e. better and more often outreach, Promotion of flood insurance to local residents and alert and warning of possible flood depths.	PE&A	City of Tehama City Clerk/ Admin	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Low / Low	Implementation has been occurring for several years and this is an on-going action.	Y

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
CoT-03-2012	Flood	Continue to develop, implement, and expand the Flood Alert and Early Warning Program systems.	PRV	City of Tehama City Clerk/ Admin	General Fund	Short Term	Medium / Low	Implementation has been occurring for several years and this is an on-going action.	Y
CoT-04-2012	Flood	Identify special needs residents and stay-at-home children that may require special assistance in hazard situations.	ES, PRV	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	
CoT-05-2012	All Hazard	Monitor and regularly update City hazard studies whenever information becomes available that would significantly modify previous date. Update GIS data as it relates to HMP documentation.	PRV	City of Tehama Contract Engineer	General Fund	Long Term	Low / Medium	Hazard Mitigation Plan Update	Y
CoT-06-2012	Flood	Implement a plan to keep brush & debris clear from Tehama Simpson Slough.	PRV, NRP	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Medium	Water/ Flood Management Plans	
CoT-07-2012	Flood	Continue annual inspection and maintenance of City's storm drain systems.	PRV	City of Tehama Contract Engineer	General Fund	Short Term	Low / High	Implementation has been occurring for several years and this is an on-going action.	
CoT-08-2012	Flood	Construct flood mitigation measures for Gyle Rd.	PRV	City of Tehama Contract Engineer, Tehama County Public Works	Flood Mitigation Assistance Grant (FMA)	Mid Term	Medium / Medium	Water/ Flood Management Plans	Y
CoT-09-2012	Flood	Repair culvert on Gyle Rd for drainage of McClure Creek.	SP	City of Tehama Contract Engineer, Tehama County Public Works	Flood Mitigation Assistance Grant (FMA)	Short Term	Medium / High	Water/ Flood Management Plans	
CoT-10-2012	Flood	Continue to promote programs to elevate and retrofit structures to protect from future damage, with repetitive loss properties as priority.	SP, PRV	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Low	Implementation has been occurring for several years and this is an on-going action.	Y
CoT-11-2012	Flood	Perform a dam failure analysis to determine probably impact of flooding within Tehama if Shasta Dam fails & create a dam failure element for City's emergency response plan.	PRV	City of Tehama Contract Engineer, Tehama County Public Works	Flood Mitigation Assistance Grant (FMA)	Long Term	High / Low	Water/ Flood Management Plans	
CoT-12-2012	Flood	Make readings readily available on water levels and educate public on readings i.e. what does gauge elevations mean in a localized area.	PRV, PPRO, PE&A	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	
CoT-13-2012	Flood	Analyze cost and benefit of flood protection measures for City Hall and School facility to lower risk of damage from flooding.	PRV	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Medium	Water/ Flood Management Plans	

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
CoT-14-2012	Flood	Inform and educate public on hazard mitigation; develop web site; annual dissemination of information.	PE&A	City of Tehama City Clerk/ Admin	General Fund, Pre-Disaster Mitigation Grant Program (PDM)	Short Term	Low / Low	Water/ Flood Management Plans	
CoT-15-2012	Severe Storm	Continue hazard tree maintenance and replacement program for aging street trees.	PRV, NRP	City of Tehama City Clerk/ Admin	General Fund	Short Term	Medium / High	General Plan Update	Y
CoT-16-2012	Earthquake	Undertake Earthquake Study for all critical facilities and non-reinforced masonry buildings. Seismic retrofit of identified buildings.	PRV	City of Tehama Contract Engineer, Tehama County Public Works	Hazard Mitigation Grant Program (HMGP)	Long Term	High/ Low	Building/ Development Codes and Zoning Ordinances	
CoT-17-2012	Earthquake	Implement an automatic gas shut off valve install program.	PRV, PPRO	City of Tehama Contract Engineer	General Fund	Mid Term	Medium / Low	Building/ Development Codes and Zoning Ordinances	
CoT-18-2012	Drought	Develop and promote water conservation programs.	NRP, PRV	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Medium	Water/ Flood Management Plans	
CoT-19-2012	Wildfire	Continue weed abatement program.	PRV, PPRO	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Medium	Implementation has been occurring for several years and this is an on-going action.	Y
CoT-20-2018	Flood	Improve south shoulder of East Gyle Rd. to prevent continual damage during flooding events.	SP	City of Tehama Contract Engineer, Tehama County Public Works	Flood Mitigation Assistance Grant (FMA)	Short Term	High / Medium	Water/ Flood Management Plans	Y
CoT-21-2018	Wildfire	Conduct fuel reduction efforts on Railroad property.	PRV	Tehama County CDF Fire Department	Hazard Mitigation Grant Program (HMGP)	Short Term	Low / Medium	Community Wildfire Protection Plans (CWPPs).	
CoT-22-2018	Flood	Wellhead protection plans for active and abandoned wells within city.	PRV, NRP	City of Tehama City Clerk/ Admin	Flood Mitigation Assistance Grant (FMA)	Short Term	Low / Low	Water/ Flood Management Plans	Y
CoT-23-2018	Severe Storm	Construct back-up power generation / comms for City Hall or other community service infrastructure / essential facilities.	SP, PRV	City of Tehama Contract Engineer, Tehama County Public Works	General Fund	Short Term	High / Low	Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP)	
CoT-24-2018	Dam Failure	Educate public on evacuation procedures for dam failure and other hazards.	PE&A	City of Tehama City Clerk/ Admin	General Fund	Short Term	Low / Low	Water/ Flood Management Plans	Y
CoT-25-2018	Drought	Developed water supply contingency planning.	PRV, NRP	City of Tehama City Clerk/ Admin	General Fund	Mid Term	Medium / Medium	Water/ Flood Management Plans	

Action No.	Hazard Type	Specific Mitigation Action	Mitigation Alternatives	Responsible Party	Potential Funding Source	Time Frame	Benefit Cost Rating	Planning Mechanism	Implementation Plan / Priority
CoT-26-2018	Slope Failure	Continue bank stabilization efforts along the west bank of the Sacramento River including the use of rip rap and other slope stabilization methods.	**SP**	City of Tehama Contract Engineer, Tehama County Public Works	General Fund, Hazard Mitigation Grant Program (HMGP)	Short Term	**High/ Medium**	Implementation has been occurring for several years and this is an on-going action.	
CoT-27-2018	All Hazard	Integrate the Hazard Mitigation Plan into the Safety Element of the General Plan.	**PRV**	City of Tehama Planning Department/ City Council	Hazard Mitigation Grant Program (HMGP)	Short Term	**Medium/ Low**	General Plan Update	

Note: As a living document, project descriptions and actions in the tables above will be modified to reflect current conditions over time.

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Section 6. Plan Implementation and Maintenance

As a living document, it is important that this plan becomes a tool in the County's resources to ensure reductions in possible damage from a natural hazard event. This section discusses plan adoption, implementation, monitoring, evaluating, and updating the MJHMP. Plan implementation and maintenance procedures will ensure that the MJHMP remains relevant and continues to address the changing environment in the County. This section describes the incorporation of the MJHMP into existing County planning mechanisms, and how the County staff will continue to engage the public.

6.1 Plan Adoption

To comply with DMA 2000, the Tehama County Board of Supervisors has officially adopted the 2018 Tehama County Multi-Jurisdictional Hazard Mitigation Plan. The adoption of the 2018 MJHMP recognizes the County's commitment to reducing the impacts of natural hazards within the County. A copy of the 2018 MJHMP adoption resolution is included immediately following the Executive Summary.

6.1.1 Plan Implementation

Over time, Implementation Strategies will become more detailed and the County's mitigation planners will work to provide more detail for priority mitigation actions. In conjunction with the progress report processes, implementation strategy worksheets will be extremely useful as a plan of record tool for updates. Each implementation strategy worksheet provides individual steps and resources need to complete each mitigation action. The following provides several options to consider when developing implementation strategies in the future:

- **Use processes that already exist;** initial strategy is to take advantage of tools and procedures identified in the capability assessment in Section 5.3. By using planning mechanisms already in use and familiar to County departments and organizations, it will give the planning implementation phase a strong initial boost, especially if a mitigation strategy calls for expanding existing programs, or creating new programs or processes at a later date.

- **Updated work plans, policies, or procedures**; hazard mitigation concepts and activities can help integrate the 2018 MJHMP into daily operations. These changes can include how major development projects and subdivision reviews are addressed in hazard prone areas or ensure that hazard mitigation concerns are considered in the approval of major capital improvement projects. Local planning mechanisms where hazard mitigation information and/ or actions may be incorporated include the comprehensive plan, zoning and building codes, capital improvements programs and permitting processes.

- **Job descriptions;** working with department or agency heads to revise job descriptions of government staff to include mitigation-related duties could further institutionalize hazard mitigation. This change would not necessarily result in great financial expenditures or programmatic changes.

6.1.2 Steering Committee

The steering committee oversaw the development of the plan and made recommendations on key elements of the plan, including the maintenance strategy. It was the steering committee's position that an oversight committee with representation similar to the initial steering committee should have an active role in the plan maintenance strategy. Therefore, it is recommended that a steering committee remain a viable body involved in key elements of the plan maintenance strategy. The new steering committee should strive to include representation from the planning partners, as well as other stakeholders in the planning area.

The principal role of the new steering committee in this plan maintenance strategy will be to review the annual progress report and provide input to Public Works and the Sheriff's Office on possible enhancements to be considered at the next update. Future plans will be overseen by a steering committee similar to the one that participated in this plan development process, so keeping an interim steering committee intact will provide a head start on future updates. Completion of a progress report is the responsibility of each planning partner, not the responsibility of the steering committee. It will simply be the steering committee's role to review the progress report in an effort to identify issues needing to be addressed by future plans.

6.2 Monitoring, Evaluating and Updating the MJHMP

This section describes the schedule and process for monitoring, evaluating, and updating the 2018 MJHMP.

6.2.1 Schedule

Monitoring the progress of the mitigation actions will be on-going throughout the five-year period between the adoption of the 2018 MJHMP and the next update effort. The MJHMP Planning Committee will meet biannually to monitor the status of the implementation of mitigation actions and develop updates as necessary.

The MJHMP will be updated every five years, as required by DMA 2000. The update process will begin at least one year prior to the expiration of the 2018 MJHMP. However, should a significant disaster occur within the County, the MJHMP Planning Committee will reconvene within 30 days of the disaster to review and update the MJHMP as appropriate. The County Board of Supervisors will adopt written updates to the MJHMP as a DMA 2000 requirement.

6.2.2 Process

The MJHMP Planning Committee will coordinate with responsible agencies/organizations identified for each mitigation action. These responsible agencies/organizations will monitor and evaluate the progress made on the implementation of mitigation actions and report to the MJHMP Planning Committee on an annual basis. Working with the MJHMP Planning Committee, these responsible agencies/organizations will be asked to assess the effectiveness of the mitigation actions and modify the mitigation actions as appropriate. A MJHMP Mitigation Action Progress Report worksheet was developed as part of this MJHMP to assist mitigation project managers in reporting on the status and assessing the effectiveness of the mitigation actions.

Information culled from the mitigation leads or "champions" will be used to monitor mitigation actions and annual evaluation of the MJHMP. The following questions will be considered as criteria for evaluating the effectiveness of the MJHMP:

- Has the nature or magnitude of hazards affecting the County changed?
- Are there new hazards that have the potential to impact the County?
- Do the identified goals and actions address current and expected conditions?

- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the MJHMP?
- Should additional local resources be committed to address identified hazards?

An Annual MJHMP Review Questionnaire worksheet has been developed as part of this MJHMP to provide guidance to the MJHMP Planning Committee on what should be included in the evaluation. Future updates to the MJHMP will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. Issues that arise during monitoring and evaluating the MJHMP, which require changes to the risk assessment, mitigation strategy and other components of the MJHMP, will be incorporated into the next update of the 2018 MJHMP in 2023. The questions identified above would remain valid during the preparation of the 2023 update.

6.2.3 Continuing Public Involvement

During the five-year update cycle (2018-2023), County staff will involve the public using public workshops and meetings. Information on upcoming public events related to the MJHMP or solicitation for comments will be announced via newspapers, mailings, and on the County MJHMP website (mitigatehazards.com/tehama-hmp/). An electronic copy of the current MJHMP document will be accessible through the County website, with hard copies available for review at the Tehama County Flood Control and Water Resources Office The MJHMP Planning Committee will, as much as practicable, incorporate the following concepts into its public outreach strategy to ensure continued public involvement in the MJHMP planning process:

- Work with public service clubs, i.e., The Lions Club, Tehama County Library
- Collaborate with faith based organizations, i.e., Sacred Heart Catholic Church, Los Molinos United Methodist, First United Presbyterian Church
- Create story ideas for media outlets, such as newspapers, local radio, and TV
- Distribute emails and postcards/mailers to County/ City residents about hazard mitigation updates
- Post meeting announcements at City Halls, coffee houses, grocery stores, libraries, etc.
- Educate and collaborate with insurance companies.
    - Piggy back on other existing local community meetings, i.e., The Red Bluff Farmers' Market
    - Distribute information through K-12 schools
    - Continue to use the County website as a distribution point of hazard mitigation information

6.2.4 HMGP Monitoring

FEMA's Mitigation Grant Program is the catalyst that drives increased understanding and supports proactive community action to reduce losses from natural hazards. To support this vision, FEMA funds three Hazard Mitigation Assistance (HMA) grant programs under HMGP. The three programs are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, and the Pre-Disaster Mitigation (PDM) Program.

- **HMGP** assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration
- **PDM** provides funds for hazard mitigation planning and projects on an annual basis
- **FMA** provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis.

HMGP funding is generally 15% of the total amount of Federal assistance provided to a State, Territory, or federally-recognized tribe following a major disaster declaration. PDM and FMA funding depends on the amount congress appropriates each year for those programs. The HMGP supports cost-effective post-disaster projects and is the longest running mitigation program among FEMA's three grant programs. Studies have shown that every $1 spent equals $4 of future damages mitigated.

Following a disaster, California Office of Emergency Services (Cal OES) and local Tehama County officials in a joint effort with FEMA will perform Preliminary Damage Assessments (PDA) of the areas that sustained damage. Cal OES submits, through the FEMA Regional Office, the information collected along with a damage estimate to request a declaration from the President. A Presidential Major Disaster Declaration provides for the availability of HMGP funds at the request of a state's Governor in eligible communities within a state, tribe, or territory. Below shows a timeline of how projects should be developed and administered by local government and FEMA under the HMGP program.

The following graphic shows the seven major HMGP application steps from project scoping to grant award closeout: project scoping, project development, project submission, project review, project award and obligation, project implementation and monitoring, and award close out. HMGP grant recipients will have 36 months from the close of the application period to complete projects.

For More information on HMGP project development process visit:
www.fema.gov/hazard-mitigation-grant-program-guide-state/local-governments

6.2.5 Incorporation into Other Planning Mechanisms

An important implementation mechanism is to incorporate the recommendations and underlying principles of the MJHMP into community planning and development such as capital improvement budgeting, building and zoning codes, general plans and regional plans. Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of the jurisdiction attempting to implement risk reducing actions. The integration of a variety of County departments on the MJHMP Planning Committee provides an opportunity for constant and pervasive efforts to network, identify, and highlight mitigation activities and opportunities at all levels of government. This collaborative effort is also important to monitor funding opportunities which can be leveraged to implement the mitigation actions. Information from this 2018 MJHMP can be incorporated into:

- **Tehama County General Plan:** The 2018 MJHMP will provide information that can be incorporated into the Land Use, Public Health and Safety, and Sustainable Development Elements during the next general plan update. Specific risk and vulnerability information from the Tehama County MJHMP will assist to identify areas where development may be at risk to potential hazards.
- **County Building / Development Codes and Zoning Ordinances:** The 2018 MJHMP will provide information to enable the County to make decisions on appropriate building/development codes and ordinances. Appropriate building codes and ordinances can increase the County's resilience against natural disasters.
- **Community Wildfire Protection Plans (CWPP):** The 2018 MJHMP will provide information that can be incorporated into CWPP updates for areas within the County.
- **Water/ Flood Management Plans:** The 2018 MJHMP will provide information that can be included in the Tehama West Watershed Management Plan update, Groundwater Management Plan update and Flood Management Plan update.
- **Emergency Food and Shelter Program (EFSP) and Emergency Operations Plan (EOP):** The 2018 MJHMP will provide information regarding vulnerable populations, natural hazards, current capabilities of the County and participating jurisdictions and areas at risk to natural hazards that can be included in the EFSP and EOP.

6.2.5.1 Planning Integration Processes

With adoption of this plan, the participating jurisdictions will be responsible for the plan implementation and maintenance. As such, Tehama County with the Cities of Corning, Red Bluff and Tehama will continue their relationship with each other, and with the HMPC, in manners such as:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to County and City officials involved with General Plans and other land use/ building regulations
- Ensure hazard mitigation risk assessment and maps remain a consideration for community development decision makers;
- Report on plan progress and recommended changes to the various governing boards or councils of all participating jurisdictions; and
- Inform and solicit input from the public.

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Appendix A Mitigation Action Trackers

2018-2023 Priority Mitigation Action Tracker

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Action No. TC-02-2018

HAZARD TYPE	Wildfire
PROBLEM NO.	WF-04 , WF-05 , WF-06 , WF-07, WF-08, WF-09
MITIGATION TYPE	PRV
BENEFIT COST RATING	Medium / High
RESPONSIBLE PARTY	Teham County RCD / CAL FIRE Tehama Glenn Unit

DESCRIPTION

Continue to review and implement CWPP Mitigation Actions with HMGP.

Background

Tehama West planning units include Cottonwood-Beegum Creek, Reeds Creek, Red Bank Creek, Elder Creek and Thomes Creek. Tehama East planning units include the Sacramento River corridor, Battle Creek-Manton, Paynes-Antelope-Highway 36E corridor and the Central-Cohasset.
RCDTC staff identified existing fuel reduction projects within the County?s westside and eastside areas, including those that were in place at the time the Tehama West Fire Plan and Tehama East CWPP were prepared.

Implementation Steps

1. Review Mitigation Action in CWPP to indentify which are alligned with HMGP program grant requirements. See Mitigation Action Spread Sheet.
2. Submit NOI to Cal OES for under HMGP
3. Review on a yearly basis and resubmit NOIs as necessary.

IMPLEMENTATION COSTS

Estimated Captial Costs	Varies Based Upon Projects
Estimated Maintenance Costs	40 HRS / YEAR (To Review and select projects for HMGP)

IMPLEMENTATION RESOURCES

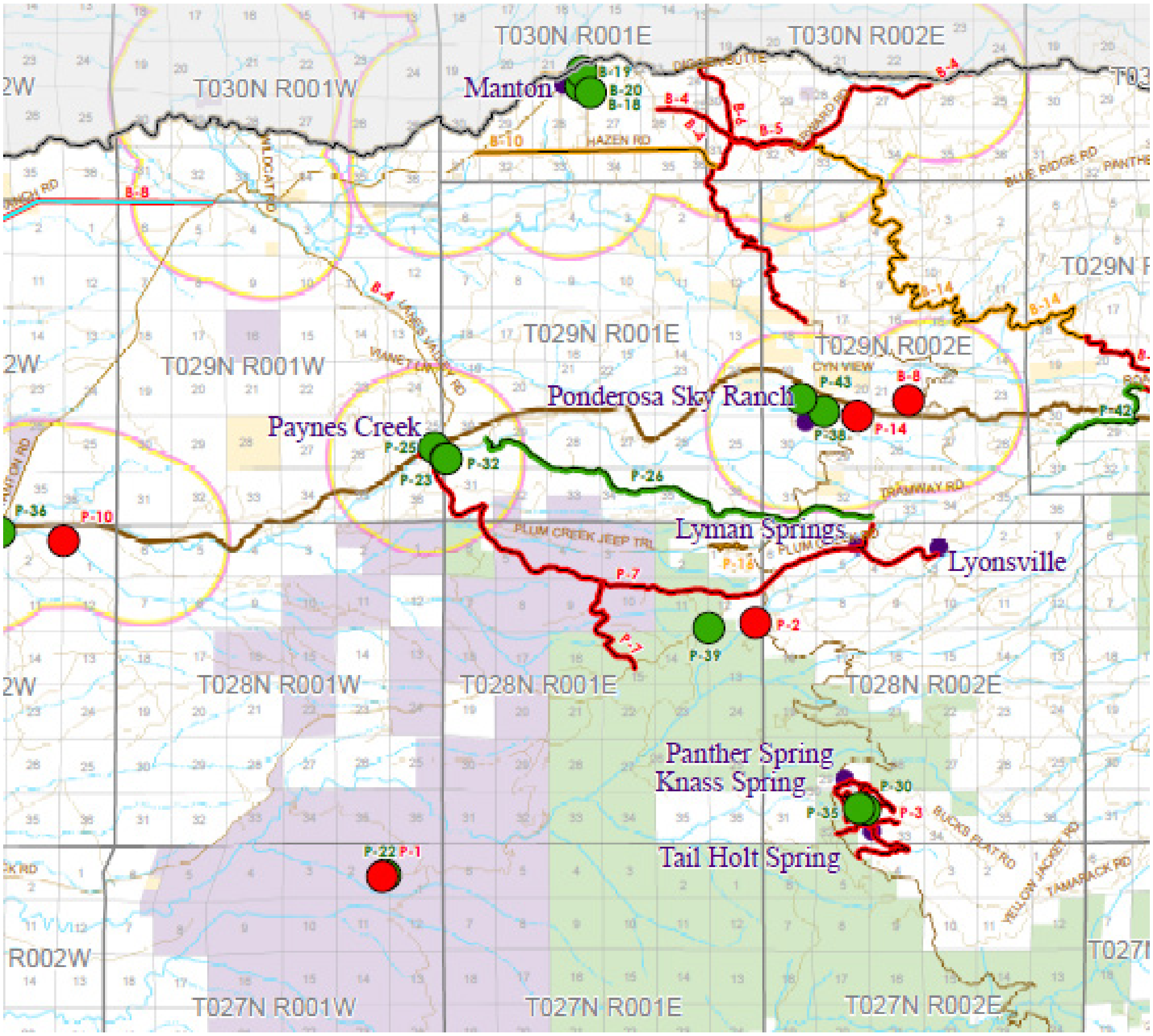
Potential Funding Sources	HMGP / Pre-Disaster Mitigation Grant Program (PDM)
Potential Technical Resources	Steve Holl Consulting http://www.trpa.org/programs/forest-management/

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Varies depending upon project. Crews, trucks, chippers, handtools.

Action No. TC-02-2018

HAZARD TYPE	Wildfire
PROBLEM NO.	WF-04 , WF-05 , WF-06 , WF-07, WF-08, WF-09
MITIGATION TYPE	PRV



GRAPHIC DESCRIPTION

Working with public and private stakeholders, RCDTC staff identified existing fuel reduction projects within the County?s westside and eastside areas, including those that were in place at the time the Tehama West Fire Plan and Tehama East CWPP were prepared. The above graphic is a screen shot of the Ponderosa Sky Ranch Projects.

Action No. TC-03-2018

HAZARD TYPE	Wildfire
PROBLEM NO.	W-10 , WF-02
MITIGATION TYPE	PRV, PPRO
BENEFIT COST RATING	Medium / High
RESPONSIBLE PARTY	CAL FIRE Tehama Glenn Unit

DESCRIPTION

Implement fuel reduction measures around Critical Facilities such as schools and other gathering facilities.

Background

The pressure to develop land over the past several decades has fueled the expansion of the residential, commercial and public sector buildings and infrastructure outward from community centers and into the surrounding wildland. Although the type and design of public buildings vary widely, building components that are most susceptible to damage during wildfires are common to many building types.
High potential loss / essential facilities are located within high and very high wildfire severity zones include: Manton, Plum Creek, Reeds Creek, Elkins and Flournoy schools and others.

Implementation Steps

1. Identify Schools and other Critical Infrastructure at risk to wildfire.
2. Develop site specific defensible space and materials upgrade plans.
3. Develop cost estimates and cost benefit analysis for each site
4. Seek Funding Mechanisms.

IMPLEMENTATION COSTS

Estimated Captial Costs	Varies Based Upon Projects
Estimated Maintenance Costs	Varies Based Upon Projects

IMPLEMENTATION RESOURCES

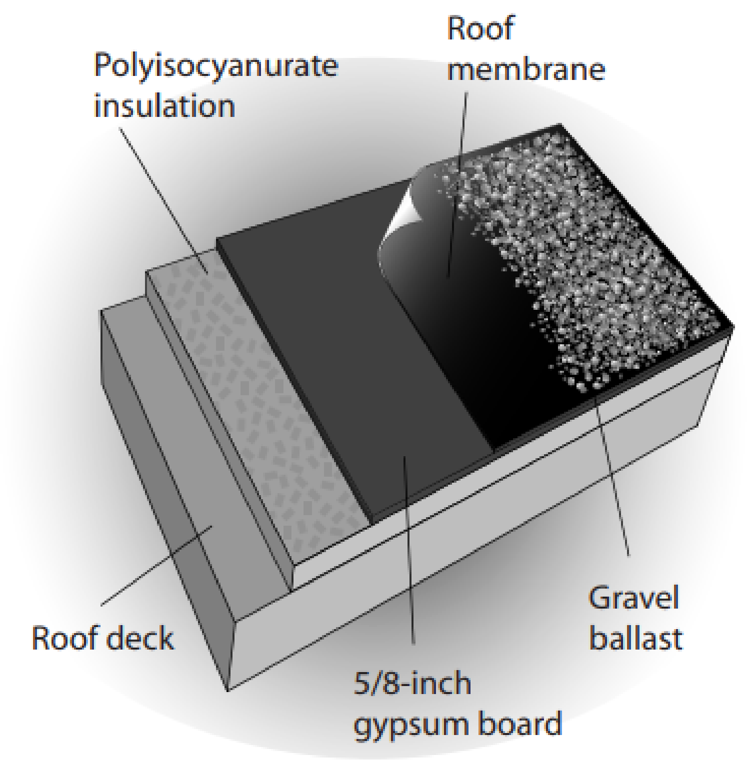
Potential Funding Sources	PA Post Disaster Mitigation Funding.
Potential Technical Resources	Wildfire Hazard Mitigation Handbook for Public Facalities P-754 Oct. 2008

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Various Construction Equipment and Defensible Space Equipment.

Action No.	TC-03-2018
HAZARD TYPE	Wildfire
PROBLEM NO.	W-10 , WF-02
MITIGATION TYPE	PRV, PPRO

Description of Mitigation Measure: Install a ***noncombustible*** roof covering such as metal roofing or gravel ballast. A wide range of proprietary products for membrane roofs, built-up roofs, and hybrids of these two types of roofs are available, some of which include noncombustible coverings or are included in Class A rated roof assemblies.



GRAPHIC DESCRIPTION

Specifying a Class A rated roof assembly is recommended and is effective in reducing the potential for ignition of the roof covering and for reducing heat transfer and fire penetration to the deck from the exterior. This system is an example of should be evaluated by professionals at each public facility.

Action No. TC-04-2018

HAZARD TYPE	Wildfire
PROBLEM NO.	WF-10 , WF-04
MITIGATION TYPE	PRV
BENEFIT COST RATING	Medium / High
RESPONSIBLE PARTY	CAL FIRE Tehama Glenn Unit / Tehama RCD

DESCRIPTION

Develop defensible space program for disabled / unable residents

Background

The Tehama West Watershed faces the growing problem of expansion of residential development into increasingly remote and historically fire prone areas (Wildland Urban Interface aka WUI). Aging populations may be unable to perform mitigation activities around the home.

Implementation Steps

1. Establish Program Parameters.
2. Advertise Program
3. Find cheap labor
4. Coordinate with community members (Boy Scouts, faith based organizations or other volunteers) to assist homeowners with fuel reduction projects.
5. Offer coupons/ other incentives for discounted tools to aid in mitigation (hedge trimmers, weed whackers, etc.)

IMPLEMENTATION COSTS

Estimated Captial Costs	Mechanical thinning costs from $2,000-$3,500 per acre
Estimated Maintenance Costs	40 HRS / YEAR (To Review and select residents)

IMPLEMENTATION RESOURCES

Potential Funding Sources	HMGP / Pre-Disaster Mitigation Grant Program (PDM)
Potential Technical Resources	Loghill Fire Protection District and West Region Fire Council http://www.cowildfire.org/ These are in Colorado but have succesfully used HMGP funding to implement defensible space for residents in a 6 county area.

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Vehicle for site visits.

Action No. TC-05-2018

HAZARD TYPE	Wildfire
PROBLEM NO.	WF-03 , WF-04
MITIGATION TYPE	SP
BENEFIT COST RATING	High / High
RESPONSIBLE PARTY	Tehama County Public Works

DESCRIPTION

Construct / expand water supply for hydrants in rural residential areas.

Background

Existing rural areas and areas growing in size have to address the critical need of establishing a water source for CAL FIRE firefighting efforts, especially if they do not have an adequate municipal water system. Title 14 Code of California Regulations: Division 1.5, Chapter 7, Subchapter 2, Articles 1-5 establishes minimum wildfire protection standards in conjunction with building, construction and development in SRA. Some neighborhoods throughout Tehama County were constructed before appliable regulations or fire flow conditions/requirements from original construction date have changed.   The Tehama County Fire Department delegates fire inspections and emergency services, directed by the Fire Marshal, and works with Cal-Fire. New buildings are required to have fire sprinkler systems installed, according to the Tehama County fire and building codes. If fire flow is not achieved with the providing water supply, additional water storage maybe needed for fire code compliance.

Implementation Steps

1. Identify areas that do not meet flow requirements.
2. Develop Capital Improvement plans for areas
3. Find Funding
4. Develop SOW for Contracts
5. Construct / Upgrade Fire Supply in occordance with CIP and SOW

IMPLEMENTATION COSTS

Estimated Captial Costs	UNKOWN
Estimated Maintenance Costs	UNKOWN

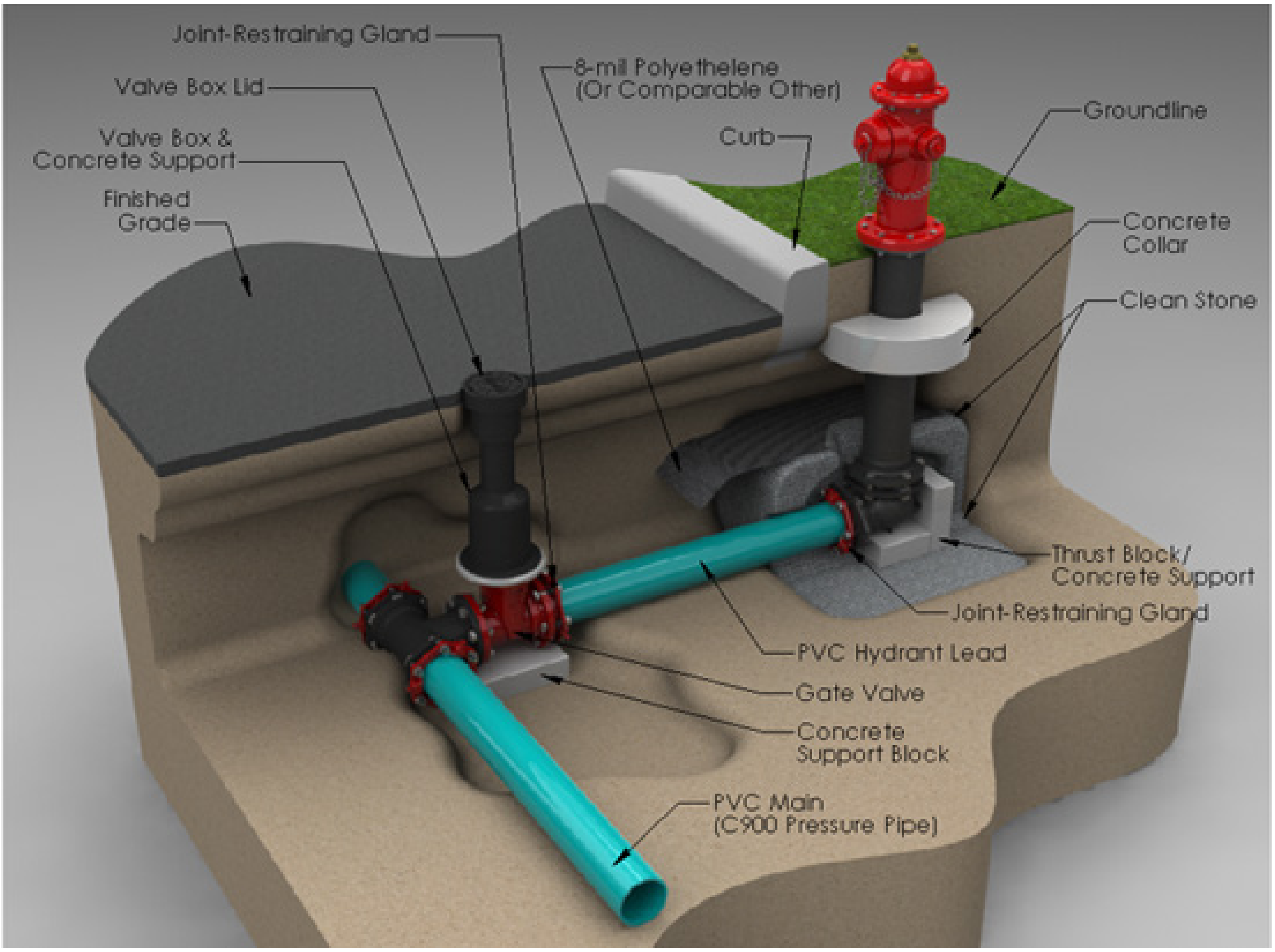
IMPLEMENTATION RESOURCES

Potential Funding Sources	Assistance to Firefighters Grant Program (AFG); Fire Prevention and Safety (FP&S)
Potential Technical Resources	Dynamic Fire Protection Systems. CAL FIRE Tehama Glen Unit

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Construction Equipment for underground piping.

Action No.	TC-05-2018
HAZARD TYPE	Wildfire
PROBLEM NO.	WF-03 , WF-04
MITIGATION TYPE	SP



GRAPHIC DESCRIPTION

Water for emergency ?fire flow? use shall be provided at a minimum rate of 300 gallons per minute, for duration of 2 hours. This can be accomplished by equipping on site agricultural well with 2 «? National Hose Thread, male fittings and posting ?all weather? operational instructions.

Action No. TC-06-2018

HAZARD TYPE	Flood
PROBLEM NO.	FL-03 , FL-17
MITIGATION TYPE	SP
BENEFIT COST RATING	low / High
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Make gauge information readily available on water levels and educate public on readings i.e. what does gauge elevations mean in a localized area.

Background

Information on the amount of water flowing in streams and rivers is critical to the management of water resources, emergency response to flooding, fisheries management, and many other uses. Providing a County specific stream gauge information provides access to real-time stream gauge readings compiled from a variety of agencies and organizations, including the possibliliy of monitoring the localized stream gauges installed by the County.

Implementation Steps

1. Develop website for streamgauges, lake levels, and dam discharges for real-time information
2. Develop outreach material for website.
3. Include outreach material to public on yearly basis.

IMPLEMENTATION COSTS

Estimated Captial Costs	200k
Estimated Maintenance Costs	40 HRS / YEAR

IMPLEMENTATION RESOURCES

Potential Funding Sources	HMGP / Pre-Disaster Mitigation Grant Program (PDM)
Potential Technical Resources	Solano County Water Agency Map Viewer: http://www.scwamonitoring.com/floodmap/index.htm

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Website Developers and webservers.

Action No. TC-07-2018

HAZARD TYPE	Flood
PROBLEM NO.	FL-03
MITIGATION TYPE	PPRO
BENEFIT COST RATING	HIGH / High
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Continue outreach program to provide information needed to increase awareness and modify actions to reduce flood damage, encourage flood insurance coverage and protect natural functions of floodplains. Seek CRS classification improvements i.e. better and more often outreach, Promotion of flood insurance to local residents and alert and warning of possible flood depths.

Background

Residents need more education about flood preparedness, flood insurance and the resources available during and after floods on a continual basis.

Implementation Steps

1. Increase community awareness about flood hazards affecting the County
2. Work with the news media to get flood prevention messages into news stories
3. Explain the importance of flood insurance and how it works
4. Educate the public on ways to prepare for floods
5. Share disaster response steps

IMPLEMENTATION COSTS

Estimated Captial Costs	Approx. 160 HRS
Estimated Maintenance Costs	40 HRS / YEAR

IMPLEMENTATION RESOURCES

Potential Funding Sources	County Personel Time
Potential Technical Resources	Local Insurance Companies, Floodsmart.gov

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Printers, Website Developer and maintenance.

Action No.	TC-08-2018
HAZARD TYPE	Flood
PROBLEM NO.	FL-07 , FL-09
MITIGATION TYPE	PRV
BENEFIT COST RATING	Medium / High
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Develop flood hazard areas beyond FEMA regulatory flood zones.

Background

The Federal Emergency Management Agency (FEMA) and many communities in the United States have long recognized that the mapping and regulatory standards of the NFIP do not adequately address all of the flood problems in the country. There are many special localized situations in which flooding or flood-related problems do not fit the national norm for riverine and coastal floodplain management. Therefore, there are situations in which the minimum NFIP requirements do not adequately protect property from flood damage.
Beyond the FEMA identified flood areas, there areas identified in the Tehama County MJHMP Flood Profile that have significant risk of flooding. These areas include the areas surrounding Jewett and Burch Creek, the Dairyville area and areas of NFIP repetative loss.

Implementation Steps

1. Verify Areas to be mapped
2. Develop refined SOW for additional flood hazard areas
3. Search for Grant Opportunities
4. Establish boundary areas that are prone to flooding.
5. Developed BFEs for areas on known flood risk. These areas include Antelope Area, Dairyville, and other flood prone areas.
6. Develop County Flood Hazard Ordinance for additional flood hazard areas

IMPLEMENTATION COSTS

Estimated Captial Costs	$500,000 for elevation modeling, survey and H&H studies
Estimated Maintenance Costs	Survey and evaluations during flood events

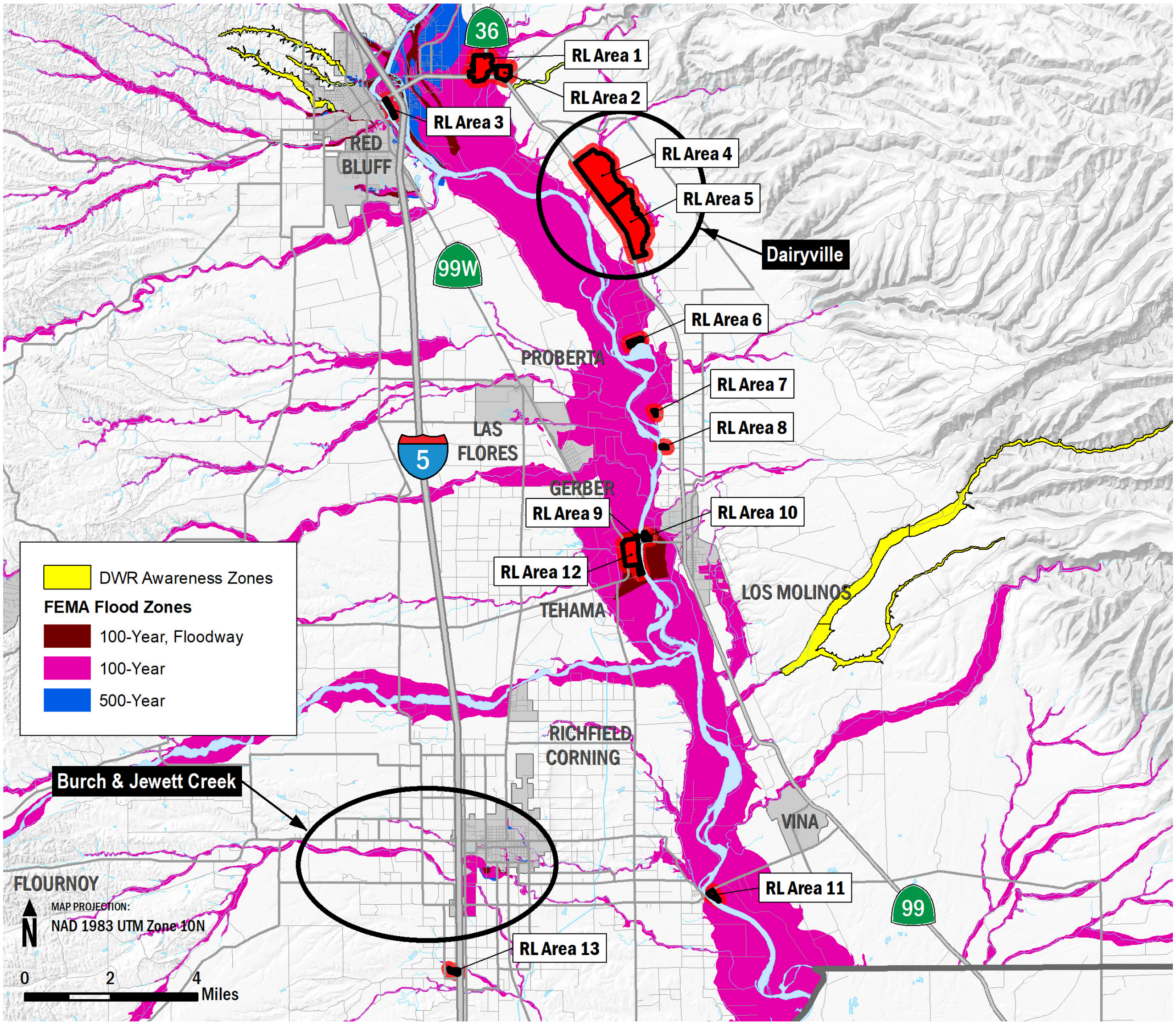
IMPLEMENTATION RESOURCES

Potential Funding Sources	DWR
Potential Technical Resources	CRS Coordinators Manual

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Trucks and Survey Equipment during flood events

Action No.	TC-08-2018
HAZARD TYPE	Flood
PROBLEM NO.	FL-07 , FL-09
MITIGATION TYPE	PRV



GRAPHIC DESCRIPTION

The above image demonstrates the areas of historical flooding, Repetative Loss Areas, and special floodhazard areas mapped by FEMA and DWR.

Action No. TC-11-2018

HAZARD TYPE	Flood
PROBLEM NO.	FL-08
MITIGATION TYPE	PRV
BENEFIT COST RATING	Low / Low
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Formally survey high water marks to establish historic flooding depths.

Background

Lack of historical damage data, such as high-water marks on structures and damage reports, to measure inundation and the cost-effectiveness of future mitigation projects.

Implementation Steps

1.
2.
3.

IMPLEMENTATION COSTS

Estimated Captial Costs	Approx. 160 HRS per flood event
Estimated Maintenance Costs	40 HRS / YEAR

IMPLEMENTATION RESOURCES

Potential Funding Sources	Staff Time, General Fund
Potential Technical Resources	Public Works Survey Crew

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Survey Eipuipment and Vehicles

Action No. TC-14-2018

HAZARD TYPE	Flood
PROBLEM NO.	FL-06
MITIGATION TYPE	PRV, PPRO
BENEFIT COST RATING	High / High
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Provide assistance to residents for flood proofing wellheads in areas of known flood risk.

Background

The EPA nor County do not regulate private drinking water wells and water quality from such. The County does not require sampling of private wells after installation. It is the responsibility of the homeowner to maintain the safety of their water. If contaminated ground water is consumed, it could cause illness. Ground water contamination can come from many sources, including flooding of the wellhead. Private wells should be located so rainwater flows away from it and minor flooding does not affect the well head. Rainwater can pick up harmful bacteria and chemicals on the land?s surface. If this water pools near your well, it can seep into it and potentially cause health problems.

Implementation Steps

1. Identify and verify private wells in floodplains or flood risk areas
2. Work with home owner to inform them of well head risk
3. Develop resources for home oweners before and after flooding.

IMPLEMENTATION COSTS

Estimated Captial Costs	$2,000 to $4,000 Per Private Well
Estimated Maintenance Costs	N/A - Homeowner Responsibility

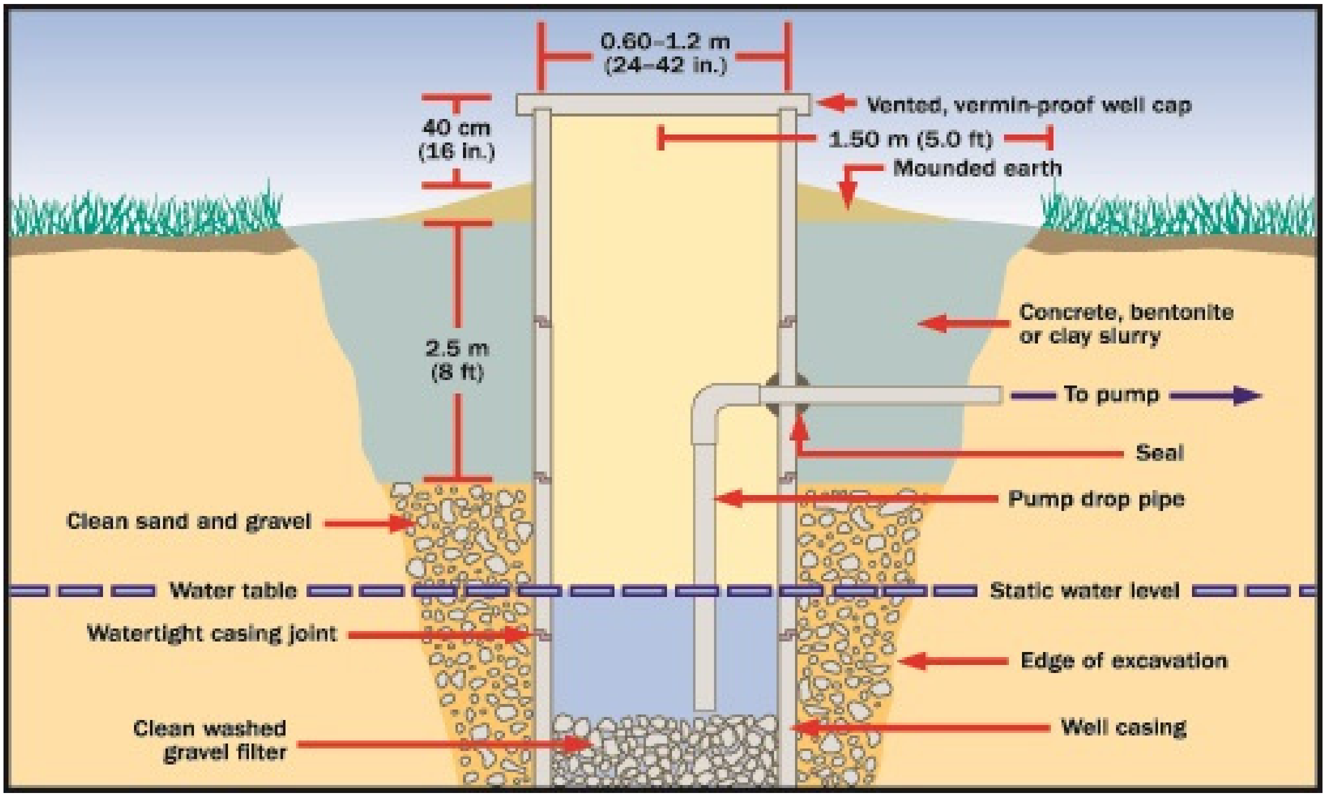
IMPLEMENTATION RESOURCES

Potential Funding Sources	EPA and DWR
Potential Technical Resources	https://www.epa.gov/privatewells

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Based upone wellhead repair contractor. Most likely well cap products, mounded earth, handtools etc..

Action No.	TC-14-2018
HAZARD TYPE	Flood
PROBLEM NO.	FL-06
MITIGATION TYPE	PRV, PPRO



GRAPHIC DESCRIPTION

A properly constructed large-diameted well, notice the 40 cm of elevation on well. A properly constructed well must be capped with a safe cover to prevent unwanted access by flood waters, rain water runoff or other contaminants to the well's interior. Unused or improperly abandoned wells are a significant potential source of groundwater contamination.

Action No.	TC-15-2018
HAZARD TYPE	Flood
PROBLEM NO.	FL-10
MITIGATION TYPE	PE&A
BENEFIT COST RATING	High / High
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Construct or improve flood control infrastructure to protect residents and property surrounding Salt Creek.

Background

Salt Creek and Antelope Creek distributaries causing flood risk to McHie Subdivision and other rural residential areas.

Implementation Steps

1.
2.
3.

IMPLEMENTATION COSTS	
Estimated Captial Costs	$1 Million?
Estimated Maintenance Costs	UNKOWN

IMPLEMENTATION RESOURCES	
Potential Funding Sources	Flood Mitigation Assistance Grant Program (FMA)
Potential Technical Resources	DWR Small Communities Iniatative Feasability Study

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

UNKNOWN

Action No.	TC-17-2018
HAZARD TYPE	Flood
PROBLEM NO.	FL-11
MITIGATION TYPE	PRV, PPRO
BENEFIT COST RATING	High / High
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Construct flood control infrastructure to protect residents and property surrounding Antelope Creek in the Dairyville Area.

Background

Antelope Creek distributaries causing flood risk to Dairyville area and surrounding rural residential properties.

Implementation Steps

1.
2.
3.

IMPLEMENTATION COSTS	
Estimated Captial Costs	$1 Million?
Estimated Maintenance Costs	UNKOWN

IMPLEMENTATION RESOURCES	
Potential Funding Sources	Flood Mitigation Assistance Grant Program (FMA)
Potential Technical Resources	DWR Small Communities Iniatative Feasability Study

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

UNKNOWN

Action No. TC-19-2018

HAZARD TYPE	Severe Storm
PROBLEM NO.	SS-02 , SS-05
MITIGATION TYPE	SP
BENEFIT COST RATING	Medium / High
RESPONSIBLE PARTY	Tehama County Public Works

DESCRIPTION

Construct Back Up power infrastructure for Critical Facilities including Public Works and shelters identified on County Sheltering Plan

Background

Power supply and communication issues occur during weather events such as the phones going down. Back-Up power at communication towers is needed. Generators are emergency equipment that provide a secondary source of power to a facility. Generators and related equipment (e.g., hook-ups) are eligible under HMGP PDM provided that they are cost effective, contribute to a long-term solution to the problem they are intended to address, and meet all other program eligibility criteria.

Implementation Steps

1. Identifiy buildings for back up system install.
2. Develop system size based upon demand of building during emergencies.
3. Develop cost estimates for each building
4. Priortize buildings based upon criticality
5. Develop grant applications for HMGP and EMPG

IMPLEMENTATION COSTS

Estimated Captial Costs	Average from $5000 to $7000 per 10KW
Estimated Maintenance Costs	40 HRS / YEAR

IMPLEMENTATION RESOURCES

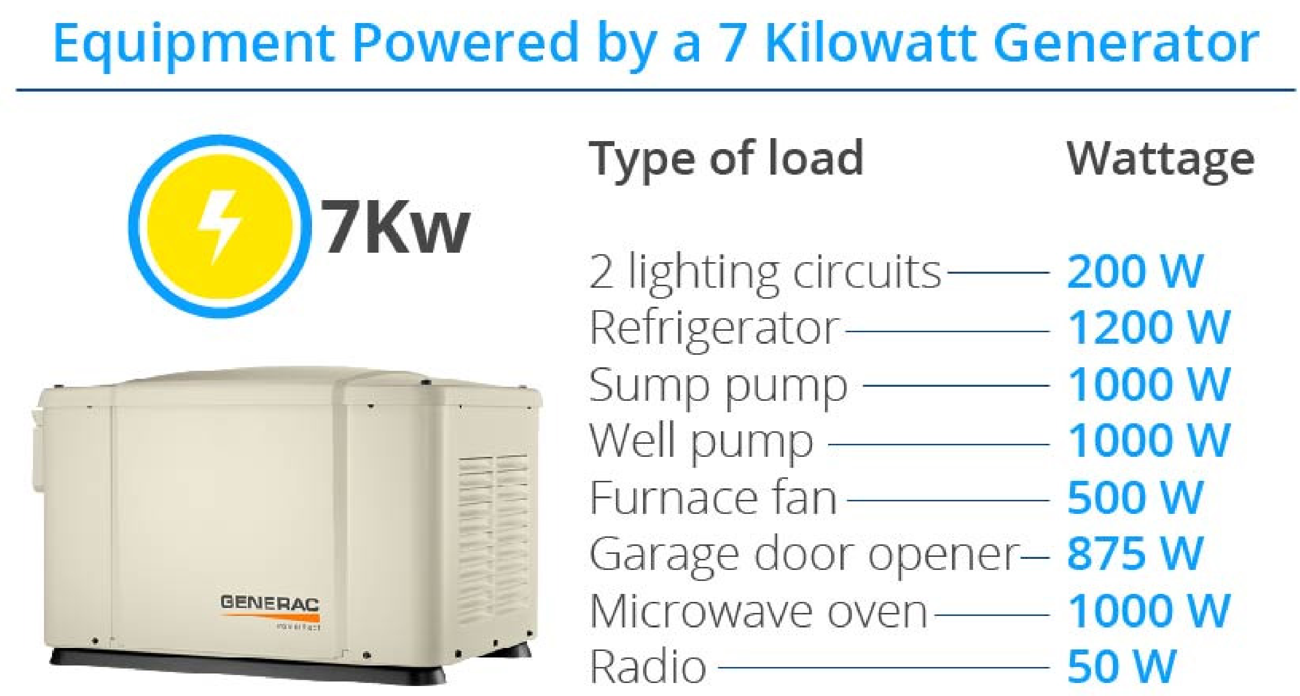
Potential Funding Sources	EMPG, Pre-Disaster Mitigation Grant Program (PDM)
Potential Technical Resources	FEMA Job AID for Generators

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Based upone generator install contractor. Most likely electrical install equipment and other related parts.

Action No. **TC-19-2018**

HAZARD TYPE	Severe Storm
PROBLEM NO.	SS-02 , SS-05
MITIGATION TYPE	SP



GRAPHIC DESCRIPTION

Generator projects must meet all HMGP and PDM requirements as described in 44 CFR Section 206.434, Eligibility and as outlined in the HMA Guidance. It is not always necessary for the generator to support facility operations to their full capacity, but it should be sized appropriately to ensure the facility is able to rovide uninterrupted critical functions in the event of future power outages.

Action No. TC-21-2018

HAZARD TYPE	Severe Storm
PROBLEM NO.	SS-04 , SS-07
MITIGATION TYPE	SP
BENEFIT COST RATING	Low / Low
RESPONSIBLE PARTY	Tehama County Planning Department

DESCRIPTION

Provide isolated populations with evacuation and emergency plans online.

Background

Isolated and vulnerable population centers exist throughout the County. I.e. Rancho Tehama, Manton, Ponderosa Sky Ranch, Lake California and others. Road closures (both rural roads and state HWYs to isolated communities and Interstate-5, I.e. HWY 99, 36) could trap residents.

Implementation Steps

1.
2.
3.

IMPLEMENTATION COSTS

Estimated Captial Costs	N/A
Estimated Maintenance Costs	40 HRS / YEAR

IMPLEMENTATION RESOURCES

Potential Funding Sources	General Fund, Staff Time
Potential Technical Resources	Website webmaster

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

NONE

Action No. TC-22-2018

HAZARD TYPE	Flood
PROBLEM NO.	FL-16 , FL-02 , FL-22
MITIGATION TYPE	PE&A
BENEFIT COST RATING	Low / Low
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Install gauges on flashy and creeks and provide real-time data to county website.

Background

Climate change impacts flood conditions in Tehama County. More severe weather events could compromise local drainage and flood control. Watershed streams show rapid responses to storms, and flow levels fluctuate or flash between storm periods in a localized environment. Multiple high loss potential facilities are located in the 100-YR Flood zone include a childcare facility and others. The County is blind to conditions (both precipitation and stream velocities) in many areas.

Implementation Steps

1. Identify Stream to be gauged
2. Conduct a radio path study to confirm reliable telecommunication transmission from all the proposed infrastructure locations
3.Determine final locations for the rain/stream gauge and repeater infrastructure based on criteria
4. Construct System / Maintain System

IMPLEMENTATION COSTS

Estimated Captial Costs	$50K per gauge
Estimated Maintenance Costs	40 HRS / YEAR

IMPLEMENTATION RESOURCES

Potential Funding Sources	General Fund, Pre-Disaster Mitigation Grant Program (PDM)
Potential Technical Resources	Larimer County CO Stream & Rain Gage Network HMGP Grant Application that was approved by FEMA.

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

Based upone install contractor. Vehicle and equipment for yearly maintenance.

Action No. TC-23-2018

HAZARD TYPE	Dam Failure
PROBLEM NO.	DF-01 , DF-02 , DF-04
MITIGATION TYPE	PRV
BENEFIT COST RATING	Low / Medium
RESPONSIBLE PARTY	Tehama County Flood Control and Water Resources

DESCRIPTION

Integrate dam inundation zones into reverse 911 / Everbridge / Tehama Alert system.

Background

There is often limited warning time for dam failure. Mapping that estimates inundation depths for federally regulated dams is already required and available; however, mapping for non-federal-regulated dams is needed to better assess the risk associated with failure of these facilities. Access to inundation zones is not readily available to residents area wide. Protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.

Implementation Steps

1. Use Dam Inundation Zone extents from MJMHP Geodatabase to can reverse 911 extents
2. Develop website material on Dam Inundation Zones and emergency evacuation protocols.
3. Test system and maintain website material on yearly basis.
4. Maintain/coordinate indundation zone mapping with Dam Owners.

IMPLEMENTATION COSTS

Estimated Captial Costs	Test 1
Estimated Maintenance Costs	Test 2

IMPLEMENTATION RESOURCES

Potential Funding Sources	General Fund
Potential Technical Resources	BOR Staff, DWR Division of Dam Safety

REQUIRED EQUIPMENT, VEHICLES, AND SUPPLIES

NONE

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Appendix B Planning Process Documentation

B.1 Planning Committee Meetings Documentation

B.2 Public Notices and Press Releases

B.3 Public Open House Documentation

B.4 Survey

B.5 Mitigation Action Prioritization Process

B.6 Website

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B.1 Planning Committee Meetings Documentation

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Tammy Kulpa

From: Ethan E. Mobley
Sent: Friday, March 10, 2017 10:38 AM
To: Tammy Kulpa
Subject: Fwd: Tehama County Hazard Mitigation Plan Update

Fyi...we need to save these emails as pdfs and store them for document production. Also track them in the spreadsheet as invite sent.

Sent from my Verizon 4G LTE smartphone

-------- Original message --------
From: Ryan Teubert <rteubert@tcpw.ca.gov>
Date: 3/9/17 12:36 PM (GMT-07:00)
To: Bill Goodwin <Bgoodwin@co.tehama.ca.us>, Gary Antone <gantone@tcpw.ca.gov>, Steve Mackey <smackey@tcpw.ca.gov>, John Stover <jstover@co.tehama.ca.us>, David Hencratt <dhencratt@tehamaso.org>, 'Rod Daugherty' <rdaughertytcso@gmail.com>, Rick Gurrola <rgurrola@tehamaag.net>, Tim Potanovic <TPotanovic@co.tehama.ca.us>, KMaze@co.tehama.ca.us
Subject: Tehama County Hazard Mitigation Plan Update

I just wanted inform you that I am facilitating the update of the County's Multi-Hazard Mitigation Plan. This plan is required to be updated every 5 years and allows the County and participating jurisdictions to apply for State/Federal disaster funding. An important part of this process will be four planning sessions (generally 2 hours in length) that will be used to gather information required for the update. I would like to request your department's attendance at these planning sessions which will occur over the next three months. Your attendance will provide both valuable knowledge towards this process, and the hours necessary to meet the match obligation required by the grant. The County will be hiring a consultant to facilitate the meetings and complete the update of the Plan. The first planning meeting is scheduled for March 30, 2017 from 10:00am-12:00, and will be held in the Walnut Room at the Tehama County Agriculture Department Building. Please confirm that someone from your staff will be able to attend this first meeting. Also please let me know if you would like someone else within your department to be the point of contact on this Steering Committee. The Steering Committee will also include participation from Cal Fire, Corning, Red Bluff and Tehama. Other agencies invited to participate include CHP, Forest Service, BLM, BOR, DWR, Cal OES, Farm Bureau, and the RCD of Tehama County.

Thanks,

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Tammy Kulpa

From: Ethan E. Mobley
Sent: Friday, March 10, 2017 10:38 AM
To: Tammy Kulpa
Subject: Fwd: Tehama County Hazard Mitigation Plan update - Need Cal Fire/Tehama County Fire contact

Same

Sent from my Verizon 4G LTE smartphone

-------- Original message --------
From: Ryan Teubert <rteubert@tcpw.ca.gov>
Date: 3/9/17 12:38 PM (GMT-07:00)
To: Randy Rapp <Randy.Rapp@fire.ca.gov>
Cc: "Ethan E. Mobley" <ethan@dynamicplanning.co>
Subject: Tehama County Hazard Mitigation Plan update - Need Cal Fire/Tehama County Fire contact

Randy, we are starting the process of updating the Tehama County Hazard Mitigation Plan. This will likely include 4 planning sessions that will generally last about 2 hours, please let me know who would be the best contact/s to include on our Planning Committee email list from your agency.

Thanks,

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Tammy Kulpa

From: Ethan E. Mobley
Sent: Friday, March 10, 2017 10:38 AM
To: Tammy Kulpa
Subject: Fwd: Tehama County Hazard Mitigation Plan update

Same

Sent from my Verizon 4G LTE smartphone

-------- Original message --------
From: Ryan Teubert <rteubert@tcpw.ca.gov>
Date: 3/9/17 12:37 PM (GMT-07:00)
To: "'Noderer, Kyle@CalOES'" <Kyle.Noderer@CalOES.ca.gov>
Cc: "Ethan E. Mobley" <ethan@dynamicplanning.co>
Subject: Tehama County Hazard Mitigation Plan update

Kyle, I just wanted to give you a heads up that we are starting the process of updating the Tehama County Hazard Mitigation Plan. I plan on adding you to the Steering Committee email list and would appreciate you participation in any of the Planning Sessions that you can attend. Please keep an eye out for emails from me or my consultant Dynamic Planning + Science concerning these matters. Our first Planning Session is currently scheduled for March 30th from 10:00-12:00.

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Tammy Kulpa

From: Ethan E. Mobley
Sent: Wednesday, March 15, 2017 9:33 AM
To: dleblanc@usbr.gov
Cc: Ryan Teubert
Subject: RE: Planning Meeting for Tehama Co. 2017 HMP Update

Hello David,

Ryan suggested that we connect. We (Dynamic Planning + Science) will be assisting as the consultant / project coordinator on the Tehama Co. 2017 HMP update process. We are grateful to have BOR as a stakeholder rep. at the first planning committee meeting! We are not requesting much from stakeholders for information at this point, but I am sure will sill start looking at the dam failure inundation zones later on. It's always hard to track down inundation zones in "digital" format from Cal OES, DWR and BOR. We use the dam inundation zones to conduct a vulnerability analysis i.e. population, improved parcels etc. within each dam inundation zone located in the planning area. We did the same for Solano County which had various dams and dam owners. We even take the dam inundation zones and build depth grids and run a models that shows potential loss based upon depth of flooding within the FEMA Hazus-MH model. Bottom line, we are excited to have BOR representation at the meeting. We will be sending out more material as we get closer to the meeting date.

If you have any questions please feel free to reach out to us,

Ethan

Dynamic Planning + Science

Ethan Mobley | Owner
ethan@dynamicplanning.co

Phone: 510-253-0054 | 970-323-4331
California: 1901 Harrison Street, Suite 1100, Oakland, CA 94612
Colorado: 19235 HWY 550 Montrose, CO 81403
www.dynamicplanning.co

From: Ryan Teubert [mailto:rteubert@tcpw.ca.gov]
Sent: Wednesday, March 15, 2017 8:56 AM
To: Ethan E. Mobley <ethan@dynamicplanning.co>
Subject: Fwd: Planning Meeting for Tehama Co. 2017 HMP Update

Can you please respond to David and cc me. Can you please send him the invitation and let him know if you need anything.

Ryan

Sent from my iPhone

Begin forwarded message:

From: "LeBlanc, David" <dleblanc@usbr.gov>
Date: March 15, 2017 at 6:30:39 AM PDT
To: <rteubert@tcpw.ca.gov>
Subject: RE: Planning Meeting for Tehama Co. 2017 HMP Update

Good morning Mr. Teubert,

My name is Dave Le Blanc, Emergency Management professional for the Bureau of Reclamation's Mid-Pacific Region.
I was forwarded this by Louis Moore in our Public Affairs Office. I am the Emergency management planning contact for our Region, and for our stakeholders and partners, and with your permission, I will attend to represent Reclamation in your planning efforts.

Aside from several years in the Dams Sector for Reclamation, I come from Cal OES where I did the same for the state, as well as for a couple of other state agencies and utilities before that.

I look forward to meeting you and your staff and assisting in any way that you may need. Are there any documents or materials that you would like me to bring to the meeting?

Thanks and have a great day,

David LeBlanc
Emergency Management Specialist
USBR Mid-Pacific Region
916-978-5566

Tammy Kulpa

From: Ethan E. Mobley
Sent: Friday, March 10, 2017 10:38 AM
To: Tammy Kulpa
Subject: Fwd: Tehama County Hazard Mitigation Plan update - Need BOR contact

Same thing.

Sent from my Verizon 4G LTE smartphone

-------- Original message --------
From: Ryan Teubert <rteubert@tcpw.ca.gov>
Date: 3/9/17 12:37 PM (GMT-07:00)
To: wmoore@usbr.gov
Cc: "Ethan E. Mobley" <ethan@dynamicplanning.co>
Subject: Tehama County Hazard Mitigation Plan update - Need BOR contact

Louis, Tehama County is starting the process of updating its Multi-Hazard Mitigation Plan. We would like to have a local BOR representative present at several planning sessions that we will be occurring over the next three months. Since the operation of Shasta Dam is critically important on managing our flood risk within the County, it would be extremely beneficial to have someone with operational knowledge of both Shasta and Keswick present at 1-2 of the planning meetings. Hopefully this person could be a valuable resource to our consultant, Dynamic Planning +Science, who may have specific questions related to dam releases and dam failure that are required under the update requirements. Do you know who would be the appropriate contact within your organization for this?

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Tammy Kulpa

From: Ryan Teubert <rteubert@tcpw.ca.gov>
Sent: Monday, April 10, 2017 11:05 AM
To: Tammy Kulpa
Subject: FW: Tehama County Hazard Mitigation Plan update - Need Cal Fire/Tehama County Fire contact

Follow Up Flag: Follow up
Flag Status: Flagged

From: Rapp, Randy@CALFIRE [mailto:Randy.Rapp@fire.ca.gov]
Sent: Thursday, March 09, 2017 1:09 PM
To: Ryan Teubert <rteubert@tcpw.ca.gov>
Cc: Ethan E. Mobley <ethan@dynamicplanning.co>; Chamblin, Matt@CALFIRE <Matt.Chamblin@fire.ca.gov>; Christine Thompson <Christine.Thompson@fire.ca.gov>
Subject: RE: Tehama County Hazard Mitigation Plan update - Need Cal Fire/Tehama County Fire contact

Ryan,

Please use myself, Chief Christine Thompson and Administrative Officer Matt Chamblin as your contacts. We will ensure info gets distributed out to our personnel appropriately and/or make assignments.

I have cc'd them in this response so you will have their email addresses. If you need additional info like phone numbers etc. please let me know and I can provide the info.

Thanks,

Randy Rapp

Deputy Chief, Operations
CALFIRE-Tehama County Fire Department
604 Antelope Blvd.
Red Bluff CA 96080

530-528-5101 Office
530-200-2501 Cell.
530-529-8538

From: Ryan Teubert [mailto:rteubert@tcpw.ca.gov]
Sent: Thursday, March 09, 2017 11:38 AM
To: Rapp, Randy@CALFIRE <Randy.Rapp@fire.ca.gov>
Cc: Ethan E. Mobley <ethan@dynamicplanning.co>
Subject: Tehama County Hazard Mitigation Plan update - Need Cal Fire/Tehama County Fire contact

Randy, we are starting the process of updating the Tehama County Hazard Mitigation Plan. This will likely include 4 planning sessions that will generally last about 2 hours, please let me know who would be the best contact/s to include on our Planning Committee email list from your agency.

Thanks,

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Tammy Kulpa

From:	Ryan Teubert <rteubert@tcpw.ca.gov>
Sent:	Monday, April 10, 2017 11:45 AM
To:	Tammy Kulpa
Subject:	FW: Tehama County Hazard Mitigation Plan update - Need CHP contact
Follow Up Flag:	Follow up
Flag Status:	Flagged

From: Aviles, Lou@CHP [mailto:LAviles@chp.ca.gov]
Sent: Friday, March 17, 2017 10:15 AM
To: Ryan Teubert <rteubert@tcpw.ca.gov>
Cc: Hoover, Shaun@CHP <Shaun.Hoover@chp.ca.gov>
Subject: RE: Tehama County Hazard Mitigation Plan update - Need CHP contact

Hello Ryan,

Sergeant Shaun Hoover will be our point of contact. I have cc'd him in this email so you have his email address.

Thank you,

Lou
Lou Aviles, Commander
California Highway Patrol
Red Bluff Area
(530) 527-2034
LAviles@chp.ca.gov

Like us on Facebook at ***CHP Red Bluff***

From: Ryan Teubert [mailto:rteubert@tcpw.ca.gov]
Sent: Thursday, March 09, 2017 11:37 AM
To: Aviles, Lou@CHP
Cc: Ethan E. Mobley
Subject: Tehama County Hazard Mitigation Plan update - Need CHP contact

Lou, we are starting the process of updating the Tehama County Hazard Mitigation Plan. We would like to invite the CHP to participate in several planning sessions that we will be occurring over the next three months. Please let me know who would be the best contact within the CHP to include on our Steering Committee email list.

Thanks,

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

From:	Tammy Kulpa
To:	Tammy Kulpa
Subject:	RE: Tehama County Hazard Mitigation Plan update - DWR Contact?
Date:	Thursday, October 26, 2017 9:11:10 AM

-------- Original message --------
From: Ryan Teubert <rteubert@tcpw.ca.gov>
Date: 3/9/17 12:37 PM (GMT-07:00)
To: "Hillaire, Todd@DWR" <Todd.Hillaire@water.ca.gov>
Cc: "Ethan E. Mobley" <ethan@dynamicplanning.co>
Subject: Tehama County Hazard Mitigation Plan update - DWR Contact?

Todd, we are starting the process of updating the Tehama County Hazard Mitigation Plan. We would like to have a local DWR representative present at several planning sessions that we will be occurring over the next three months. Having someone like yourself or Julia with local flooding knowledge would be a great asset during these meetings. Do you know who would be the appropriate contact within the Northern Region for this?

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Tammy Kulpa

From: Scott Hardage <shardage@TNC.ORG>
Sent: Monday, April 17, 2017 2:02 PM
To: Tammy Kulpa
Subject: RE: Tehama County MJHMP Planning Committee Meeting #2

Hi Tammy,

Thanks for your call last week inviting us to help with updates to the hazard management plan. We both have a lot on our plates right now and won't be able to participate in the meetings. Thank you for including us, and best of luck-

Scott

-----Original Appointment-----
From: Tammy Kulpa [mailto:tammy@dynamicplanning.co]
Sent: Monday, April 17, 2017 10:00 AM
To: rkampmann@cityofredbluff.org; sfriend@cityofredbluff.org; rbarber@cityofredbluff.org; ksanders@cityofredbluff.org; meckels@cityofredbluff.org; dbrown@cityofredbluff.org; rcrabtree@cityofredbluff.org; Shaun.Hoover@chp.ca.gov; Jim_richardson@nps.gov; Scott Hardage; jpray@crainwalnut.com; Bgoodwin@co.tehama.ca.us; JSisneros@co.tehama.ca.us; gantone@tcpw.ca.gov; smackey@tcpw.ca.gov; gwall@tcpw.ca.gov; rgurrola@tehamaag.net; Kmaze@co.tehama.ca.us; dhencratt@tehamaso.org; rdaughertytcso@gmail.com; rteubert@tcpw.ca.gov; TPotanovic@co.tehama.ca.us; jstover@co.tehama.ca.us; Christine.Thompson@fire.ca.gov; Randy.Rapp@fire.ca.gov; Matt.Chamblin@fire.ca.gov; DGarton@co.tehama.ca.us; dgrine@corning.org; smiller@cityofredbluff.org; cdsteffan@sbcglobal.net; tbradley@blm.gov; jmata@blm.gov; wmoore@usbr.gov; sgriffin@fs.fed.us; laviles@chp.ca.gov; Todd.Hillaire@water.ca.gov; jkelley@spi-ind.com; tcrcd@tehamacountyrcd.org; Drew.Hammond@CalOES.ca.gov; Kyle.Noderer@CalOES.ca.gov; vetboy21@yahoo.com; mrk_dtr@yahoo.com; rooneymurphy@gmail.com; dbrower@co.tehama.ca.us; rduvarney@tehamaschools.org; ian_turnbull@ruralits.com; Tehama@theskybeam.com; dleblanc@usbr.gov; brigittefoster@fs.fed.us; lskuno@fs.fed.us; Steven.Larson@CalOES.ca.gov; Ethan E. Mobley; Brian Greer; Alex Krebs; stevek@sbcglobal.net; spjapp@att.net; george@sigalasinsruance.com; jstoufer@corning.org; gcstrack@sbcglobal.net; firechief@corning.org; lori.pini@caloes.ca.gov; dstoffel@tehamaag.com; jstrait@blm.gov
Subject: Tehama County MJHMP Planning Committee Meeting #2
When: Thursday, May 04, 2017 1:30 PM-3:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Tehama County Agriculture Department Building, Walnut Room

The 2nd Planning Committee Meeting for the Tehama County MJHMP Update will be held on Thursday, May 4th from 1:30-3:30 PM at the Tehama County Agriculture Department Building, Walnut Room. During this meeting we will assess the hazards and problems facing Tehama County.

Tammy Kulpa

From: Ryan Teubert <rteubert@tcpw.ca.gov>
Sent: Thursday, March 9, 2017 5:44 PM
To: Ethan E. Mobley; Tammy Kulpa
Subject: FW: Tehama County Hazard Mitigation Plan update - Need Farm Bureau contact

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From: Julie Kelley [mailto:JKelley@spi-ind.com]
Sent: Thursday, March 09, 2017 4:41 PM
To: Ryan Teubert <rteubert@tcpw.ca.gov>
Cc: Kari Dodd <kari@tehamacountyfarmbureau.org>
Subject: Re: Tehama County Hazard Mitigation Plan update - Need Farm Bureau contact

Hi, Ryan: Thank you for thinking of us!

TC Farm Bureau Directors have a monthly meeting next week. I will bring this up and get back to you.

Regards,
Julie Kelley

Sent from my iPhone

On Mar 9, 2017, at 11:37 AM, Ryan Teubert <rteubert@tcpw.ca.gov> wrote:

> Julie, we are starting the process of updating the Tehama County Hazard Mitigation Plan. We would like to invite the Farm Bureau to participate in several planning sessions that we will be occurring over the next three months. It would be extremely helpful to have a representative with knowledge of how severe weather, drought, and flooding can impact our local farming and ranching communities and operations. Please let me know who would be the best contact at the Farm Bureau to include on our Steering Committee email list.
>
> Thanks,
>
> **Ryan Teubert, CFM**
> Tehama County Flood Control &
> Water Resource Manager
> rteubert@tcpw.ca.gov
> Tel: (530)-385-1462 x3020
> Cell: (530)-200-2166

Tammy Kulpa

From: Ryan Teubert <rteubert@tcpw.ca.gov>
Sent: Monday, April 10, 2017 11:47 AM
To: Tammy Kulpa
Subject: FW: Tehama Co HMP 2017 Update

Follow Up Flag: Follow up
Flag Status: Flagged

National Park Service contact.

From: Ryan Teubert
Sent: Thursday, March 23, 2017 5:02 PM
To: 'Ethan E. Mobley' <ethan@dynamicplanning.co>
Subject: RE: Tehama Co HMP 2017 Update

Also can you send an invite to Jim Richardson, he is the incoming Superintendent to Lassen National Park. Supposedly he is taking over in the middle of April. The secretary said that this was the best way and he will decide who should attend.

Jim_richardson@nps.gov

Ryan

From: Ethan E. Mobley [mailto:ethan@dynamicplanning.co]
Sent: Thursday, March 23, 2017 2:47 PM
To: Ryan Teubert <rteubert@tcpw.ca.gov>
Subject: FW: Tehama Co HMP 2017 Update

FYI…

From: postmaster@usda.gov [mailto:postmaster@usda.gov]
Sent: Thursday, March 23, 2017 3:41 PM
To: Ethan E. Mobley
Subject: Undeliverable: Tehama Co HMP 2017 Update

Delivery has failed to these recipients or groups:

chcouts@fs.fed.us (chcouts@fs.fed.us)
The address you sent your message to wasn't found at the destination domain. It might be misspelled or it might not exist. Try to fix the problem by doing one or more of the following:

1. Send the message again, but before you do, delete and retype the address. If your email program automatically suggests an address to use, don't select it.
2. Clear the recipient AutoComplete cache in your email program by following the steps in this article: Status code 5.1.10. Then resend the message, but before you do, be sure to delete and retype the address.

From:	Tammy Kulpa
To:	Tammy Kulpa
Subject:	FW: same subject as last email...better description of my concern
Date:	Thursday, October 26, 2017 9:31:10 AM
Attachments:	image001.png

From: Julie Kelley [mailto:JKelley@spi-ind.com]
Sent: Thursday, April 13, 2017 1:13 PM
To: 'Ryan Teubert' <rteubert@tcpw.ca.gov>
Cc: Ethan E. Mobley <ethan@dynamicplanning.co>; Jud Pray <jpray@crainwalnut.com>; 'Kari Dodd' <kari@tehamacountyfarmbureau.org>
Subject: RE: same subject as last email...better description of my concern

Ryan,

Please add Jud Pray, a director with Tehama County Farm Bureau, to your email list as he will be able to offer some valuable input from an ag producer's perspective.

Thanks, again, for the opportunity.

Julie K.

Julie Kelley
Biologist
Sierra Pacific Industries
530-378-8134 Office
530-941-1754 Cell

From: Ryan Teubert [mailto:rteubert@tcpw.ca.gov]
Sent: Tuesday, April 04, 2017 5:37 PM
To: Julie Kelley
Cc: Ethan E. Mobley
Subject: RE: same subject as last email...better description of my concern

Julie, there will be 3 more planning sessions that we welcome input from the Farm Bureau. If you want to send me an email for an interested FB representative I can add them to the agenda email list. That way they will receive the invites and agendas for the three remaining meetings, and they can then review the agenda to see what topics will be covered and decide if they want to attend or not.

Planning Meetings

- May 4th, 1:30-3:30
- June 13th , 11:30-1:30
- July 13th 10:30-12:30

Please let me know who you want added to the email list and if you have any additional questions.

Ryan Teubert, CFM

Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

From: Julie Kelley [mailto:JKelley@spi-ind.com]
Sent: Tuesday, April 04, 2017 3:59 PM
To: Ryan Teubert <rteubert@tcpw.ca.gov>
Subject: RE: same subject as last email...better description of my concern

Ryan:

Thank you for reaching out to me with these opportunities.

I did not find a FB member for the HMP Update process before your end of March deadline. Is there still an opportunity to occupy a seat with a member or are you at capacity?

I also asked around here at SPI regarding the two different committee seats. While there is interest, ultimately it was decided to pass. Everyone gets spread pretty thin, especially at this time of year.

...looking forward to your reply regarding the HMP Update and TCFB.

Regards,

Julie K.

Julie Kelley
Biologist
Sierra Pacific Industries
530-378-8134 Office
530-941-1754 Cell

From: Ryan Teubert [mailto:rteubert@tcpw.ca.gov]
Sent: Thursday, March 23, 2017 5:29 PM
To: Julie Kelley
Subject: RE: same subject as last email...better description of my concern

Kelly, did you get a contact for the Farm Bureau for the Hazard Mitigation Plan update?

Also do you know if someone from SPI would be interested in attending these meetings? I could put them on the mailing list, they may only be interested in attending the fire or drought workshop.

Thanks,

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager

rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

From: Ethan E. Mobley [mailto:ethan@dynamicplanning.co]
Sent: Tuesday, March 14, 2017 4:14 PM
To: DGarton@co.tehama.ca.us; tbradley@blm.gov; jmata@blm.gov; sgriffin@fs.fed.us; wmoore@usbr.gov; laviles@chp.ca.gov; Todd.Hillaire@water.ca.gov; Julie Kelley; tcrcd@tehamacountyrcd.org; Drew.Hammond@CalOES.ca.gov; Kyle.Noderer@CalOES.ca.gov
Cc: rteubert@tcpw.ca.gov; Victoria.LaMar-Haas@CalOES.ca.gov
Subject: Invite to Planning Meeting for Tehama Co. 2017 HMP Update
Importance: High

You are invited to make a difference!

Tehama County Hazard Mitigation Plan, 2017 Update.

Tehama County has begun the process to prepare the 2017 update to the 2012 Hazard Mitigation Plan (HMP) and we invite you to participate. The HMP will serve as a blueprint for reducing property damage and saving lives from the effects of future natural disasters in the County. To guide this process, the County has established two groups:

- The Planning Committee who will work most closely to shape the plan;
- and the Stakeholder Group to give a broad perspective during plan development.

You are receiving this because you or your agency has been identified as a key participant at the "Stakeholder Group" level. If interested, we welcome you (or other interested parties) to assist the HMP Project Management Team to update our natural hazard mitigation documents for the County! This would involve periodic review of documentation and feedback during certain points of the planning process. We anticipate the HMP development process to last about 6 months.

We will be hosting a kick-off meeting on **Thursday, March 30th 2017 from 10:00am-12:00pm** in the **Walnut Room at the Tehama County Agricultural Department Building located at 1834 Walnut Street, Red Bluff, CA 96080.** You are more than welcome to join this meeting but attendance in this meeting is not a requirement by any means. The strategy of this meeting is to have members meet, organize and provide input on the hazards, mitigation strategies, and other components of the HMP planning process.

DON'T WORRY COFFEE AND SNACKS WILL BE PROVIDED!

Please respond to this e-mail and advise if you will be participating in this process, and who will be assigned to represent your agency. If you are unable to attend this meeting but still wish to participate in the planning process, additional information regarding future meetings, draft documents for review, and other project milestones will be provided through e-mails, e-news and the Tehama County Hazard Mitigation Plan project page currently under construction: http://mitigatehazards.com/tehama-hmp

If you have any additional questions, please do not hesitate to contact Us!

Ryan Teubert, Tehama County Flood Control & Water Resource Manager - (530) 385-1462 x3020
rteubert@tcpw.ca.gov

Ethan Mobley, Project Consultant, Dynamic Planning + Science – (970)-323-4331
ethan@dynamicplanning.co

Thank you for your time and consideration!

Project HMP Consultant with Dynamic Planning + Science

MITIGATE HAZARDS

Ethan Mobley | Owner
ethan@dynamicplanning.co

Phone: 510-253-0054 | 970-323-4331
California: 1901 Harrison Street, Suite 1100, Oakland, CA 94612
Colorado: 19235 HWY 550 Montrose, CO 81403
www.dynamicplanning.co

Tammy Kulpa

From: Ethan E. Mobley
Sent: Friday, March 10, 2017 10:38 AM
To: Tammy Kulpa
Subject: Fwd: Tehama County Hazard Mitigation Plan update - Need RCD contact

Same

Sent from my Verizon 4G LTE smartphone

-------- Original message --------
From: Ryan Teubert <rteubert@tcpw.ca.gov>
Date: 3/9/17 12:37 PM (GMT-07:00)
To: Vicky Dawley <vicky@tehamacountyrcd.org>
Cc: "Ethan E. Mobley" <ethan@dynamicplanning.co>
Subject: Tehama County Hazard Mitigation Plan update - Need RCD contact

Vicky, we are starting the process of updating the Tehama County Hazard Mitigation Plan. We would like to invite the RCD to participate in several planning sessions that we will be occurring over the next three months. Please let me know who would be the best contact within the RCD to include on our Steering Committee email list.

Thanks,

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Tammy Kulpa

From: Ethan E. Mobley
Sent: Friday, March 10, 2017 10:38 AM
To: Tammy Kulpa
Subject: Fwd: Tehama County Hazard Mitigation Plan update - Need USFS contact

Same thing

Sent from my Verizon 4G LTE smartphone

-------- Original message --------
From: Ryan Teubert <rteubert@tcpw.ca.gov>
Date: 3/9/17 12:37 PM (GMT-07:00)
To: Steve Griffin <sgriffin@fs.fed.us>
Cc: "Ethan E. Mobley" <ethan@dynamicplanning.co>
Subject: Tehama County Hazard Mitigation Plan update - Need USFS contact

Steve, Tehama County is starting the process of updating its Multi-Hazard Mitigation Plan and would like to offer the USFS an opportunity to participate in several planning sessions that will occur over the next three months. The USFS is a valued partner agency within Tehama County and we want to make sure that your current and future management practices are incorporated within the plan. Your agencies participation in the Wildfire and Drought planning sessions would be extremely helpful. Please let me know who would be the appropriate contact within your organization to include on our Steering Committee email list.

Ryan Teubert, CFM
Tehama County Flood Control &
Water Resource Manager
rteubert@tcpw.ca.gov
Tel: (530)-385-1462 x3020
Cell: (530)-200-2166

Planning Committee Meeting #1

This meeting package contains:

- Agenda
- Sign In Sheets
- Photos

More information on Planning Committee Meeting #1, including PowerPoint Presentation Slides and Handouts (agenda, 2012 Executive Summary and 2017 Executive Summary) can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

www.mitigatehazards.com

Tehama County Project Meetings Page:

http://mitigatehazards.com/tehama-hmp-pmt/tc-meetings/

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Meeting Agenda:

Tehama County, California

Mulit-Jurisdictional Hazard Mitigation Plan 2017 Update Kick-Off Meeting

Thursday, March 30th, 2017, 10:00 a.m. – 12:00 p.m.

- **Meeting Objectives**
  - Welcome and Introductions
  - Mitigation Planning Defined
  - Background
  - Local Hazard Mitigation Planning Process
  - NFIP/ CRS Process
  - Overall Objectives
  - Project Schedule
  - Today's Tasks / Accomplishments
  - Next Steps

NOTES

MEETING SIGN-IN SHEET

Project: 2017 Tehama County HMP Update	**Meeting Date:** 03/30/2017
Facilitator: Ethan Mobley	**Place/Room:** Ag Dept / Walnut Room

Name	Title	Company	Phone	Fax	E-Mail
Ryan Teubert	Flood Control & Water Resources Manager	Tehama County	530-385-1462		rteubert@tcpw.ca.gov
Gary Strack	Corning	Corning	530-824-5622		GCSTRACK@sbcglobal.net
Carolyn Steffan	City Clerk/Admin	Tehama (City)	530-384-1501	530-384-1625	Tehama@theskybeam.com
Lori Pini	ESC	Cal OES	916-955-7552		lori.pini@caloes.ca.gov
Mike Murphy	Dist. MGR	Gerber/Las Flores	530-385-1904		jmurph@theskybeam.com
Kristen Maze	Planning Div	Tehama Co	572-2200		kmaze@co.tehama.ca.us
Julie Sisneros	Admin	Tehama Co.	527-4655		jsisneros@co.tehama.ca.us
Randy Rapp	D.C.	TCFD	528-5199		randy.rapp@fire.ca.gov
Rose Flores	Ins. Agent	Corning	709-4569		rflores@farmersagent.com
David Stoffel	Ag Dept	Tehama County	527-4504		DStoffel@tehamaag.com
Bill Goodwin	Admin	Tehama Co.	527-~~46~~05		bgoodwin@co.tehama.ca.us
David Brewer	R.E.H.S. II	Tehama Co	527-8020		[illegible]
Todd Hillaire	Senior Engineer	CDWR-NRO	529-7347		todd.hillaire@water.ca.gov
Steven Larson	OAPS II	OES	916 845-8136		STEVEN.LARSON@CALOES.CA.GOV
Mark Dutro		Dutro Farms	[redacted]		[redacted]
R Scott Miller	P.W. Assoc. Engineer	Red Bluff	530 527-2605 ext. 3063		smiller@cityofredbluff.org

MEETING SIGN-IN SHEET

Project:	2017 Tehama County HMP Update	**Meeting Date:**	03/30/2017
Facilitator:	Ethan Mobley	**Place/Room:**	Ag Dept / Walnut Room

Name	Title	Company	Phone	Fax	E-Mail
David LeBlanc	Emerg. Mgmt. Spec.	USBR	916-978-5566		dleblanc@usbr.gov
Steve Mackey	Superintendent Operations	Tehama Co.	530-385-1462-3052		SMackey@TCPW.CA.GOV
Ethan Mobley	DP+S owner	DP+S	970 323 4331		ethan@dynamicplanning.co
Brian Greer	DP+S owner	DP+S	925 642 3649		brian@dynamicplanning.co
IAN TURNBULL	CHIEF	CAPAY FIRE PROT. DISTRICT	530-864-8177		ian_turnbull@ruralits.com
Dawn Grine	Public Works	City of Corning	530 824-7025		dgrine@corning.org
John Stoufer	Planning	City of Corning	530 824-7036		jstoufer@corning.org
Kyle Noderer	ESC	CalOES, Inland Region	916 709-5492		kyle.noderer@caloes.ca.gov
GARY ANTONE	TCPW	DPW	530 385-1462		gantone@tcpw.ca.gov
Stan Johnson	Appraiser	Johnson Appraisals	[redacted]		[redacted]
John Stover	Bldg Off.	TCBD	527-7002		jstover@co.tehama.ca.us
Matt Chamblin	Assistant Chief	Cal Fire/TCFD	528-5199		matt.chamblin@fire.ca.gov
JEREMY STRAIT	FIRE PREV.	BLM	224-2155		jstrait@blm.gov
ROD DAUGHERTY	TEHAMA CO SO		737-3123		rdaugherty@tehamaso.org


Have an idea in mind?
...let's scope it out!

Planning Committee Meeting #2

This meeting package contains:

- Agenda
- Sign In Sheets
- Photos

More information on Planning Committee Meeting #2, including PowerPoint Presentation Slides and Handouts (agenda, and Risk Factor Explanation) can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

www.mitigatehazards.com

Tehama County Project Meetings Page:

http://mitigatehazards.com/tehama-hmp-pmt/tc-meetings/

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Meeting Agenda:

Tehama County, California

Mulit-Jurisdictional Hazard Mitigation Plan 2017 Update

Planning Committee Meeting #2

Thursday, May 4th, 2017, 1:30-3:30 pm

Tehama County Agriculture Department Building, Walnut Room

- **Meeting Objectives**
  - Welcome and Introductions
  - Project Re-Caps
  - Vulnerability Data Initial **Draft** Review
  - Hazard Ranking and Review
  - Next Steps and Wrap Up

NOTES

2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #2
May 4, 2017

Name	Agency	Email	Phone
MARTIN SPANNAUS	Corning City Fire	firechief@corning.org	530-824-7044
Carolyn Steffan	City of Tehama	tehama@theskybeam.com	530-384-1501
Ryan Teubert	Tehama County Flood Control & Water Conservation Dist / Public Works	rteubert@tcpw.ca.gov	385-1462
Kyle Nuderer	Cal OES, Inland Region	kyle.noderer@caloes.ca.gov	916-709-5492
Rick GURROLA	TEHAMA Co. Ag.	rgurrola@tehama ag.net	527-4504
Tim POTANOVIC	T.C.E.H.	tpotanovic@co.tehama.ca.us	527-8020
ROD DAUGHERTY	TCSO	rdaugherty@tehamaso.org	529-7930 737-3113 CELL
Stan John		[redacted]	[redacted]
Robin Kampmann	City of Red Bluff	rkampmann@cityofredbluff.org	530-527-2605
Bill Goodwin	County of Tehama	bgoodwin@co.tehama.ca.us	527-4655
Kristen Maze	C of Tehama	kmaze@co.tehama.ca.us	527-2200

2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #2
May 4, 2017

Name	Agency	Email	Phone
Gary Strada	Corning	gcstrada@sbcglobal.net	
Brian DeSmet	CAL FIRE / Tehama County Fire	Brian.DeSmet@fire.ca.gov	
IAN TURNBULL	CAPAY FIRE	ian_turnbull@ruralits.com	
Matt Chamblin	CALFIRE / Tehama County Fire Dept.	matt.chamblin@fire.ca.gov	530-528-5199
MICHAEL WARD	CA DWR	MICHAEL.WARD@WATER.CA.GOV	(530) 529-7378
John Stover	TCBD	jstover@co.tehama.ca.us	527-7002
Jud Pray	TCFB	jpray@crainwalnut.com	530-567-5878
Dawn Grine	City of Corning	dgrine@cornin.org	824-7025
KYLE SANDER	RBPD	KSANDERS@RBPD.ORG	527-8282
Scott Miller	Red Bluff Public Works	smiller@cityofredbluff.org	527-2605
John Stoufer	City of Corning	jstoufer@corning.org	824-7036

2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #2
May 4, 2017

Name	Agency	Email	Phone
Steve Kimbrough	Corning Community	[redacted]	[redacted]
DENNIS GARTON	BOS	DGARTON @ CO. TEHAMA CA.US	2W 1984


2017
Local Hazard Mitigation Plan
Update
Tehama County
Stakeholder Meeting #2
May 4th, 2017
Unincorporated County
City of Corning
City of Red Bluff
80%
20%

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Planning Committee Meeting #3

This meeting package contains:

- Agenda
- Sign In Sheets
- Photos

More information on Planning Committee Meeting #3, including PowerPoint Presentation Slides and Handouts (agenda, and Mitigation Alternatives Handout) can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

www.mitigatehazards.com

Tehama County Project Meetings Page:

http://mitigatehazards.com/tehama-hmp-pmt/tc-meetings/

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Meeting Agenda:

Tehama County, California

Mulit-Jurisdictional Hazard Mitigation Plan 2017 Update

Planning Committee Meeting #3

Thursday, June 15th, 2017, 1:00-3:00 pm

Tehama County Agriculture Department Building, Walnut Room

- **Meeting Objectives**
  - Welcome and Introductions
  - Project Briefs
    - PC Meeting #2
    - Flood Windshield Tour
    - Wildfire Windshield Tour
    - Public Open House
    - Community Survey
    - CRS Update
  - Problem Statement Review

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2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #3
June 15, 2017

Name	Agency	Email	Phone
Dave Grime	City of Corning	dgrime@corning.org	530-824-7025
Steve Mackey	TCPW	SMackey@TCPW.CA.GOV	530-385-1462
MICHAEL WARD	CA. DWR	MICHAEL.WARD@WATER.CA.GOV	529-7378
KYLE SANDERS	RED BLUFF PD	KSANDERS@RBPD.ORG	527-8282
Carolyn Steffan	Tehama City	tehama@theskybeam.com	384-1501
John Stoufer	Corning	jstoufer@corning.org	~~530~~ 824-7036
Steve Kimbrough	Corning Chamber	steveK712@sbcglobal.net	5200156
Ryan Teubert	Tehama County Flood Control & Water Conservation Dist	rteubert@tcpw.ca.gov	385-1462
Lauri Dilworth	TC Environmental Health	ldilworth@co.tehama.ca.us	(530)527-8020
Robin Kampmann	City of Red Bluff	rkampmann@cityofredbluff.org	527-2605
John Stover	TC Bldg&Safety	jstover@co.tehama.ca.us	527-7002

2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #3
June 15, 2017

Name	Agency	Email	Phone
Randy Rapp	CalFire/TCFD	randy.rapp@fire.ca.gov	530-200-2501
R. Scott Miller	Red Bluff P.W.	smiller@cityofredbluff.org	530-527-2605
Kristen Maze	Tehama Co Planning	kmaze@co.tehama.ca.us	530 527-2200
ROD DAUGHERTY	TCSO	rdaugherty@tehamaso.org	530 737-3113
MARTIN SPANNAUS	CVFF	firechief@corning.org	824-7044
Rosie Flores	Farmers Ins.	Rflores@farmersagent.com	588-1141

2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #3
June 15, 2017

Name	Agency	Email	Phone
Matt Chamblin	CALFIRE/TCFD	matt.chamblin@fire.ca.gov	530-528-5199
Tammy Kulpa	Dynamic Planning + Science	tammy@dynamicplanning.co	970-323-4335
ROBERT GOYEVICHE	CALOES	robert.goyevich@caloes.ca.gov	916-694-9906


2017
Local Hazard Mitigation Plan
Update


2017
Local Hazard Mitigation Plan
Update

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Planning Committee Meeting #4

This meeting package contains:

- Agenda
- Sign In Sheets
- Photos

More information on Planning Committee Meeting #4, including PowerPoint Presentation Slides can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

www.mitigatehazards.com

Tehama County Project Meetings Page:

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Meeting Agenda:

Tehama County, California

Mulit-Jurisdictional Hazard Mitigation Plan 2017 Update

Planning Committee Meeting #4

Thursday, July 13th, 2017, 10:00 am -12:30 pm

Tehama County Agriculture Department Building, Walnut Room

- **Meeting Objectives**
    - Planning Process and Schedule Update
    - Phase 3 Check-In
    - Mitigation Guiding Principles, Goals and Objectives Review
    - Capabilities Review
    - Mitigation Action Review
    - Mitigation Prioritization

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2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #4
July, 13 2017

Name	Agency	Email	Phone
ROBERT GOYENECHE	CalOES	robert.goyeneche@caloes.gov	916-694-9906
Carolyn Steffan	City of Tehama	tehama@theskybeam.com	530-384-1501
John Stoufer	City of Corning Tehama	jstoufer@corning.org	530-824-7036
Lauri Dilworth	Environmental Health	ldilworth@co.tehama.ca.us	(530)527-8020
GEORGE SIGALAS	SIGALAS INSURANCE	george@SIGALASINSURANCE.COM	530-736-4500
TODD HILLAIRE	CDWR	todd.hillaire@water.ca.gov	530-529-7347
Dawn Grine	Corning		
R. Scott Miller	City of Red Bluff		
Randy Rapp	Cal Fire	randy.rapp@fire.ca.gov	530-528-5199

2017 Hazard Mitigation Plan
Tehama County
Local Planning Committee Meeting #4
July, 13 2017

Name	Agency	Email	Phone
Ryan Teubert	Tehama County Flood Control & Water Conservation Dist	—	—
Steve Mackey	TCBW	SMackey@TCBW.CA.GOV	530-737-9220
Rob Rianda	Resource Conservation District of Tehama County	Rob@Tehamacountyrcd.org	530 737 5178
Robin Kampmann	City of Red Bluff	rkampmann@cityofredbluff.or	
[illegible]	TEHAMA CO SHERIFF OFFICE	rdaugherty@tehamaso.org	530737-3113


EXIT

Hazard Prioritization Supplemental Meeting- Unincorporated Tehama County

This meeting package contains:

- Hazard Prioritization Exercise Handout
- Photos

More information on Tehama County's Hazard Prioritization Supplemental Meeting, including the Hazard Prioritization Exercise Handout can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

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Tehama County Project Meetings Page:

http://mitigatehazards.com/tehama-hmp-pmt/tc-meetings/

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Hazard Prioritization Exercise

Using the attached Powerpoint file, you will rank the potential hazards against one another for your City. Using the criteria below, you will assess the **Probability** and **Impact** of each hazard during a *worst case scenario event* for your City. A worst case scenario event is defined as the most severe possible outcome that can reasonably be projected to occur in a given situation.

We completed a similar risk assessment exercise during Planning Committee Meeting #2 to rank the County's hazard priorities- now you must do the same for your individual jurisdiction. The results will be documented in your City's annex.

Probability

What is the likelihood of a hazard event occurring in a given year?

Unlikely- less than 1% annual probability

Possible- between 1 & 10% annual probability

Likely- between 10 &100% annual probability

Highly likely- 100% annual probability

Impact

In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?

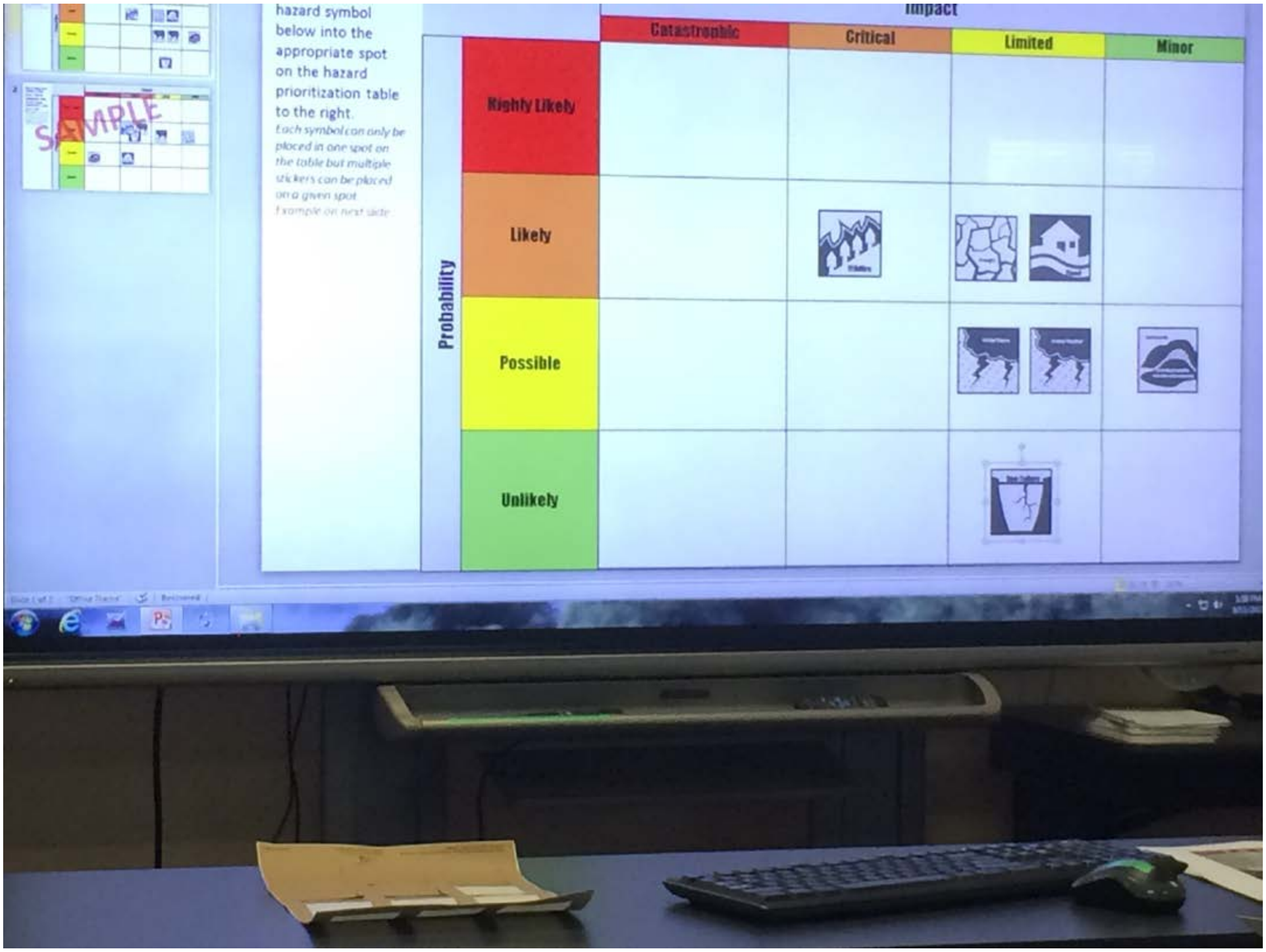
Minor- very few injuries, if any. Only minor property damage & minimal disruption on quality of life. Temporary shutdown of critical facilities.

Limited- minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.

Critical- multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.

Catastrophic- high number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.


Express
Express
Purell


hazard symbol below into the appropriate spot on the hazard prioritization table to the right.
Each symbol can only be placed in one spot on the table but multiple stickers can be placed on a given spot
Impact
Catastrophic
Critical
Limited
Minor
Probability
Highly Likely
Likely
Possible
Unlikely
SAMPLE

Hazard Prioritization Supplemental Meeting- City of Corning

This meeting package contains:

- Sign in Sheet
- Hazard Prioritization Exercise
- Mitigation Action Prioritization Exercise

More information on the City of Corning's Hazard Prioritization Supplemental Meeting, including the Hazard Prioritization Exercise Criteria Handout can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

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Tehama County Project Meetings Page:

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City of Corning
Hazard Prioritization Session
Tuesday, August 22, 2017

Multi-Jurisdictional Hazard Mitigation Plan Update

Sign in Sheet

Dawn Grine	Dawn Grine	City of Corning
Steve Lindeman	Steve Lindeman	city of corning
John Stoufer	John Stouf	City of Corning
MARTIN SPANNAUS	Mart Spann	City of CORNING
Gary Strack	Gary Strack	City of Corning
Stephen Kimbrough	Steve Kimb	Corning Community

City of Corning
Hazard Prioritization Session
Tuesday, August 22, 2017
10am to Noon

Multi-Jurisdictional Hazard Mitigation Plan Update

Six Committee members discussed the seven potential hazards that most likely could affect the City of Corning along with their probability and potential impact on the community.

The group has determined their priority as listed below:

1. Winter Storms and Flood
2. Severe Weather
3. Wildfire
4. Drought
5. Geohazards

The group also concluded that Dam Failure should be removed from the list.

City of Corning
Hazard Prioritization Session
Tuesday, August 22, 2017
10am to Noon

Multi-Jurisdictional Hazard Mitigation Plan Update

Six Committee members reviewed the City of Corning Mitigation Actions proposed for the 2017 HMP update and have listed the below actions as the 'top 10' priorities.

1. Storm drain improvements and construction:
    a) CC-26-2018; Toomes Avenue
    b) CC-27-2018; Edith Avenue
    c) CC-28-2018; Fig Lane/Chicago Avenue/West Street
    d) CC-10-2012; Blackburn Avenue/Third Street

2. CC-05-2018; Maintenance and operation agreement with Department of Fish and Game

3. CC-06-2012; Conduct study of solution options for increasing drain capacity under the RR bridge on Kirkwood (Jewett Creek)

4. CC-12-2012; Feasibility study to create retention basin(s)

5. CC-16-2018; Address failing dry wells throughout the City

6. CC-20-2018; Develop hazard tree program

7. CC-23-2018; Install groundwater monitoring wells/Upgrade City wells for monitoring

8. CC-24-2018; Develop alternative water source for City of Corning (Additional water wells)

9. CC-25-2018; Continue weed abatement program (including non-maintained orchard abatement within City and sphere of influence)

10. CC-03-2012; Upgrade City Hall electrical/communication system to accommodate EOC

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Hazard Prioritization Supplemental Meeting- City of Red Bluff

This meeting package contains:

- Hazard Prioritization Exercise
- Mitigation Action Prioritization Exercise

More information on the City of Red Bluff's Hazard Prioritization Supplemental Meeting, including the Hazard Prioritization Exercise Criteria Handout can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

www.mitigatehazards.com

Tehama County Project Meetings Page:

http://mitigatehazards.com/tehama-hmp-pmt/tc-meetings/

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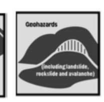
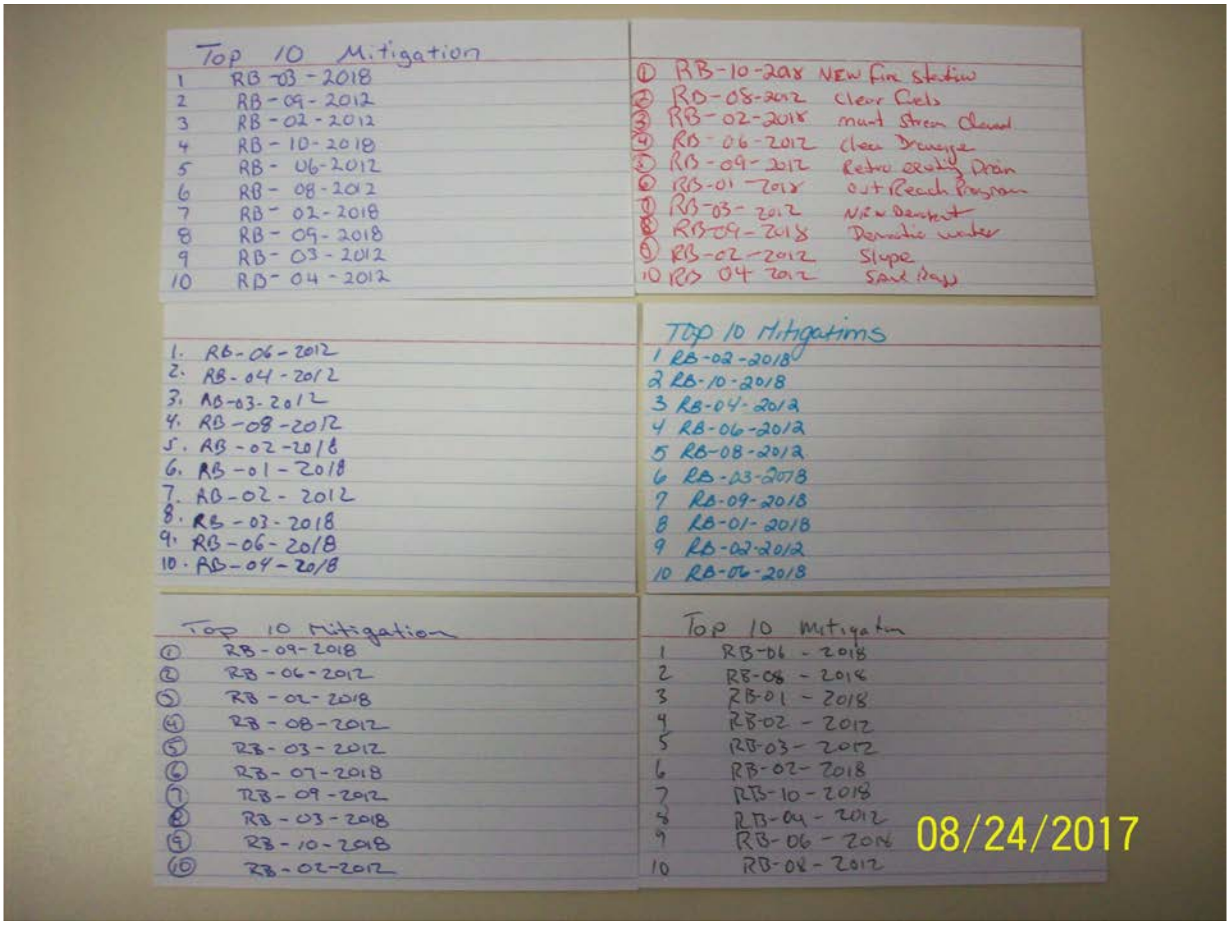
9/21/2017

Drag & Drop each hazard symbol below into the appropriate spot on the hazard prioritization table to the right.
Each symbol can only be placed in one spot on the table but multiple stickers can be placed on a given spot.
Example on next slide.

		Impact			
		Catastrophic	**Critical**	**Limited**	**Minor**
Probability	**Highly Likely**				
	Likely				 
	Possible				 
	Unlikely				 


Top 10 Mitigation
1 RB-03-2018
2 RB-09-2012
3 RB-02-2012
4 RB-10-2018
5 RB-06-2012
6 RB-08-2012
7 RB-02-2018
8 RB-09-2018
9 RB-03-2012
10 RB-04-2012
1 RB-10-2018 NEW fire station
2 RB-08-2012
3 RB-02-2018
4 RB-06-2012 Clear Drainage
5 RB-09-2012
6 RB-01-2018 Out Reach Program
7 RB-03-2012
8 RB-09-2018 Domestic water
9 RB-02-2012 Slope
10 RB 04 2012
1. RB-06-2012
2. RB-04-2012
3. RB-03-2012
4. RB-08-2012
5. RB-02-2018
6. RB-01-2018
7. RB-02-2012
8. RB-03-2018
9. RB-06-2018
10. RB-04-2018
Top 10 Mitigations
1 RB-02-2018
2 RB-10-2018
3 RB-04-2012
4 RB-06-2012
5 RB-08-2012
6 RB-03-2018
7 RB-09-2018
8 RB-01-2018
9 RB-02-2012
10 RB-06-2018
Top 10 Mitigation
1 RB-09-2018
2 RB-06-2012
3 RB-02-2018
4 RB-08-2012
5 RB-03-2012
6 RB-07-2018
7 RB-09-2012
8 RB-03-2018
9 RB-10-2018
10 RB-02-2012
Top 10 Mitigation
1 RB-06-2018
2 RB-08-2018
3 RB-01-2018
4 RB-02-2012
5 RB-03-2012
6 RB-02-2018
7 RB-10-2018
8 RB-04-2012
9 RB-06-2018
10 RB-08-2012
08/24/2017

Hazard Prioritization Supplemental Meeting- City of Tehama

This meeting package contains:

- Hazard Prioritization Exercise
- Photo

More information on the City of Tehama's Hazard Prioritization Supplemental Meeting, including the Hazard Prioritization Exercise Criteria Handout can be found on the Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update Website on MitigateHazards.com

MITIGATE HAZARDS

www.mitigatehazards.com

Tehama County Project Meetings Page:

http://mitigatehazards.com/tehama-hmp-pmt/tc-meetings/

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9/21/2017

Drag & Drop each hazard symbol below into the appropriate spot on the hazard prioritization table to the right.
Each symbol can only be placed in one spot on the table but multiple stickers can be placed on a given spot.
Example on next slide.

		Impact			
		Catastrophic	**Critical**	**Limited**	**Minor**
Probability	**Highly Likely**				
	Likely		 		
	Possible			earthquake 	
	Unlikely				


NO SMOKING
NO FUMAR

B.2 Public Notices and Press Releases

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PROTECT YOUR HOME FROM NATURAL DISASTERS!

Attend a free open house event on natural disaster threats in your area.

Learn what you can do to protect your home and family from the effects of wildfire, flooding, earthquake and other hazards...

Tell us your thoughts on local hazards!

Tell us what incentives will help us protect your home!

HAZARD MITIGATION PUBLIC OPEN HOUSE

Wednesday, June 14th
Drop in anytime between
3:00 PM and 7:00 PM

Red Bluff Community Center
1500 S Jackson St.
Red Bluff, CA 96080

PIZZA & SOFT DRINKS!

GIVE-A-WAYS!

BRING HISTORIC DISASTER PHOTOS, GET A REWARD!!

This outreach effort is coordinated by the Tehama County Local Hazard Mitigation Planning Committee. Learn more about resources and the County's planning efforts to reduce risk in your area by visiting the LOCAL HAZARD MITIGATION QUICK LINK at:

www.mitigatehazards.com/tehama-hmp

Brought to you by:

TEHAMA COUNTY CALIFORNIA

CITY OF CORNING

CITY OF RED BLUFF CALIFORNIA 1876

CITY OF TEHAMA
Little City of Big Trees

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HAZARD MITIGATION PUBLIC OPEN HOUSE
HAZARD MITIGATION PUBLIC OPEN HOUSE
NOTICE
EFFECTIVE IMMEDIATELY:
NEW REGULATION ON LEAD:
Renovation, Repair and Painting (RRP)
YOU NEED:

Tehama County Public Works

9380 San Benito Avenue, Gerber, CA 96035-9701 Phone: (530) 385-1462

Engineering | Flood Control & Water Resources | Operations & Maintenance | Transportation Commission | Transit Agency Board | TRAX & Transit Information

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- GIS Information
- Weather & Forecast
- ± Road Closures & Storm Information
  - Current Road Closures
  - Storm & Sandbag Information

Engineering Division
- Land Development
- Permits
- ± Projects & RFP's

Flood Control & Water Resources
- Drought Information
- Floodplain Management
- Levee Systems
- ± Emergency Flood Information

Tehama County Flood Control & Water Conservation District

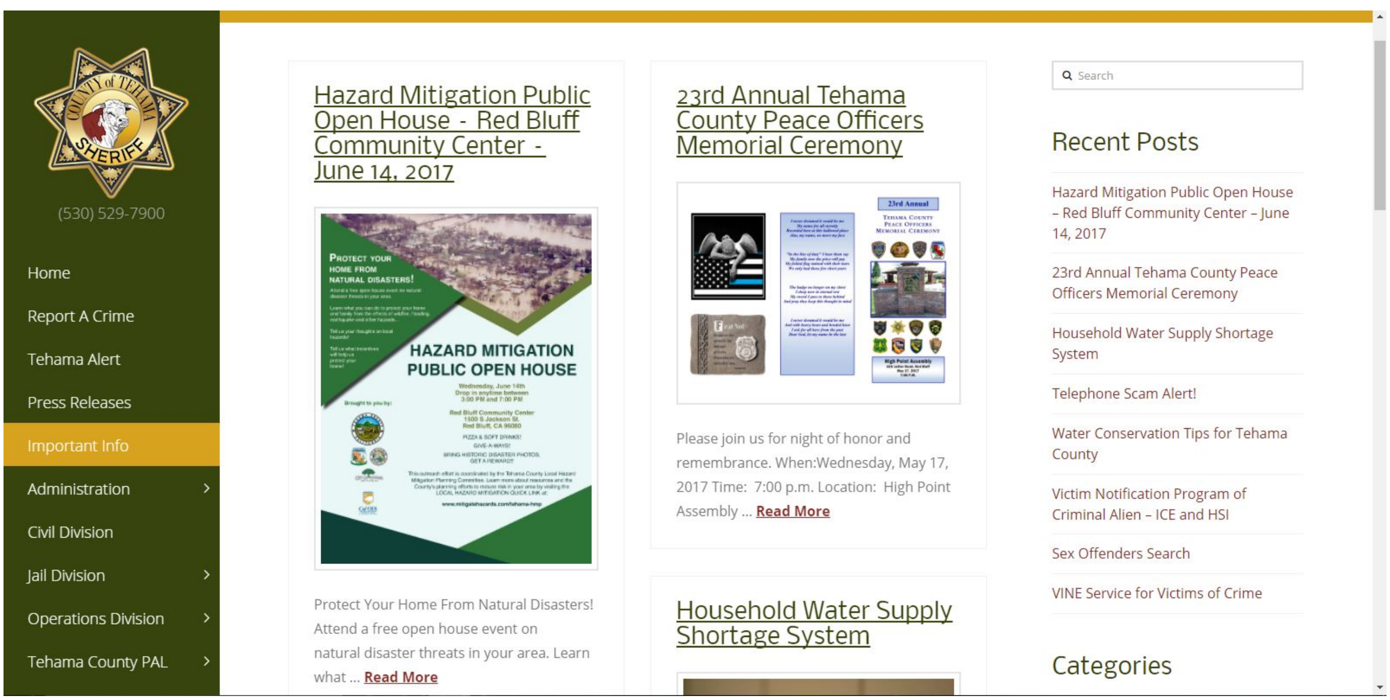
Ryan Teubert
Flood Control & Water Resources Manager
(530) 385-1462
rteubert@tcpw.ca.gov

The Tehama County Flood Control & Water Conservation District was originally established in 1957 by the Tehama County Flood Control and Water Conservation District Act. This Act defined the boundary and territory of the District as follows: "all that territory of the County of Tehama lying within the exterior boundaries thereof."

Tehama County Multi-Jurisdictional Hazard Mitigation Plan - Public Open House
Join us for the Tehama County Multi-Jurisdictional Hazard Mitigation Plan Public Open House Wednesday, June 14th from 3-7pm at the Red Bluff Community Center. Enjoy free pizza, soft drinks and give-a-ways as you learn how to protect your home from natural disasters and voice your opinion on natural hazards facing the County. Bring your historic disaster photos and get a reward. Click to continue reading...

Statewide Emergency Water Conservation Regulations - Adopted May 18, 2016
The State Water Resources Control Board (Water Board) shall, as soon as practicable, adjust emergency water conservation regulations through the end of January 2017 in recognition of the differing water supply conditions across the state. To prepare for the possibility of another dry winter, the Water Board shall also develop, by January 2017, a proposal to achieve a mandatory reduction in potable urban water usage that builds off of the mandatory 25% reduction called for in Executive Order B-29-15 and lessons learned through 2016. Click to continue reading...

Sustainable Groundwater Management Act



(530) 529-7900

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- Press Releases
- Important Info
- Administration
- Civil Division
- Jail Division
- Operations Division
- Tehama County PAL

Hazard Mitigation Public Open House - Red Bluff Community Center - June 14, 2017

PROTECT YOUR HOME FROM NATURAL DISASTERS!
HAZARD MITIGATION PUBLIC OPEN HOUSE

Protect Your Home From Natural Disasters! Attend a free open house event on natural disaster threats in your area. Learn what ... **Read More**

23rd Annual Tehama County Peace Officers Memorial Ceremony

Please join us for night of honor and remembrance. When:Wednesday, May 17, 2017 Time: 7:00 p.m. Location: High Point Assembly ... **Read More**

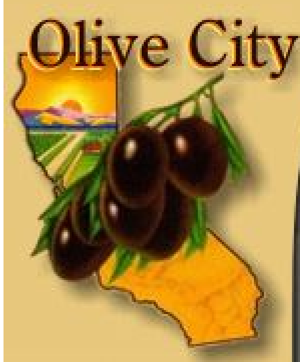
Household Water Supply Shortage System

Search

Recent Posts

- Hazard Mitigation Public Open House – Red Bluff Community Center – June 14, 2017
- 23rd Annual Tehama County Peace Officers Memorial Ceremony
- Household Water Supply Shortage System
- Telephone Scam Alert!
- Water Conservation Tips for Tehama County
- Victim Notification Program of Criminal Alien – ICE and HSI
- Sex Offenders Search
- VINE Service for Victims of Crime

Categories



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CITY OF CORNING
HOME OF THE QUEEN OLIVE

2017 Agendas	CPD Online	Commission Agendas
Choose Year ▼		Choose One ▼ Previous Agendas

Hazard Mitigation Open House - June 14th

Public Works Employment Application

Pool Schedule

Pay your Water Bill Online

The City of Corning, California (pop 7663), was incorporated in 1907 and provides a full range of municipal services including Police, Fire, Parks and Recreation, Library, Public Works and Municipal Airport. Located just 25 miles northwest of Chico and 17 miles south of Red Bluff, Corning is perhaps best known for its award-winning olive products.

CITY OF CORNING
Department Links

- Administration
- Agendas
- Building & Safety

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CITY OF TEHAMA
Little City of Big Trees
City of Tehama California

Residents

- Alerts
- Payment Options
- Building Permits & Inspections
- Departments
  - Animal Services
  - Emergency Services
    - Fire Department
    - Police Department
  - Parks & Recreation
    - Park Facilities
  - Gas & Electric Utilities
  - Sanitation & Recycling
  - Water Utilities
    - Meter Reading
    - Water Rates & Policies
    - Water Quality Report
- Flood Information

Our Local Weather

ALERTS

CLOSE ✖

Marijuana Ordinance - June 18, 2017
The Tehama City Council adopted a revised marijuana ordinance at its meeting on June 13, 2017. [more...]

Hazard Mitigation Plan - March 31, 2017
The County of Tehama and the cities of Tehama, Corning, and Red Bluff are starting the update... [more...]

Residents

Alerts

Stay tuned here to the latest breaking news and alerts from City of Tehama. **Subscribe today** and have News & Notices, and Alerts delivered directly to you via email and or text! Just another way we are working harder to better serve our community.

Marijuana Ordinance

June 18, 2017

The Tehama City Council adopted a revised marijuana ordinance at its meeting on June 13, 2017.

Hazard Mitigation Plan

March 31, 2017

The County of Tehama and the cities of Tehama, Corning, and Red Bluff are starting the update of its Multijurisdictional Hazard Mitigation Plan. Watch for an announcement of an open house to gain more information about this important plan.

Red Bluff-Tehama County Chamber of Commerce

@redbluffchamber

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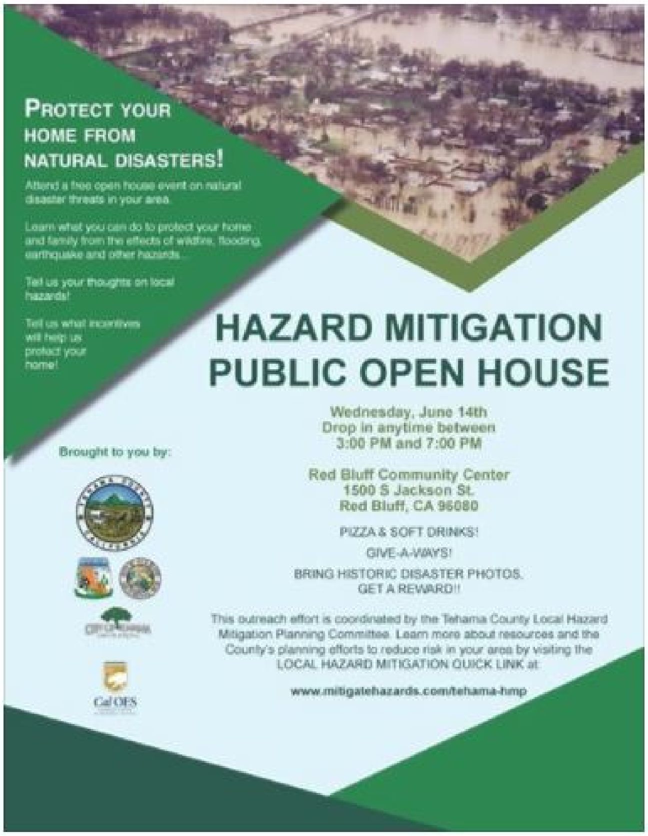
Red Bluff-Tehama County Chamber of Commerce added a new photo — at Red Bluff Community / Senior Center.
June 9 at 2:06pm



Like | Comment | Share

2 | Chronological

Red Bluff-Tehama County Chamber of Commerce Tehama County Hazard Mitigation Public Open House on June 14th at the Red Bluff Community Center and This is a FREE event that will teach the public how to protect their homes and families
My e-mail address is tammy@dynamicplanning.co if you'd like to reach me for more information.
Like · Reply · June 9 at 2:10pm

promoting... See More
May 26, 2017

Like | Comment

Amanda Jenkins
5★ Can't wait for Farmer's Market to start! The Chamber does a fabulous job at putting on this event! Another great one to ... See More
May 24, 2017

Like | Comment

Tell people what you think

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- **Shasta County Sheriff's...** — Law Enforcement Agency — Like
- **Tehama District Fairgro...** — Fairground — Like

Event Planning in Red Bluff, California

Pages liked by this Page

- **BBQ Tools** — Like
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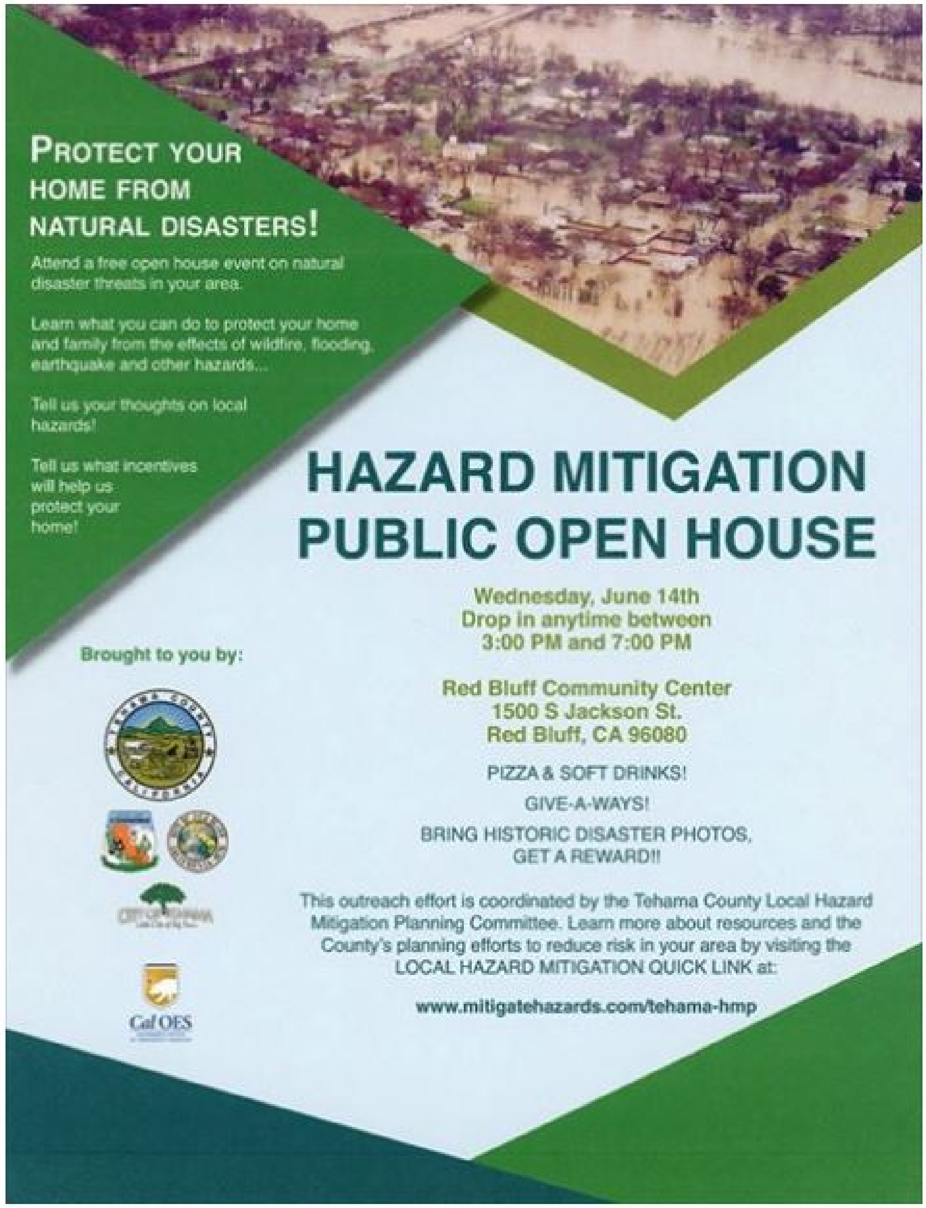
June 8 ·



Like Comment

Denden Scribner, Georgia Scott and 2 others like this.

Tehama County Public Works

Gary Antone, P.E. P.L.S.
Director of Public Works
(530) 385-1462

Office Hours	Field Operations
8:00am - 5:00pm	6:30am - 5:00pm
Monday - Friday	Monday - Thursday

Mission:
To provide high quality services, products and protection of County infrastructure through design, construction and maintenance in an efficient, effective and safe manner for the people of Tehama County.

Vision:
We are a proactive and fully capable, cooperative team which meets all the planning, engineering, operating, maintenance and administrative needs of Tehama County Public Works in a highly competent manner, maintaining a positive work environment where individuals have opportunities for self improvement and are recognized for their achievements and contributions on behalf of the people of Tehama County.

Public Asked to Review Hazard Mitigation Activities - Please Give Feedback
As part of the Tehama County Multi-Jurisdictional Hazard Mitigation Plan update process, the County and Cities of Corning, Red Bluff and Tehama are again seeking public input. The public is being asked to review the priority hazard mitigation activities developed by the County and participating cities. These activities focus on mitigating the effects of natural hazards throughout the County to protect lives as well as the built and natural environment.

Public input is critical to ensure the priorities of the Hazard Mitigation Plan match the priorities of Tehama County residents. In addition to reviewing the mitigation activities, the County and participating Cities are also accepting comments on the Draft Hazard Mitigation Plan itself **through October 10th**. Click to view and comment on the mitigation activities and draft plan...

2016 Local Streets & Roads Assessment - Final Report
The first comprehensive statewide study of California's local street and road system in 2008 provided critical analysis and information on the local transportation network's condition and funding needs.

News & Events

Tehama Tough Mud Run to Benefit Tehama County Youth

Hazard Mitigation Activities - Public asked to review and give feedback

As part of the Tehama County Multi-Jurisdictional Hazard Mitigation Plan update process, the County and Cities of Corning, Red Bluff … **Read More**

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Project Update
Your input is needed on Draft Documents and Mitigation Actions!

We are now in the comment and review period of the Hazard Mitigation Plan Update Process. During this phase, we invite you to review the draft documents and mitigation actions identified for the jurisdiction(s) you represent.

Document Review: Please click the links below to access the DRAFT version of the 2018 Tehama County Multi-Jurisdictional Hazard Mitigation Plan Update.

DRAFT Volume 1 (Download)
DRAFT Volume 2 (Jurisdictional Annexes) (Download)

Instructions for commenting: http://mitigatehazards.com/tehama-county-hmp-documents/

Mitigation action review tools: Mitigation action review tools can be found at the weblinks below. On the individual jurisdictional websites, one can review and comment on mitigation actions and also use an online tool to prioritize them based upon an individual perception of importance. Further instructions are provided on the links below.

Tehama County: http://mitigatehazards.com/tehama-county-hmp-ma-votes/tehama-county/
City of Corning: http://mitigatehazards.com/tehama-county-hmp-ma-votes/city-of-corning/
City of Tehama: http://mitigatehazards.com/tehama-county-hmp-ma-votes/city-of-tehama/
City of Red Bluff: http://mitigatehazards.com/tehama-county-hmp-ma-votes/city-of-red-bluff/

We would appreciate your comments and responses before Tuesday, October 10th.

Welcome to the City of Red Bluff

Statement of Philosophy and Mission - It is the mission of the City of Red Bluff to make decisions, plan and act in the best interest of the general populace of Red Bluff above and beyond the interest of City Government entities and City government officials in providing municipal services.

We recognize that the City has been entrusted with the stewardship of financial resources which rightly belong to the community and we value prudent financial management.

We believe that our first responsibility is to the health, safety, and welfare of our citizens through efficient and effective programs.

We believe in the worth of every person in our organization we strive to maximize everyone's potential. We seek ideas and participation from all levels.

We have a bias for action and support reasonable risk-taking.

To sustain consistency, growth and a high quality of life in our community, we are committed to long-range planning, effective management of resources and openness toward innovative ideas.

SEE PUBLIC NOTICES FOR ADA INFORMATION

MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN (click on link)

9/21/17 Press Release

Public Asked to Review Hazard Mitigation Activities, Give Feedback

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Public input is critical to ensure the priorities of the Hazard Mitigation Plan match the priorities of Tehama County residents.

In addition to reviewing the mitigation activities, the County and participating Cities are also accepting comments on the Draft Hazard Mitigation Plan itself through October 10th.

To view and comment on the mitigation activities and draft plan, please visit:

Draft Plan Review:

http://mitigatehazards.com/tehama-county-hmp-documents/

Pay Your Bills Online

- Pay Utility Bill
- Pay Motel Tax
- Pay City Services
- Pay Building Permits
- Pay Recreational Services

To make utility payments by phone, please call:
1-855-288-4082

Community Center Senior Center Information Click Here

REQUEST AUTOMATIC WITHDRAWAL FROM YOUR BANK ACCOUNT FOR MONTHLY UTILITY BILLING »

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Agriculture & Open Spaces
Tourism
Community Organizations

Public Asked to Review Hazard Mitigation Activities, Give Feedback

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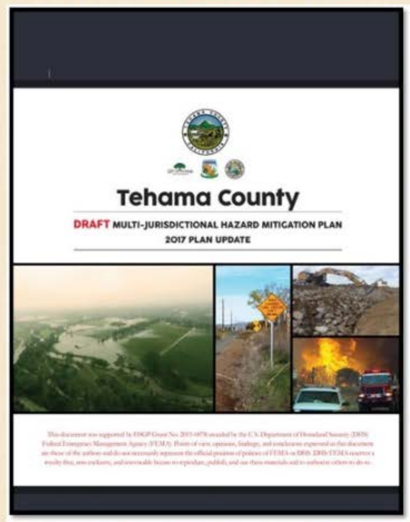

Abandoned Vehicle Abatement Program

Your comments and opinions are important to us and will provide valuable information regarding how the County of Tehama can better serve individuals with disabilities. Surveys are available online at www.co.tehama.ca.us. They can also be mailed to you or are available at:

Julie Sisneros, ADA Coordinator
County of Tehama
727 Oak Street
Red Bluff, CA 96080

Please contact Julie Sisneros, ADA Coordinator, if you have questions or comments or would like to request a survey in an alternate format.

(530) 527-4655 ext 3032
Fax: (530)527-3764
jsisneros@co.tehama.ca.us

Information regarding the Americans with Disabilities Act can be obtained from the ADA Coordinator.

The County of Tehama complies with the Americans with Disabilities Act of 1990, Public Law 101-336, which prohibits discrimination on the basis of disability.

Input sought on hazard mitigation activities

ContributedInput is being sought on hazard mitigation activities within the county.

POSTED: 10/06/17, 11:22 AM PDT | 0 COMMENTS

As part of the Tehama County Multi-Jurisdictional Hazard Mitigation Plan update process, the county and cities of Corning, Red Bluff and Tehama are seeking public input.

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To view and comment on the mitigation activities and draft plan, visit https://tinyurl.com/y7yfpaba.

82°
Clear

Community Briefs: Sept. 28, 2017

Posted: Wednesday, September 27, 2017 7:20 pm

Corning Observer

Hazard Mitigation Plan public input needed

As part of the Tehama County Multi-jurisdictional Hazard Mitigation Plan update process, the county and cities of Corning, Red Bluff and Tehama are seeking public input.

The public is being asked to review the priority hazard mitigation activities developed by county and participating cities. These activities focus on mitigating the effects of natural hazards throughout the county to protect lives as well as the built and natural environments

Public input is critical to ensure the priorities of the plan match the priorities of county and city residents.

In addition to reviewing the mitigation activities, the county and cities are also accepting comments on the Draft Hazard Mitigation Plan through Oct. 10. To view and comment on the mitigation activities and draft plan go online to tinyurl.com/y7yfpaba.

Corning supports county's hazard mitigation plan draft

By Jeff Larson, jlarson@redbluffdailynews.com, @jtlarson on Twitter

POSTED: 10/11/17, 2:18 PM PDT | UPDATED: 5 DAYS AGO 0 COMMENTS

Corning >> As many other areas witnessed first-hand earlier this week, a natural disaster can happen anytime, anywhere, during any circumstance.

On Tuesday night the City Council took a step forward in preparing for such disasters within city limits when it granted a letter of support written by Mayor Douglas Hatley, Jr. on behalf of the council supporting the new five-year Tehama County Multi-Jurisdictional Hazard Mitigation draft proposal.

The letter read in part that Hatley and the council provide "acceptance and support" of the planning process outlined by Ethan Mobley and Brian Greer of Dynamic Planning and Science.

In presentation to the council at an earlier meeting, Mobley outlined the planning process for Corning that included a county wildfire risk area tour and flood tour.

"We researched the area and understood why (Corning) is having flood issues south of town," Mobley during the Sept. 26 presentation.

Mobley went on to reiterate that last year there was a billion dollars available in the program and 129 grants available in FEMA region nine, which includes California.

"We do have eligibility to receive dollars under this grant program," Mobley said.

The council unanimously approved the letter of support with little to no discussion.

The plan will ultimately be sent to the Federal Emergency Management Agency for approval.

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B.3 Public Open House Documentation

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2017 Hazard Mitigation Plan
Tehama County
Public Open House
June 14, 2017

Name	Address	City	# Persons in Household
DENNIS GARTON	[redacted]	RED BLUFF	2
WALT MANSELL		RED BLUFF	2
Rob Moore		Cottonwood ~~TCSO~~	2
ROD DAUGHERTY		RED BLUFF	2
Dave Brown			4
Chris Hurton		Red Bluff	6
Austin Bronze		Red Bluff	7
MICHAEL DECKER		RED BLUFF	10
Orle Jackson		Red Bluff	3
Heather Lake		Cottonwood	1
Chuck Schoendienst		R.B	2
Tammy Thulpa		Montrose	2

2017 Hazard Mitigation Plan
Tehama County
Public Open House
June 14, 2017

Name	Address	City	# Persons in Household
Kristen Mazi	[redacted]	Red Bluff	—
Dan Roche	[redacted]	Red Bluff	1
Tim Potanovic	[redacted]	RB	1
Carolyn Steffan	[redacted]	Tehama	1
Christine Thompson	[redacted]	Red Bluff	
Randy Rapp	[redacted]		Business
Stephen Kimbrough	[redacted]	Corning	Representing Corning
Dawn Grine	[redacted]	Corning	2
Gary Antone	[redacted]	RED BLUFF	1
R. Scott Hille	[redacted]	Red Bluff	2
Robin Thraenk	[redacted]	Tehama	1
MILA CHRISTISON	[redacted]	//	1

2017 Hazard Mitigation Plan
Tehama County
Public Open House
June 14, 2017

Name	Address	City	# Persons in Household
Laurel Hampel	[redacted]	Tehama	2
Fred Hampel	[redacted]	Tehama	2
Tena Cervantes	[redacted]	Red Bluff	4
Amanda Sharp	[redacted]	Cottonwood	NOT IN COUNTY
Val Lucero	[redacted]	Corning	2
Lee Morych	[redacted]	Tehama	2
CINDY PILI	[redacted]	RB	2
Nichole Bethuren	[redacted]	Red Bluff	3
Lynette Freund	[redacted]	Red Bluff	2
Paul Freund	[redacted]	" "	" "
Rob Rianda	[redacted]	Red Bluff	1
Kyle, Abby, Thomas Granfield	[redacted]	Red Bluff	5

2017 Hazard Mitigation Plan
Tehama County
Public Open House
June 14, 2017

Name	Address	City	# Persons in Household
Alvin Sernholt	[redacted]	Cottonwood	3
Bill Goodwin	[redacted]	Red Bluff	1
Holden Mikesell	[redacted]	Red Bluff	1
Angel Guzman	[redacted]	Gerber	5
John Stoufer	[redacted]	Red Bluff	3
TERRY STEPHENS	[redacted]	RED BLUFF	3
RONALD BACA JR	[redacted]	RED Bluff	2
David S Kendall Jr	[redacted]	"	2
Ryan Teubert	[redacted]		
JAIME CRANE	[redacted]	RED BLUFF	5
amanda blue	[redacted]	→	1

21
June

Tehama County Hazard Mitigation Public Open House

June 21, 2017 / In **Tehama** / By **Tammy Kulpa**

On Wednesday, June 14th, we hosted a hazard mitigation open house at the Red Bluff Community Center to educate the public on natural hazards facing Tehama County and how to protect their homes and families. The hazard stations focused on flooding, wildfire and severe weather.

We couldn't have done it without the support of our awesome vendors who came out and did some public outreach. Thank you PG&E, Tehama 2-1-1, Tehama County Sheriffs and Cal Fire! Staff members from the County and participating cities of Tehama, Corning and Red Bluff were also in attendance to show their support and answer questions from members of their community.

Collecting community input is an important element of a hazard mitigation plan update. Open house attendees who completed our brief community survey on natural hazards were entered to win prizes that would help mitigate hazards around their homes. Pictured is a brand new weed whacker, donated by McCoy's Ace Hardware. Anyone who brought in historic disaster photos were entered to win even more prizes!

Once attendees visited all 10 hazard stations, they were granted access to see the Tehama County Sheriff's Critical Incident Response Vehicle. People of all ages enjoyed the opportunity to hop into the vehicle and look around!

The Red Bluff Daily News wrote a great article recapping the Open House. You can read it by clicking here.

Newest Hottest Most votes Most views

No questions found.

Ask a Question

Enter question here...

Enter more details if needed... (optional)

Choose project/topic:

Project/topic

Drag and drop attachments here

Browse... No files selected.

Max file size: 10.0 MB

☑ Check to receive email notification of responses to your question

Enter your nickname

Enter your email

I'm not a robot

reCAPTCHA
Privacy - Terms

Add Question


Station
2


FIND YOUR HOUSE
AND STICK-A-DOT


GEOHAZARD
SLOPE FAILURE
GEOHAZARD
EARTHQUAKE
Station
3


DIAL 211
Pacific Gas and
Electric Company


O.E.S.

B.4 Survey

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dynamic.planning.01@gmail.com

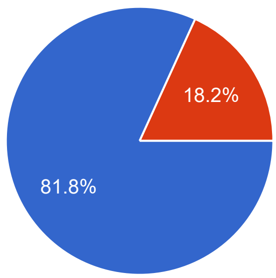
Edit this form

77 responses

View all responses

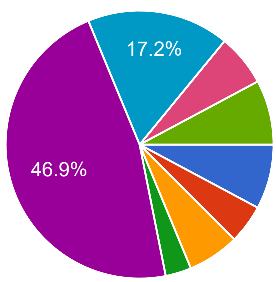
Summary

Q1A. Do you believe your property is at risk from a natural hazard disaster?



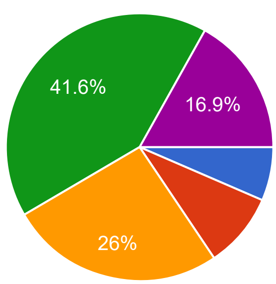
Yes	63	81.8%
No	14	18.2%

Q1B. If you selected Yes to Q1, please select the one hazard you think is the highest threat to your neighborhood or property.



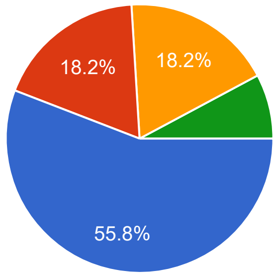
Severe Weather	5	7.8%
Drought	3	4.7%
Earthquake	4	6.3%
Landslide	2	3.1%
Flooding	30	46.9%
Wildfire	11	17.2%
High Heat	4	6.3%
Other	5	7.8%

Q2. Please indicate how you feel about the following statement:



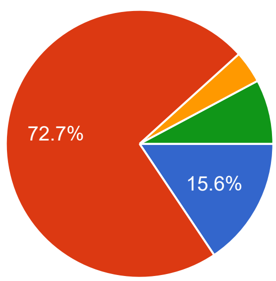
Strongly Disagree	5	6.5%
Somewhat Disagree	7	9.1%
Neither Agree nor Disagree	20	26%
Somewhat Agree	32	41.6%
Strongly Agree	13	16.9%

Q3. To the best of your knowledge, does your homeowner's, or renter's, insurance policy provide coverage for damage from natural hazards?



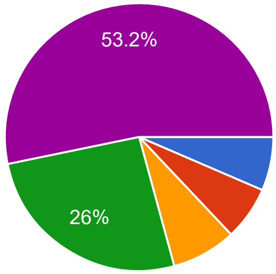
Yes	**43**	55.8%
No	**14**	18.2%
Not Sure	**14**	18.2%
Do not have property insurance	**6**	7.8%

Q4. Have you ever had problems getting homeowner's or renter's insurance due to risks from natural hazards?



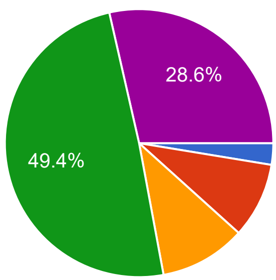
Yes	**12**	15.6%
No	**56**	72.7%
Not Sure	**3**	3.9%
Never tried obtaining hazard insurance	**6**	7.8%

Q5. Please indicate how you feel about the following statement:



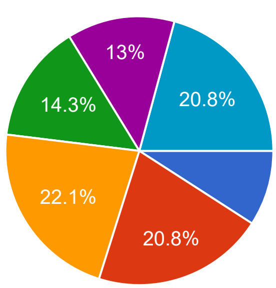
Strongly Disagree	**5**	6.5%
Somewhat Disagree	**5**	6.5%
Neither Agree nor Disagree	**6**	7.8%
Somewhat Agree	**20**	26%
Strongly Agree	**41**	53.2%

Q6. Please indicate how you feel about the following statement:



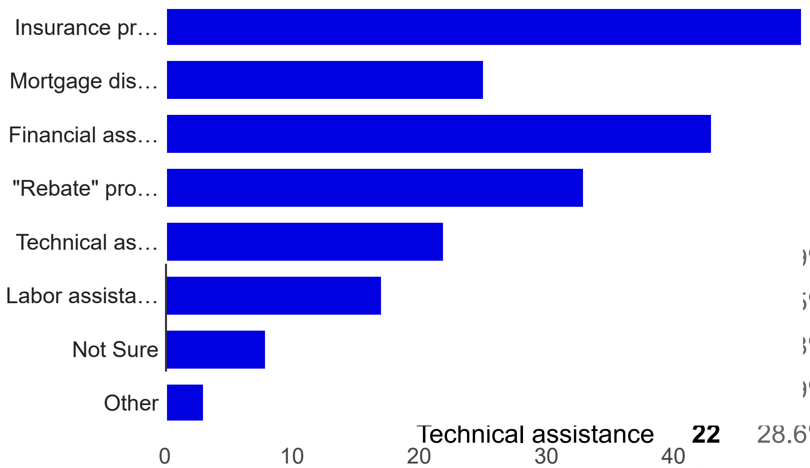
Strongly Disagree	**2**	2.6%
Somewhat Disagree	**7**	9.1%
Neither Agree nor Disagree	**8**	10.4%
Somewhat Agree	**38**	49.4%
Strongly Agree	**22**	28.6%

Q7. How much money would you be willing to spend to protect your property from natural hazards? (for example, by elevating a home above the flood level, replacing flammable roofing material, or obtaining renter's insurance)



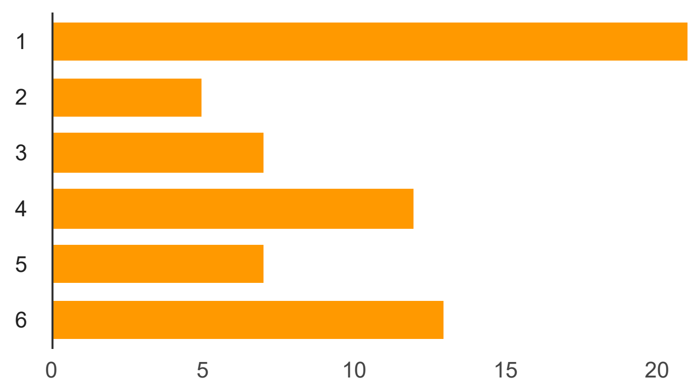
$10,000 or above	**7**	9.1%
$5,000 to $9,999	**16**	20.8%
$1,000-$4,999	**17**	22.1%
Less than $1,000	**11**	14.3%
Nothing	**10**	13%
Not Sure	**16**	20.8%

Q8. Which of the following incentives would encourage you to protect your home against natural hazards? (Check all that apply)



Technical assistance	**22**	28.6%
Labor assistance	**17**	22.1%
Not Sure	**8**	10.4%
Other	**3**	3.9%

Assess essential facilities such as police and fire facilities, schools and hospitals for their wildfire risk. [Q9 - We understand that all types of community protection are important. What protection methods do you believe the County, State or Federal agencies should be using in order to reduce damage and disruption from hazard events within Tehama County?]

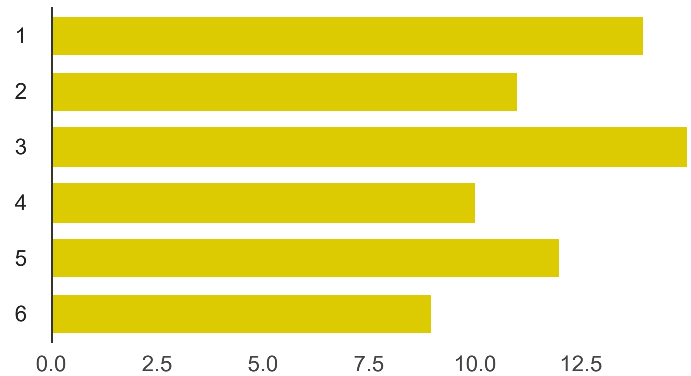


1	**21**	27.3%
2	**5**	6.5%
3	**7**	9.1%
4	**12**	15.6%
5	**7**	9.1%
6	**13**	16.9%

Fund projects such as flood walls, drainage improvements, fuel breaks, and bank stabilization projects. [Q9 - We understand that all types of community protection are important. What protection methods do you believe the County, State or Federal agencies should be using in order to reduce damage and disruption from hazard events within Tehama County?]

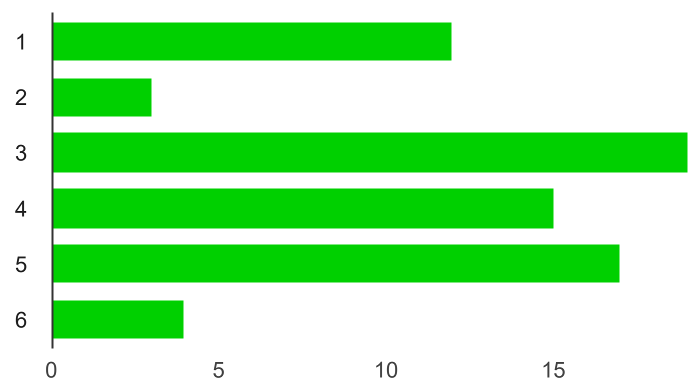
1	**21**	27.3%
2	**4**	5.2%
3	**9**	11.7%
4	**16**	20.8%
5	**8**	10.4%
6	**8**	10.4%

Strengthen codes and regulations to include higher hazard areas. [Q9 We understand that all types of community protection are important. What protection methods do you believe the County, State or Federal agencies should be using in order to reduce damage and disruption from hazard events within Tehama County?]



1	**14**	18.2%
2	**11**	14.3%
3	**15**	19.5%
4	**10**	13%
5	**12**	15.6%
6	**9**	11.7%

Assist vulnerable property owners with securing funding for mitigation / property protection. [Q9 - We understand that all types of community protection are important. What protection methods do you believe the County, State or Federal agencies should be using in order to reduce damage and disruption from hazard events within Tehama County?]

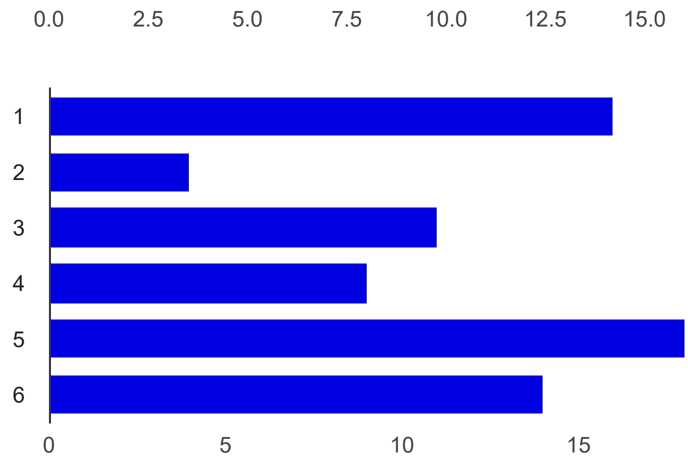


1	**12**	15.6%
2	**3**	3.9%
3	**19**	24.7%
4	**15**	19.5%
5	**17**	22.1%
6	**4**	5.2%

Provide better public information about risk, and the exposure to hazards within Tehama County. [Q9 - We understand that all types of community protection are important. What protection methods do you believe the County, State or Federal agencies should be using in order to reduce damage and disruption from hazard events within Tehama County?]

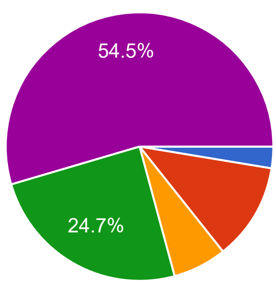
1	**10**	13%
2	**5**	6.5%
3	**16**	20.8%
4	**15**	19.5%
5	**13**	16.9%
6	**13**	16.9%

Carry out projects to restore the natural environments capacity to absorb the impacts from natural hazards.



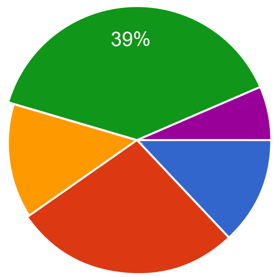
1	**16**	20.8%
2	**4**	5.2%
3	**11**	14.3%
4	**9**	11.7%
5	**18**	23.4%
6	**14**	18.2%

Q10. How long have you lived within or near Tehama County?



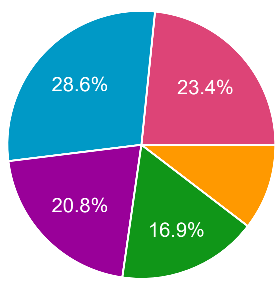
Less than 1 Year	**2**	2.6%
More than 1 Year	**9**	11.7%
More than 5 Years	**5**	6.5%
More than 10 Years	**19**	24.7%
More than 20 Years	**42**	54.5%

Q11. I live in...



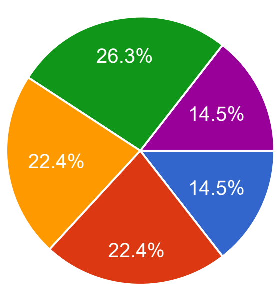
City of Corning	**10**	13%
City of Red Bluff	**21**	27.3%
City of Tehama	**11**	14.3%
Unincorporated Tehama County	**30**	39%
I do not live in Tehama County.	**5**	6.5%

Q12. Please indicate your age range.



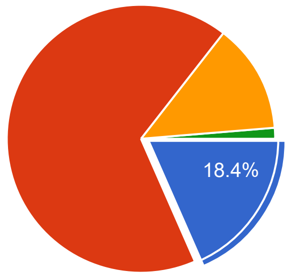
Under 18	**0**	0%
18-24 years	**0**	0%
25-34 years	**8**	10.4%
35-44 years	**13**	16.9%
45-54 years	**16**	20.8%
55-64 years	**22**	28.6%
65 years or older	**18**	23.4%

Q13. Please indicate your yearly household income range.



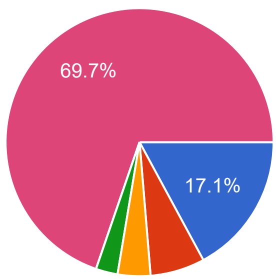
Less than $24,999	**11**	14.5%
$25,000 to $49,999	**17**	22.4%
$50,000 To $74,999	**17**	22.4%
$75,000 To $99,999	**20**	26.3%
$100,000 +	**11**	14.5%

Q14. Including yourself, please indicate the number of people living in your household.



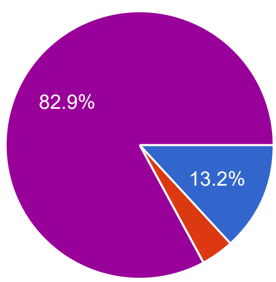
1	**14**	18.4%
2-3	**51**	67.1%
4-5	**10**	13.2%
More than 5	**1**	1.3%
More than 10	**0**	0%

Q15. Please indicate the number of people living in your household under the age of 18 years old.



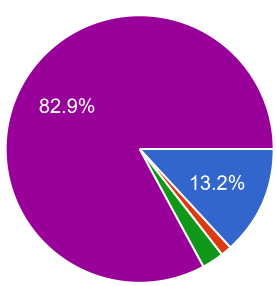
1	**13**	17.1%
2	**5**	6.6%
3	**3**	3.9%
4	**2**	2.6%
5	**0**	0%
More than 5	**0**	0%
None	**53**	69.7%

Q16. Including yourself, please indicate the number of people living in your household age 75 years or older.



1	**10**	13.2%
2	**3**	3.9%
3	**0**	0%
More than 3	**0**	0%
None	**63**	82.9%

Q17. Please indicate the number of people with disabilities living in your household who may need assistance during an emergency.



1	**10**	13.2%
2	**1**	1.3%
3	**0**	0%
More than 3	**2**	2.6%
None	**63**	82.9%

Thank you again for completing the survey!!!! Please provide any additional comments that you may have regarding hazard mitigation and community protection against natural disasters.

We need the city to fix pot holes

No hazards though I did spend $1900 to survey my property to remove the flood designation.

delete me

take action against blighted and abandoned properties as well as red tag unsafe residences. provide assistance to create fire breaks and reduce natural fuel build up.

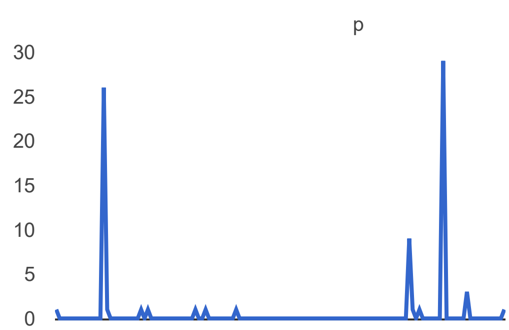
FEMA flood maps not easy to pull up and read. limits s/b put on orchards going in and they orchard s/b reqd to have a cover crop. Prisoners s/b used to clean creeks (big and small) vs eradication of 1 weed

I didn't really understand Q9

We are paying an additional tax on sales in Red Bluff to hire more firefighters;just to watch them leave the county several time every fire season. And the state can reimburse their overtime, causing higher state taxes.This feels like fraud.

Reduce wildfire hazard by enforcing vegetation abatement. Offer incentive in the forma of reduced insurance premiums for vegetation abatement.

Number of daily responses



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B.5 Mitigation Action Prioritization Process

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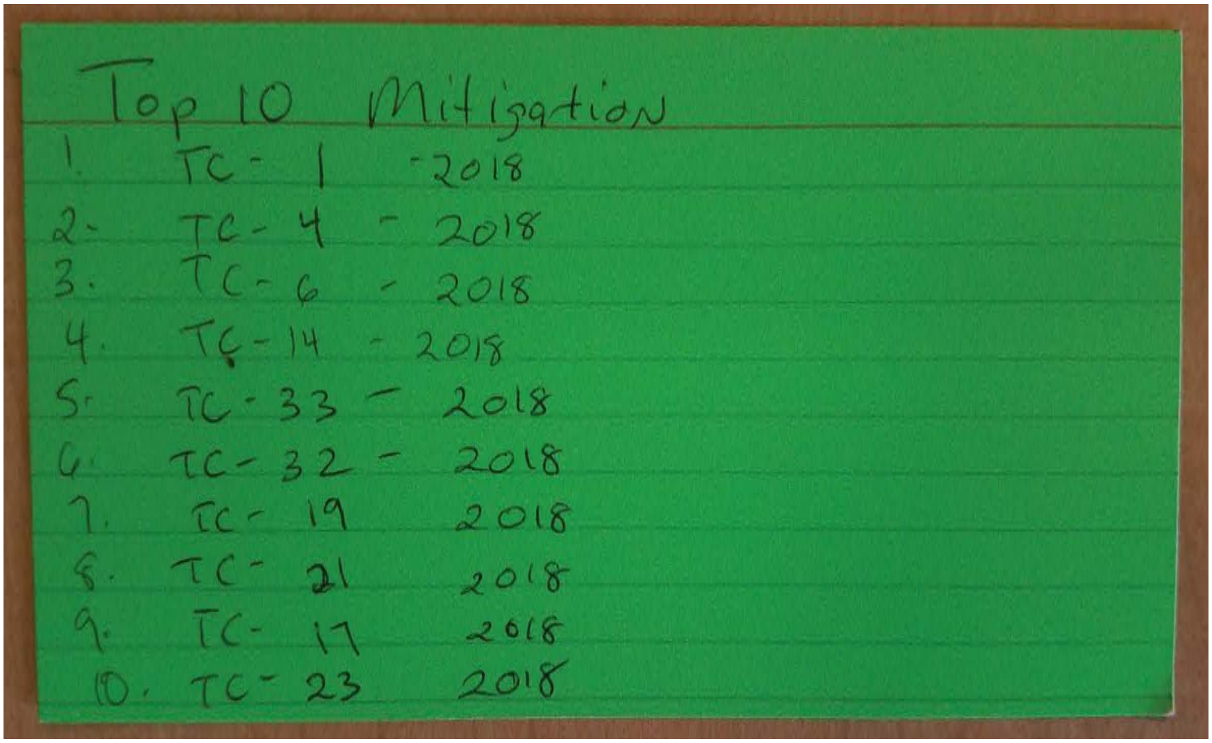
Hazard Prioritization Exercise

Prioritizing your jurisdiction's mitigation activities is a required element in the Hazard Mitigation Plan. This is also an important step in choosing which mitigation actions to allocate time and resources to.



Step 1: Hand out index cards to your planning team.

Step 2: Using the supplied Mitigation Activities table for your jurisdiction, have each member of the planning team rank their top 10 priority mitigation actions. Number 1 is their highest priority action item, and 10 is their lowest priority action item.

Step 3: Photograph the completed index cards and email the photos to tammy@dynamicplanning.co. We will tally up your priority actions and send you a report containing your top 10 mitigation actions.

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B.6 Website

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Public Pages

- Executive Summary
- 2018 MJHMP
- Get Involved
- Photo Blog
- Learn More
- Contact Us
- Flood Inundation Maps

Stakeholder Pages

- Meetings
- Schedule
- Outreach
- Stakeholder Coordination
- Essential Facilities Mapping
- Q&A Forum

Project Contacts

Tehama County

RYAN TEUBERT
530-385-1462 X3020

Dynamic Planning + Science

ETHAN MOBLEY
970-323-4331

BRIAN GREER
510-253-0054

TAMMY KULPA

Tehama County Multi-Jurisdictional Hazard Mitigation Plan 2017 Update

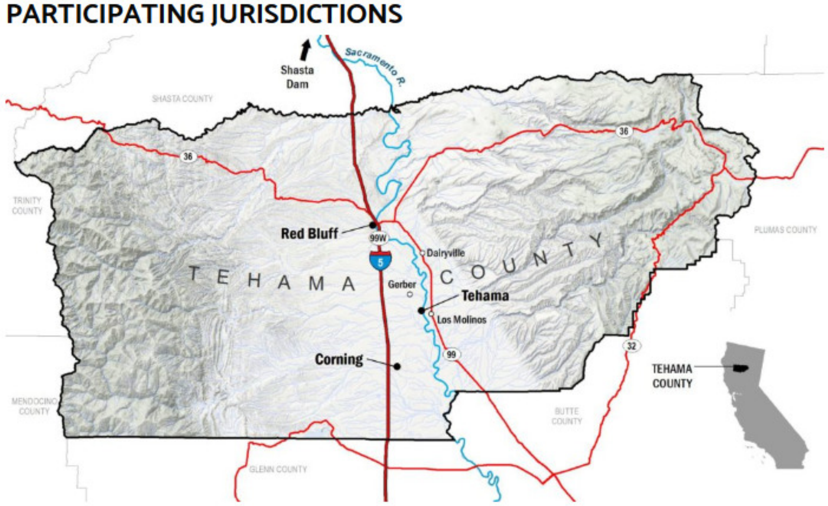
EXECUTIVE SUMMARY

2018 HMP AVAILABLE HERE (Vol 1)

PRINT

Tehama County along with the cities of Corning, Red Bluff, and Tehama will develop an update to the 2012 Tehama County Hazard Mitigation Plan (HMP) to reduce further losses resulting from disasters. Hazard mitigation is the use of long- and short-term actions to reduce the loss of life, personal injury, and property damage that can result from a disaster. It involves planning efforts, policy changes, programs, capital projects, and other activities that can mitigate the impacts of hazards. The 2017 HMP Update will cover each of the major natural hazards that pose risks to County infrastructure and residents.

PARTICIPATING JURISDICTIONS



- Tehama County (Unincorporated Area)
- City of Corning
- City of Red Bluff
- City of Tehama

HMP UPDATE REQUIREMENTS AND DMA 2000

The Robert T. Stafford Act constitutes the statutory authority for most Federal disaster response activities especially as they pertain to FEMA and FEMA programs and created the Hazard Mitigation Grant Program (HMGP). The HMGP assists states and local communities in implementing long term hazard mitigation measures following a major disaster declaration.

On October 30, 2000, the Robert T. Stafford Disaster Relief and Emergency Assistance Act was amended by Public Law 106-390 and is referred to as the Disaster Mitigation Act of 2000 (DMA 2000). As a DMA 2000 requirement, the HMP must be updated every five (5) years to remain in compliance with regulations and Federal mitigation grant conditions. Federal regulations require hazard mitigation plans to include a plan for monitoring, evaluating, and updating the hazard mitigation plan. A current and approved hazard mitigation plan is a prerequisite for jurisdictions wishing to pursue funding under the Robert T. Stafford Act.

FLOODPLAIN MANAGEMENT PLAN CONSOLIDATION

As part of this planning effort, the planning team will combine Tehama County's Flood Management Plan (currently under separate cover) with Tehama County's 2017 HMP. The 2017 HMP Update will be compliant with all Community Rating System (CRS) 510 activities. Following the 10-step process described in CRS Activity 510 (Floodplain Management Planning) the planning team will develop a more comprehensive plan for flood damage reduction within the hazard mitigation plan update.

FLOOD INUNDATION MAPPING

The Local Planning Project Management Team will identify areas where Flood Inundation mapping products would be most beneficial for internal emergency response and mitigation planning personal. As part of this effort a series of public outreach maps will be developed to communicate anticipated flood depths in populated areas of the County. Areas of mapping will be determined later through planning team analysis.

CRS PARTICIPATION FEASABILITY STUDY

FEMA's CRS program is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum National Flood Insurance Program (NFIP) requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the goals of the CRS Program:

1. Reduce flood damage to insurable property;
2. Strengthen and support the insurance aspects of the NFIP,
3. Encourage a comprehensive approach to floodplain management, and
4. Reduce Flood Insurance premiums for constituents.

Through a feasibility study the planning team will outline how the County and each of the non-participating jurisdictions could benefit from participating in FEMA's CRS program. This study will include the associated costs and benefits to start and maintain the CRS program for each participating community. The City of Tehama (currently participating in CRS Program) will benefit from this feasibility study which will include possible improvements that could increase Tehama's CRS classification, further reducing flood insurance premiums for residents within the City. A CRS Impact Analysis Report will be prepared under separate cover from the completed HMP.

PROJECT FUNDING INFORMATION

Tehama County was awarded FEMA Hazard Mitigation Grant Program planning funds as a subgrantee under the California Office of Emergency Services (Cal OES) to support this project. Using these funds, the County has contracted with Dynamic Planning + Science (DP+S) to update the County's current local Multi-Jurisdictional Hazard Mitigation Plan, develop a Community Rating System program feasibility study for the County, and develop flood inundation mapping products for flood prone areas within Tehama County.

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