

Glenn County, CA Multi-Jurisdiction Hazard Mitigation Plan February 2016



Prepared by:

Michael Baker
INTERNATIONAL

One Kaiser Plaza, Suite 1150
Oakland, CA 94612

Glenn County, CA Multi-Jurisdiction Hazard Mitigation Plan (MJHMP)

DRAFT – February 2016

Prepared Under Contract with
Glenn County Planning and Public Works Agency



In cooperation with the participating jurisdictions of the
Cities of Orland and Willows



Prepared by:

Michael Baker
INTERNATIONAL

Michael Baker International | One Kaiser Plaza, Suite 1150 | Oakland, CA 94612
Phone: 510-879-0950 | Fax: 510-879-0969 | www.mbakertnl.com

Table of Contents

| | |
|---|------------|
| Section 1. Introduction | 1-1 |
| 1.1 Purpose..... | 1-1 |
| 1.2 Background and Scope | 1-1 |
| 1.3 Plan Organization..... | 1-3 |
| Section 2. Community Profile | 2-1 |
| 2.1 History..... | 2-1 |
| 2.2 Geography, Topography, and Climate | 2-1 |
| 2.2.1 Geography | 2-1 |
| 2.3 Socioeconomic Factors | 2-3 |
| 2.3.1 Population..... | 2-3 |
| 2.4 Economic Background and Trends | 2-5 |
| 2.5 Land Use and Development Trends..... | 2-5 |
| Section 3. The Planning Process | 3-1 |
| 3.1 Planning Process | 3-1 |
| 3.2 Organize Resources | 3-2 |
| 3.3 Assess Risks..... | 3-5 |
| 3.4 Develop Mitigation Strategy..... | 3-5 |
| 3.5 Draft MJHMP | 3-6 |
| 3.6 Plan Review and Revision | 3-6 |
| 3.7 Plan Adoption and Submittal..... | 3-6 |
| 3.8 Steering Committee Meetings..... | 3-6 |
| 3.9 Public Outreach | 3-7 |
| Section 4. Natural Hazard Risk Assessment | 4-1 |
| 4.1 Identifying the Hazards..... | 4-1 |
| 4.2 Dam Failure..... | 4-10 |
| 4.3 Drought..... | 4-14 |
| 4.4 Flood Hazard Profile | 4-23 |
| 4.5 Geographic Hazards Profile | 4-31 |
| 4.6 Levee Failure..... | 4-42 |
| 4.7 Severe Weather | 4-48 |
| 4.8 Wildfire Hazard Profile..... | 4-53 |
| 4.9 Vulnerability Assessment..... | 4-58 |
| Section 5. Mitigation Strategy | 5-1 |
| 5.1 Hazard Mitigation Goals | 5-1 |
| 5.2 Capabilities Assessment..... | 5-1 |
| 5.3 Mitigation Actions..... | 5-12 |
| Section 6. Plan Implementation and Maintenance | 6-1 |
| 6.1 Plan Adoption | 6-1 |
| 6.2 Implementation | 6-1 |
| 6.3 Monitoring, Evaluating, and Updating the MJHMP..... | 6-1 |

| | |
|---|-----|
| 6.4 Incorporation into Existing Planning Mechanisms | 6-3 |
| 6.5 Continued Public Involvement..... | 6-4 |

List of Figures

| | |
|---|------|
| Figure 2-1: Glenn County Location Map | 2-2 |
| Figure 2-2: Glenn County Land Use | 2-7 |
| Figure 2-3: City of Orland Land Use | 2-8 |
| Figure 2-4: City of Willows Land Use | 2-9 |
| Figure 3-1: Multi-Hazard Mitigation Planning Process | 3-1 |
| Figure 3-2: Glenn County MJHMP Project Webpage..... | 3-8 |
| Figure 4.3-1: Drought Monitor Map for the State of California on June 9, 2015 | 4-18 |
| Figure 4.3-2: USSDO Drought Tendency Map (Valid from May 21, 2015 to August 31, 2015) | 4-19 |
| Figure 4.3-3: 72-Month SPI through June 6, 2015 for Glenn County | 4-20 |
| Figure 4.3-4: VegDRI results for the Northern Quad of California for June 1, 2015 | 4-21 |
| Figure 4.5-1: Shasta Cascade Area Shaking Potential..... | 4-36 |
| Figure 4.5-2: Glenn County Regional Shrink Swell Potential | 4-38 |
| Figure 4.6-1: Diagram of “J” Levee along Sacramento River | 4-46 |
| Figure 4.6-2: Aerial Photograph of “J” Levee along Sacramento River..... | 4-47 |
| Figure 4.8-1: Urban Wildland Interface | 4-53 |
| Figure 4.8-2: Fire History..... | 4-55 |

List of Tables

| | |
|--|------|
| Table 2-1: Glenn County Population..... | 2-4 |
| Table 2-2: Glenn County Unincorporated Housing Units, 2000-2008 | 2-5 |
| Table 3-1: MJHMP Project Team..... | 3-2 |
| Table 3-2: MJHMP Steering Committee Members | 3-3 |
| Table 3-3: Existing Plans, Studies, Reports, and Other Technical Data/Information..... | 3-4 |
| Table 3-4: MJHMP Steering and Planning Committee Meetings..... | 3-7 |
| Table 4.1-1: Document Review Crosswalk..... | 4-3 |
| Table 4.1-2: Federal and State Declared Disasters | 4-5 |
| Table 4.1-3: Hazard Prioritization Matrix for Glenn County | 4-7 |
| Table 4.1-4: Hazard Prioritization Matrix for City of Orland..... | 4-7 |
| Table 4.1-5: Hazard Prioritization Matrix for City of Willows | 4-8 |
| Table 4.2-1: Dams within County Limits | 4-12 |
| Table 4.2-2: Dams outside County Limits | 4-12 |
| Table 4.4-1: Major Federal Flood Disaster Declarations..... | 4-26 |
| Table 4.4-2: Special Flood Hazard Area | 4-26 |
| Table 4.5-1: Moment Magnitude Scale | 4-34 |
| Table 4.5-2: Modified Mercalli Scale | 4-34 |
| Table 4.7-1: Past Disaster Declarations, Proclamation and Other Recorded Events..... | 4-48 |
| Table 4.7-2: SHELDTUS Severe Weather Hazard Data 1960-2005* | 4-50 |
| Table 4.8-1: Glenn County Recent Wildfire Occurrences | 4-55 |
| Table 4.8-2: Glenn County Historic Fire Acreages by Decade..... | 4-56 |

| | |
|--|------|
| Table 4.9-1: County/City Government Facilities Located in the Unincorporated Glenn County, and the Cities of Orland and Willows..... | 4-59 |
| Table 4.9-2: Educational Facilities in Glenn County..... | 4-60 |
| Table 4.9-3: Medical Facilities in Glenn County..... | 4-60 |
| Table 4.9-4: Fire and Police Department Facilities in Glenn County..... | 4-61 |
| Table 4.9-5: Other Critical Facilities/Infrastructure in Glenn County..... | 4-61 |
| Table 4.9-6: Vulnerability Assessment Results for Community Assets and Critical Facilities in Glenn County..... | 4-63 |
| Table 4.9-7: Dam Failure Hazard Vulnerability Assessment Summary..... | 4-67 |
| Table 4.9-8: Flood Hazard Vulnerability Assessment Summary..... | 4-70 |
| Table 4.9-9: Earthquake Vulnerability Assessment Summary..... | 4-72 |
| Table 4.9-10: Expansive Soils Hazard Vulnerability Assessment Summary..... | 4-74 |
| Table 4.9-11: Land Subsidence Hazard Vulnerability Assessment Summary..... | 4-75 |
| Table 4.9-12: Levee Failure Hazard Vulnerability Assessment Summary..... | 4-77 |
| Table 4.9-13: Wildfire Hazard Vulnerability Assessment Summary..... | 4-79 |
| Table 4.9-14: Risk Factor Criteria..... | 4-80 |
| Table 4.9-15: Risk Factor Value Designation..... | 4-82 |
| Table 4.9-16: Risk Factor Results for Glenn County..... | 4-83 |
| Table 4.9-17: Risk Factor Results for the City of Orland..... | 4-83 |
| Table 4.9-18: Risk Factor Results for the City of Willows..... | 4-83 |
| Table 4.9-19: Summary of Hazard Risk..... | 4-84 |
| Table 5-1: Glenn County’s Regulatory Mitigation Capabilities..... | 5-2 |
| Table 5-2: City of Orland’s Regulatory Mitigation Capabilities..... | 5-3 |
| Table 5-3: City of Willows’ Regulatory Mitigation Capabilities..... | 5-4 |
| Table 5-4: Glenn County Administrative and Technical Mitigation Capabilities..... | 5-5 |
| Table 5-5: City of Orland Administrative and Technical Mitigation Capabilities..... | 5-6 |
| Table 5-6: City of Willows Administrative and Technical Mitigation Capabilities..... | 5-7 |
| Table 5-7: State and Federal Agencies with Administrative/Technical Capabilities..... | 5-9 |
| Table 5-8: Glenn County’s Fiscal Capabilities..... | 5-10 |
| Table 5-9: City of Orland’s Fiscal Capabilities..... | 5-10 |
| Table 5-10: City of Willows’ Fiscal Capabilities..... | 5-11 |
| Table 5-11: Potential Funding Programs/Grants from State and Federal Agencies..... | 5-12 |
| Table 5-12: Hazards by Region Ranked according to Risk Levels..... | 5-13 |
| Table 5-13: STAPLEE Method for Evaluating and Prioritizing Mitigation Actions..... | 5-14 |
| Table 5-14: Glenn County Mitigation Actions..... | 5-16 |
| Table 5-15: City of Orland Mitigation Actions..... | 5-18 |
| Table 5-16: City of Willows Mitigation Actions..... | 5-20 |
| Table 6-1: Plan Monitoring, Evaluating, and Updating Process..... | 6-3 |

Appendices

Appendix A: Planning Process

Appendix B: Stakeholder/Public Involvement

Appendix C: Hazard Profile and Vulnerability Maps

Appendix D: Sample Adoption Resolution

Appendix E: Plan Maintenance

Appendix F: Glenn County/Cities of Orland and Willows Adoption Resolutions

Section 1. Introduction

Past natural disasters have caused significant damage to property and infrastructure, as well as loss of life. These damages and losses have taken a toll economically, psychologically, and financially on communities in the response and recovery processes. The Glenn County Multi-Jurisdiction Hazard Mitigation Plan (MJHMP) is an effort undertaken by the County and the Cities of Orland and Willows to mitigate the effects of natural hazards and plan for resiliency in the future that respects the character and needs of the people who live and work in Glenn County. This section provides the foundation for the overall plan, outlining the purpose, background, and scope of this planning document.

1.1 Purpose

The purpose of the Glenn County MJHMP Update is to provide the County and the Cities of Orland and Willows with a blueprint for hazard mitigation planning to better protect the people and property of the County and the Cities of Orland and Willows from the effects of future natural hazard events. The Glenn County MJHMP is the official statement of the County's and the Cities' of Orland and Willows commitment to ensuring a resilient community and serves as a tool to assist decision makers in directing mitigation activities and resources. The MJHMP was also developed to ensure the County and the Cities of Orland and Willows eligibility for federal disaster assistance, including Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM), Hazard Mitigation Grant Programs (HMGP), and Flood Mitigation Assistance Program (FMA).

1.2 Background and Scope

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses incurred by insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be reduced or even eliminated.

Over the past 60 years, Glenn County has experienced numerous natural disasters. Since 1955, 12 federally declared disasters have occurred, including:

- Six flooding events;
- Four severe storm events;
- One snow storm; and
- One coastal storm.

The coastal storms from January to March 1983 resulted in statewide impacts. In the inland areas of northern California, these coastal storms resulted in flooding, landslides, and

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

tornadoes. Specifically, the coastal storms resulted in flooding due to the swelling of the Sacramento River.

The California Emergency Management Agency's (Cal EMA) Emergency and Disaster Proclamations/Executive Orders lists the 2006 severe storm, the 2008 winter storms, and the 2009 and 2014 drought events as affecting Glenn County.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of \$4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. A review of the County's 1993 General Plan identified drought, dam failure, geologic hazards (earthquake, expansive soils, and subsidence), flood, landslide, volcano, and wildfire as potential hazards facing the region. A review of other relevant documentation including the California State Hazard Mitigation Plan, the County's EOP, jurisdiction-specific plans (including the cities of Orland and Willows), and surrounding counties' plans steered the selection of the seven (7) primary hazards impacting Glenn County.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA) or DMA 2000.) While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). As noted, Glenn County is subject to many kinds of hazards; thus, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for County and the Cities of Orland and Willows land use policies in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. With the memory of the impacts from past hazard events, Glenn County and the Cities of Orland and Willows are

committed to reducing future impacts from similar hazard events and maintaining eligibility for mitigation-related federal funding.

1.3 Plan Organization

The MJHMP is organized into seven sections to reflect the logical procession of activities undertaken to develop the plan and includes all relevant documentation required to meet the necessary criteria for FEMA approval. Each section is briefly described below.

- **Section 2, Community Profile** describes the County's history, geography, topography, climate, population, economy, housing, and land use and development trends in Glenn County and the Cities of Orland and Willows.
- **Section 3, The Planning Process** describes the 10-Step MJHMP Planning Process, as well as the meetings and outreach activities undertaken to engage the Steering Committee members/stakeholders and the public.
- **Section 4, Hazard Risk Assessment** identifies and prioritizes natural hazards affecting Glenn County and the Cities of Orland and Willows, and assesses the vulnerability from the identified hazards.
- **Section 5, Mitigation Strategy** identifies mitigation goals, assesses the capabilities of the County and the Cities of Orland and Willows to implement mitigation actions, and identifies and prioritizes mitigation actions.
- **Section 6, Plan Implementation and Maintenance** discusses plan adoption and implementation, as well as the process to monitor, evaluate, update, and maintain the MJHMP. This section also includes a discussion on continued public involvement.

This page is intentionally left blank.

Section 2. Community Profile

The Community Profile summarizes Glenn County's conditions as well as the Cities of Orland and Willows' history and existing environmental and socioeconomic conditions. Environmental and socioeconomic factors include geography, topography, climate, population, economy, housing, and land use and development trends.

2.1 History

Glenn County was incorporated on March 5, 1891 from parts of Colusa County and was named for Dr. Hugh Glenn, the largest landowner in the County. Glenn fought in the Mexican-American War and came to California to make his fortune.

A great deal of the wheat raised in California during the late nineteenth and early twentieth centuries was produced in Glenn County, as well as neighboring Colusa County. The City of Willows was incorporated in 1886 and the City of Orland was incorporated in 1909.

Glenn County is located within portions of two California geomorphic provinces: the Coast Range and the Great Valley. Each province has a distinctly different geologic history, which coupled with local climatic conditions, has resulted in a wide variation of geologic conditions within the County.

2.2 Geography, Topography, and Climate

Brief descriptions of the County's geography, topography, and climate are provided in the following discussions. This section provides an understanding of existing environmental conditions that could influence the impacts of natural hazards on the County.

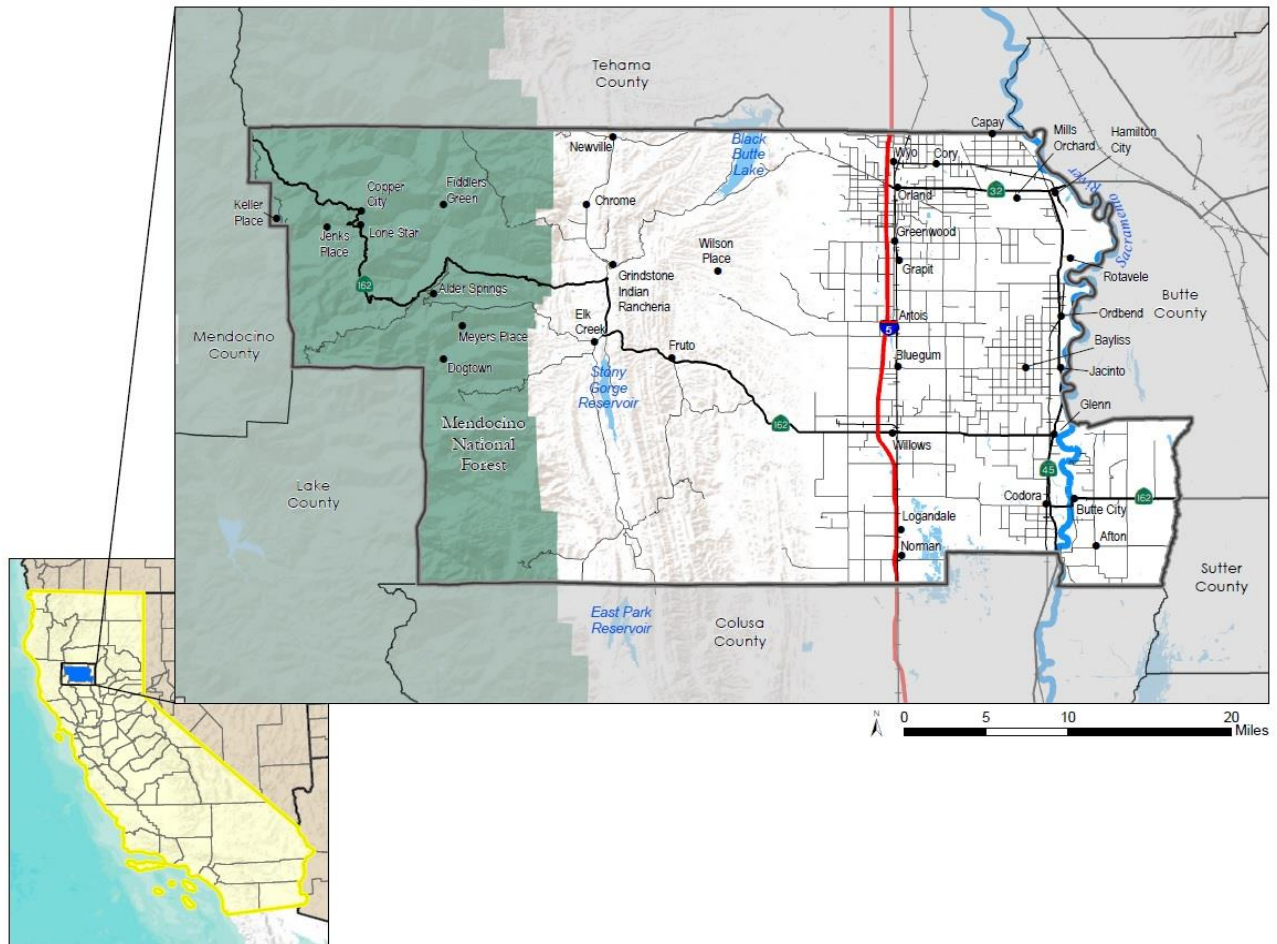
2.2.1 Geography

Glenn County is located in the Northern Sacramento Valley and the eastern foothills and mountains of the Coast Range, approximately 80 miles north of the City of Sacramento, as shown in [Figure 2-1](#). The County encompasses approximately 1,317 square miles and extends from the Sacramento River west of the Coast Range.

Four main thoroughfares run through Glenn County – one interstate and three state routes. Interstate-5 traverses north to south through the valley region of the County. The Cities of Orland and Willows are both located along the I-5 corridor. California State Route 45 runs north to south along the Sacramento River and the east side of the County. California State Route 162 runs east to west through the City of Willows, and California State Route 32 is situated east to west through the City of Orland and the unincorporated community of Hamilton City.

Glenn County encompasses the incorporated cities of Willows and Orland, as well as the unincorporated communities of Hamilton City, Ord Bend, Artois, Elk Creek, Butte City, Glenn, and numerous other small settlements. It is bounded by Tehama County to the north, Butte County to the east, Colusa County to the south, and Lake and Mendocino Counties to the west.

Figure 2-1: Glenn County Location Map



2.2.2 Topography

Glenn County is typified by steeper terrain in the western portion of the County (covered by the Mendocino National Forest) trending down to relatively flat features along its eastern boundary. Two major geologic provinces exist within the County and have a major influence on the County's topography. They are the Sacramento Valley, which generally characterizes the eastern third of the County, and the Coast Range, which dominates the western two-thirds.

The Sacramento Valley consists of nearly level terraces, smooth alluvial fans, narrow flood plains and water filled basins. Elevation ranges from approximately 100 feet above mean sea level (MSL) at the Sacramento River to approximately 300 feet above MSL at the western edge of the Valley, west of Interstate 5. A small portion of southeastern Glenn County, in the vicinity of Butte City, is located east of the Sacramento River. This is essentially an area of level flood plains and basins with little discernible slope (Glenn County General Plan, 1993).

West of the Valley province is the Coast Range, which can be further subdivided into the rolling terrain of the Coast Range foothills, which increase in elevation from the edge of the Valley to approximately 2,000 feet, and the mountainous Coast Range, which rises to an elevation of almost 7,500 feet above MSL at Black Butte Mountain. The foothills consist of smooth, rolling to steep hills and narrow valleys with distinct areas of south to north drainage. Much of the mountainous region to the west of the foothills ranges above 6,000 feet and includes a portion of the crest of the Coast Range.

2.2.3 Climate

Climate influences the occurrences of natural hazards; extreme climate conditions can result in drought, flooding, landslides, severe weather, and wildfires. Glenn County's climate is generally Mediterranean with hot dry summers and moderate to cool wet winters. Average daily maximum temperatures range from the mid-fifties in January to the high nineties in July, an average daily minimum temperatures range from mid-thirties in January to the mid-sixties in July.

Nearly 90 percent of the County's annual rainfall occurs between November and April, usually from frontal systems from the west. During the winter, snowfall in the valley is infrequent and only in trace amounts. Totals increase to the west, reaching four to eight inches on the lower slopes of the mountains. Normal annual precipitation across the County varies widely, from 15 inches in the southeast to as much as 50 or 60 inches at the highest elevations. On the valley floor, the City of Willows receives approximately 17.7 inches per year (Glenn County General Plan, 1993).

Surrounding topography greatly influences wind patterns in Glenn County. Ventilation is commonly inadequate due to calm winds and continual temperature inversions. The combination of inversions, light winds, and constructive topography results in air being trapped horizontally and vertically during much of the year.

2.3 Socioeconomic Factors

The population, economic, and housing factors in the various areas of Glenn County are described in this section. Understanding these socioeconomic factors is imperative to determining the potential impacts a natural hazard event can have on the County's population and economy.

2.3.1 Population

According to the U.S. 2010 Census Data, Glenn County's total population was 28,122; 14,609 people (51.9 percent of Glenn County's total population) reside in the unincorporated areas of the County, as shown in [Table 2-1](#). 7,367 people reside in the City of Orland (22.6 percent of the County's total population) and 6,146 people live in the City of Willows (21.9 percent of the County's total population). From 2000 to 2010, the total population across the County has grown by 6.32 percent, and the unincorporated areas of the County have experienced a 5.00 percent increase in population.

Table 2-1: Glenn County Population

| Population | 2000 Population | 2010 Population | Percent Change (2000-2010) |
|----------------|--|--|----------------------------|
| Glenn County | 26,451 (100 percent of Total Population) | 28,122 (100 percent of Total Population) | 6.32% |
| Unincorporated | 13,913 (52.6 percent of Total Population) | 14,609 (51.9 percent of total population) | 5.00% |
| Orland | 6,323 (23.9 percent of Total Population) | 7,367 (26.2 percent of Total Population) | 16.51% |
| Willows | 6,215 (23.5 percent of Total Population) | 6,146 (21.9 percent of Total Population) | -1.11% |

The major population clusters in the unincorporated areas of the County border the incorporated cities of Orland and Willows. Within the unincorporated areas of the County, the communities of Artois, Elk Creek, and Hamilton City are considered Census Designated Places (CDP), as they contain more than 500 people per census block. Many portions of the unincorporated areas of the County contain less than eight people per square mile. The projected population in Glenn County in 2030 is 29,466, an increase of 1,344 people over 20 years.

The City of Orland has experienced a population growth of almost two percent annually from 1998 to 2008, while Willows has experienced growth of just 0.3 percent annually during that time frame. Neighboring jurisdictions have seen a steady population increase due in part to a greater number of births than deaths, growth in employment opportunities, and an increase in available housing (Glenn County Housing Element 2010).

2.3.2 Housing

A household is defined as a person or group of persons living in a housing unit. As of 2010, there were 9,800 households in the County. The average household size was 2.84 and the average family size was 3.32 (Glenn County Housing Element 2010).

In Glenn County, most residents live in single-family housing or mobile homes. Mobile homes are more widespread in the unincorporated area. Most single-family detached structures are located in the two incorporated cities of Orland and Willows and in the unincorporated communities of Artois, Butte City, Elk Creek, Glenn, and Hamilton City. As one moves away from these community centers, housing becomes secondary to the primary land use of commercial agriculture. Table 2-2 illustrates the composition of housing stock in 1990 and 2000 and percent change over time, based on data from the California Department of Finance (DOF).

Table 2-2: Glenn County Unincorporated Housing Units, 2000-2008

| Unit Type | 2000 | | 2008 | | Change | |
|--------------------------------|--------------|------------|---------------|------------|------------|------------|
| | Number | Percent | Number | Percent | Number | Percent |
| Single Family | 7,168 | 71.81 | 7,765 | 71.87 | 597 | 72.63 |
| 2-4 Units | 722 | 7.23 | 787 | 7.28 | 65 | 7.91 |
| 5+ Units | 705 | 7.06 | 700 | 6.48 | -5 | 0.61 |
| Mobile Home & Other | 1,387 | 13.90 | 1,552 | 14.37 | 165 | 20.07 |
| TOTALS | 9,982 | 100 | 10,804 | 100 | 822 | 100 |

Source: 2010 Glenn County Housing Element

2.4 Economic Background and Trends

The economic drivers in Glenn County are the agricultural sector (including farmers, ranchers, and value-add agricultural producers) and small businesses (89 percent of which are under 20 employees and 77 percent are under 10 employees). Currently, economic development services are focused on the micro-small business, which is necessary but has little impact on economic growth. The County implemented a collaborative economic development structure, which includes the Cities, partner organizations, and several department heads working together to implement economic development initiatives and services (Glenn County Economic Development Strategy).

Economic development is typically measured by businesses assisted, jobs, and capital investment on an annual basis over time based on economic indicator benchmarks to gauge overall progress on the economy. The Cities and County Economic Development committee and their actions toward collaboration has made significant progress over recent years. Given limited resources – financial and staff – the main objective for the Glenn County region is to utilize existing resources, partners, programs, and expertise to link and leverage those resources to focus on opportunities and address the needs/issues of the existing business sectors and emerging market opportunities.

2.5 Land Use and Development Trends

This section describes the land use and development trends in Glenn County. Information in this section will be used to help guide and coordinate future mitigation activities and decisions for local land use policy. Glenn County created its General Plan (GP) in 1993. The GP designates land uses in the unincorporated areas of the County. [Figure 2-2](#) identifies the locations of the designated land uses in the County.

The vast majority of Glenn County’s eastern land remains in the Intensive Agricultural designation (Glenn County General Plan Land Use 2006). The next most dominant land use type is General Agricultural. The

majority of land in the western two-thirds of the County is designated Foothill Agriculture/Forestry and Recreation. The areas surrounding the Cities of Orland and Willows remain more residentially focused than the rest of the Glenn County region. These land use types consist mainly of rural residential, single family residential, suburban residential, and public facilities. There are some small areas of land designated as industrial surrounding the cities.

According to the City of Orland General Plan 2008-2028, commercial and high-density residential land uses are largely concentrated along the Walker Street (California State Route 32) corridor and between Interstate 5 and the railroad tracks. Mixed uses are centered in the area east of the railroad tracks and along the Walker Street corridor. The City of Orland consists mainly of low-density residential uses. Land use designations and patterns in the City of Orland are shown in [Figure 2-3](#).

According to the City of Willows General Plan June 2010 Land Use Map, commercial uses are clustered near Interstate 5 and Wood Street (California State Route 162). The majority of the City's commercial uses are clustered along the Tehama Street corridor. The Wood Street corridor accommodates much of the City's public facilities and services. The City of Willows consists mainly of low-density residential uses. Land use designations and patterns in the City of Willows are shown in [Figure 2-4](#).

Figure 2-2: Glenn County Land Use

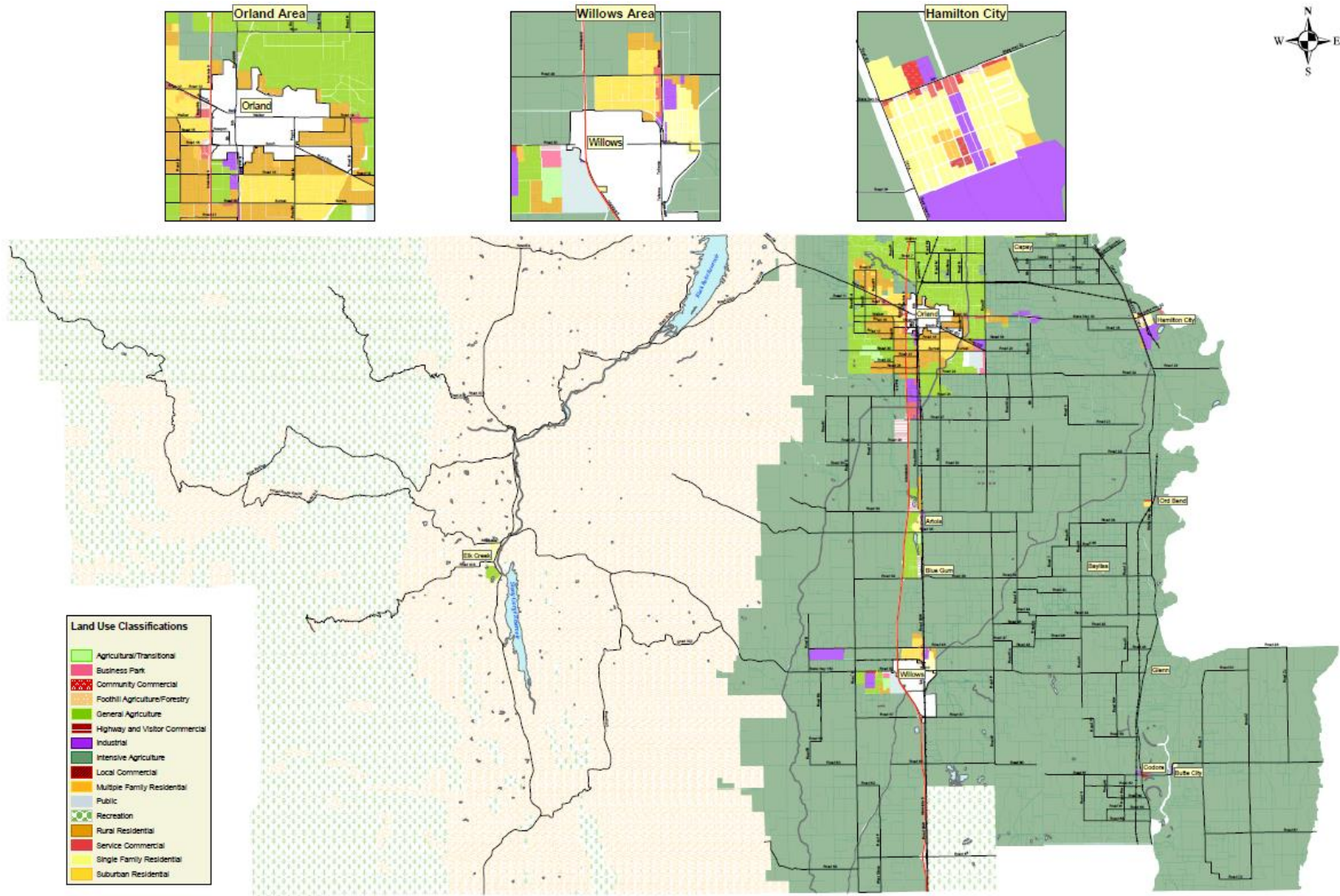


Figure 2-3: City of Orland Land Use

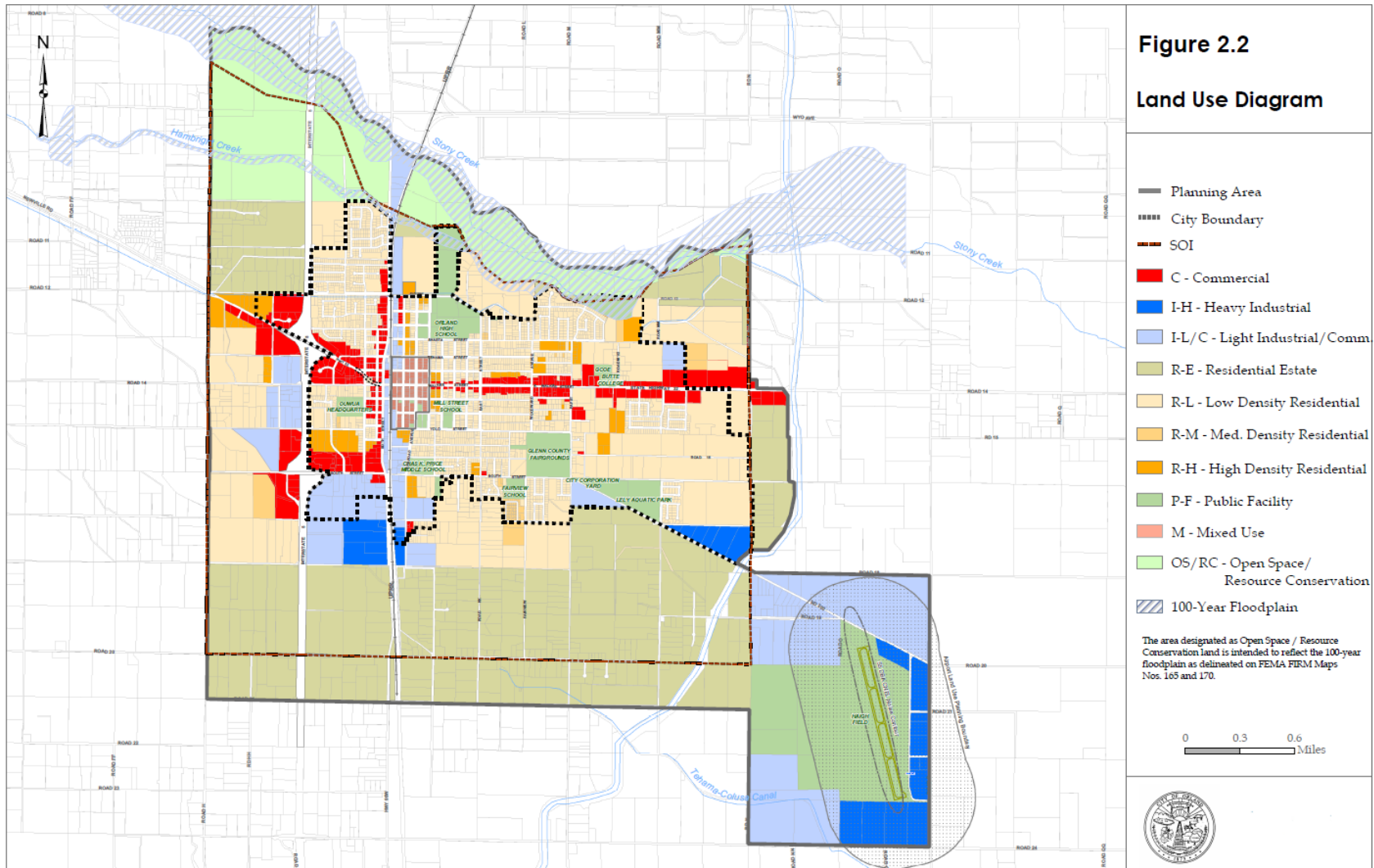
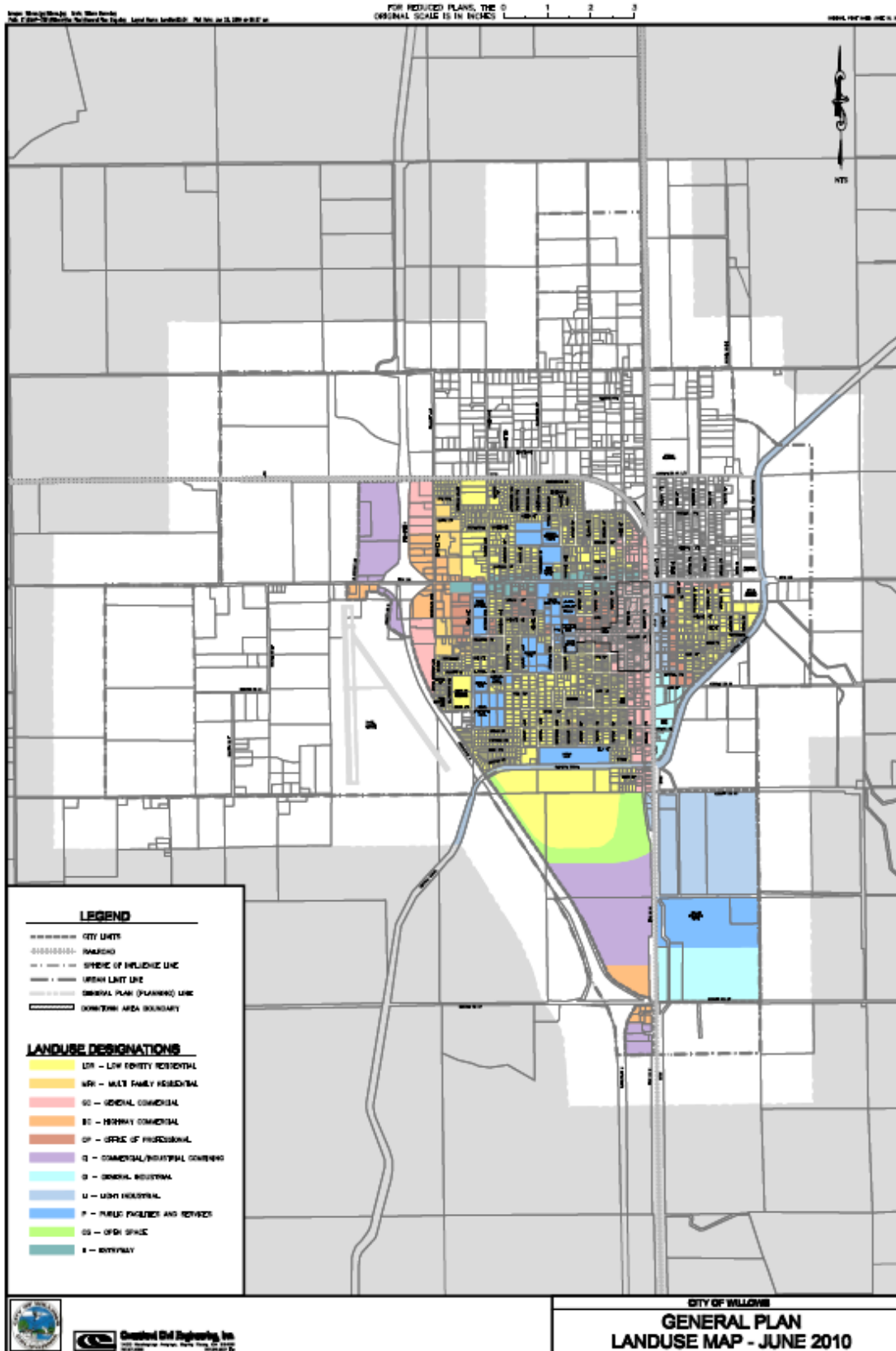


Figure 2-4: City of Willows Land Use



This page is intentionally left blank.

Section 3. The Planning Process

This section describes each stage of the planning process used to develop the 2016 Glenn County MJHMP. The MJHMP planning process provides a framework for the document development. The planning process includes organizing resources, assessing risk, developing the mitigation plan, drafting the plan, reviewing and revising the plan, adopting and submitting the plan for approval.

3.1 Planning Process

Hazard mitigation planning in the United States is guided by the statutory regulations described in the DMA 2000 and implemented through 44 Code of Federal Regulations (CFR) Part 201 and 206. FEMA’s guidelines outline a four-step planning process for the development and approval of hazard mitigation plans.

For the development of the MJHMP, a planning process was created based on the various federal guidance documents and regulations. As shown in Figure 3-1, the MJHMP planning process included organizing resources, assessing risk, developing the mitigation action strategy, drafting the plan, reviewing and revising the plan, and adopting and submitting the plan. Documentation of the planning process is provided in Appendix A.

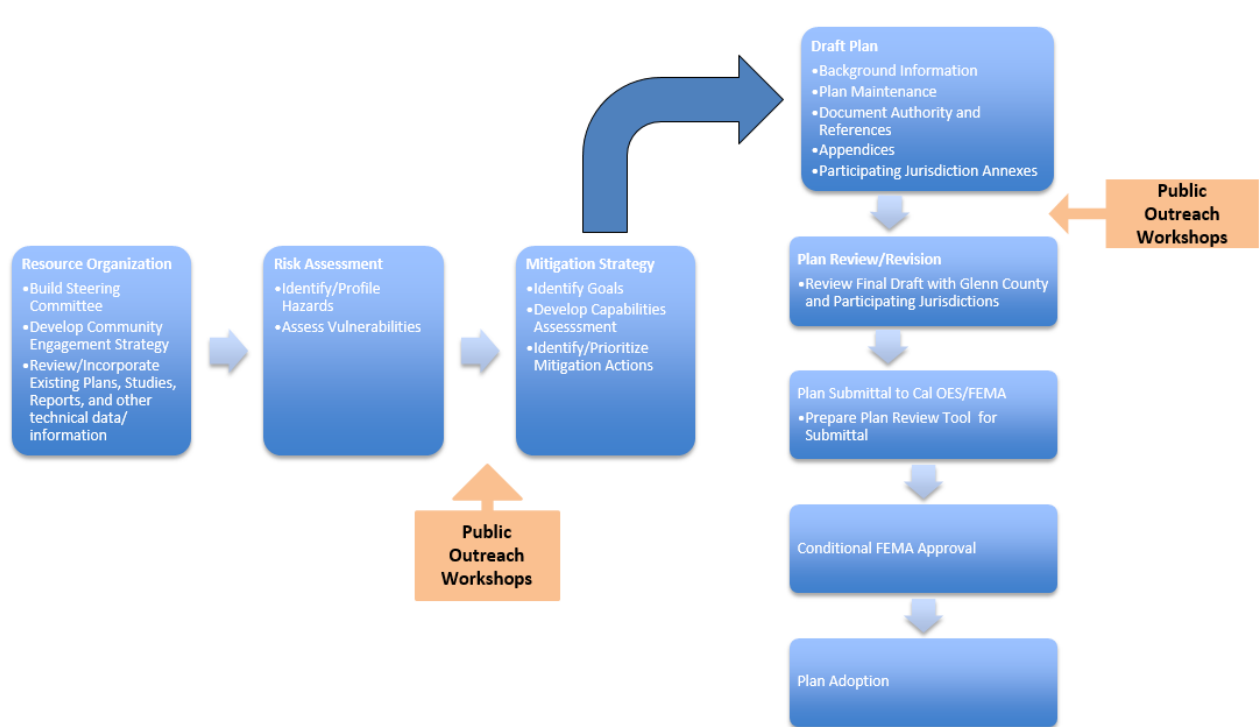


Figure 3-1: Multi-Jurisdiction Hazard Mitigation Planning Process

3.2 Organize Resources

This section describes the first step of the 2016 Glenn County MJHMP planning process – Organizing Resources. It outlines the MJHMP Project Team, and includes information on the development of the MJHMP Steering Committee. As part of this step, the Project Team reviewed and incorporated, as appropriate, a variety of existing plans, studies, reports, and other technical data/information into the MJHMP document.

This section describes the MJHMP Committee, details the members of the MJHMP Steering Committee, and meeting information.

3.2.1 Build Planning Team

This section describes the MJHMP Project Team, details the members of the MJHMP Steering Committee and meeting information.

3.2.1.1 MJHMP Project Team

Michael Baker International (Michael Baker) assembled a project team to facilitate the MJHMP planning process and the development of the MJHMP document for the incorporated and unincorporated areas of Glenn County. The MJHMP Project Team, as shown in [Table 3-1](#), consists of a variety of professionals from Michael Baker.

Table 3-1: MJHMP Project Team

| MJHMP Update Project Team | MJHMP Update Project Team Role |
|----------------------------------|---|
| Wynne Kwan, AICP, LEED AP | Project Manager |
| Lisa Messano | Outreach/NFIP Specialist |
| Emma Reed, GISP | Hazard Mitigation Planner |
| Richard Harmon | Geographic Information Systems (GIS) Specialist |

3.2.1.2 Steering Committee

At the core of the MJHMP planning process is the MJHMP Steering Committee. This committee served as the backbone of the MJHMP planning process. The composition of the MJHMP Steering Committee was integral in ensuring the success of the MJHMP planning process, its implementation, and future maintenance. The MJHMP Steering Committee worked with the MJHMP Project Team to provide direction for the development of the MJHMP document. The MJHMP Steering Committee members, as shown in [Table 3-2](#), represent Glenn County and City of Orland and Willows staff that serve as key decision-makers in their specific government roles, including staff from Planning and Public Works, Transportation, Public Health, Air Pollution Control, and Environmental Health. Additionally, external stakeholders, including the Glenn County Resource Conservation District, California Highway Patrol,

Hamilton City Community Services District (CSD), Butte City CSD, and Hamilton City Fire Protection District participated as members of the MJHMP Steering Committee.

Table 3-2: MJHMP Steering Committee Members

| MJHMP Steering Committee | Title | Jurisdiction/ Organization |
|------------------------------|---|---|
| Glenn County | | |
| Andy Popper | Associate Planner/MJHMP Project Lead | Glenn County Planning and Public Works Agency |
| Di Aulabaugh | Deputy Director | Glenn County Planning and Public Works Agency |
| Matt Gomes | Deputy Director | Glenn County Planning and Public Works Agency |
| Mardy Thomas | Principal Planner, Fixed Transportation/GIS | Glenn County Planning and Public Works Agency/Regional Transportation Planning Agency |
| Joe Bettencourt | Administrative Services Analyst | Glenn County Planning and Public Works Agency |
| Ken Dunn | Airports | Glenn County Planning and Public Works Agency |
| Todd Murray | | Glenn County Planning and Public Works Agency |
| Dean Miller | Building Inspector | Glenn County Planning and Public Works Agency |
| Marty Hauser | Road Supervisor | Glenn County Planning and Public Works Agency |
| Amy Travis | Emergency Preparedness Coordinator | Glenn County HHSA - Public Health |
| Kevin Backus | Director | Environmental Health |
| Eric Scott | Environmental Program Manager | Air Pollution CUPA |
| Jason Beauchamp | Interim Agriculture Commissioner | Glenn County Agricultural Commission |
| Sean Arlin | Lt. | Glenn County Sheriff's Office |
| Ian Ledbetter | Air Pollution Specialist | Glenn County Air Pollution Control District |
| Jack Cavier | District Manager | Glenn County MUCD |
| Keith Corum | | Board of Supervisors |
| City of Orland | | |
| Peter Carr | City Manager | City of Orland |
| Scott Friend | City Planner | City of Orland |
| Mike Martin | City Planner | City of Orland |
| City of Willows | | |
| Steve Holsinger | City Manager | City of Willows |
| Scott Taylor | City Manager | City of Willows |
| Natalie Butler | City Clerk | City of Willows |
| Steve Soeth | Director, Planning and Public Works | City of Willows |
| External Stakeholders | | |
| Jose Puente | General Manager | Hamilton City Community Services District |
| Jesus Campos | President | Butte City Community Services District |
| Kandi Manhart | Executive Officer | Glenn County Resource Conservation District |
| Bruce Carpenter | Lt. Commander | CHP Willows |
| Don Guy | Sargeant | CHP Willows |
| Dan James | Chief | Hamilton City Fire Protection District |

3.2.1.3 Local Jurisdiction Planning Process

Both the Cities of Orland and Willows are small communities with very limited city staffing. As such, departmental positions at these cities are staffed by consultants working as on-site contract employees. Alternatively, one staff person may wear many hats within the city government, thus performing multiple functions within the government. Unlike larger city jurisdictions, the Cities of Orland and Willows do not have the extensive number of city government departments that would be involved in the local planning process.

Due to the limited staffing capacity, the local planning process at the jurisdiction level was not as comprehensive as that for larger jurisdictions in other multi-jurisdictional planning processes. The City of Orland was represented on the MJHMP Steering Committee by its contract planning consultants, who report directly to the City Manager. The City of Willows was represented on the MJHMP Steering Committee by its Public Works Director, City Manager, and City Clerk. Because the City Manager for each city jurisdiction participated directly or through the planning consultant (as in the case of the City of Orland), working with the city representatives on the MJHMP Steering Committee provided the leadership and direction required for decision-making on behalf of the cities during the planning process.

The MJHMP Project Team worked with each participating jurisdiction throughout the planning process to identify hazards of concerns and mitigation actions specific to each jurisdiction. The city representatives worked with available city staff, as appropriate, outside of MJHMP Steering Committee meetings to obtain feedback and provide input about specific concerns for each of these jurisdictions.

3.2.2 Review and Incorporation Existing Information

The MJHMP Project Team worked with the MJHMP Steering Committee to review and assess existing plans, studies, and data available from local, state, and federal sources. Documents reviewed as part of the MJHMP planning process are shown in [Table 3-3](#). Relevant information from these documents, as well as other sources, is incorporated in the MJHMP, especially in the hazards profiles.

Table 3-3: Existing Plans, Studies, Reports, and Other Technical Data/Information

| | |
|---|--|
| 2010 and 2013 California State Enhanced MHMP | Glenn County Land Uses, Water Resources, Emergency Preparedness |
| 1993 Glenn County GP and Specific Plans | Flood studies that may identify new special flood hazard areas |
| 2015 Glenn County Emergency Operations Plan (EOP) and Associated Annexes | Existing County Zoning and Floodplain Management Ordinances |
| 2011 Glenn County Community Wildfire Protection Plan (CWPP) | 2008 City of Orland GP |
| 2009/2010 Glenn County Regional Transportation Plan (RTP) Update | 2014 City of Willows GP |
| City of Willows Hazard Mitigation Plan | Glenn County and Cities of Orland and Willows GIS mapping data |

3.3 Assess Risks

In accordance with FEMA requirements, this step of the MJHMP planning process identified and prioritized the natural hazards affecting Glenn County and assessed the vulnerability from the identified hazards. Results from this phase in the MJHMP planning process formed the foundation for the subsequent identification of appropriate mitigation actions for reducing risk and losses in Glenn County. This section of the MJHMP planning process is detailed in Section 4.

3.3.1 Identify/Profile Hazards

Based on a review of past hazards as well as a review of the existing plans, reports, and other technical studies/data/information, the MJHMP Project Team and Steering Committee determined if the existing hazards were still valid, and identified new hazards that could affect Glenn County. Content for each hazard profiled is provided in Sections 4.2 to 4.8.

3.3.2 Assess Vulnerabilities

Hazard profiling exposes the unique characteristics of individual hazards and begins the process of determining which areas within Glenn County are vulnerable to specific hazard events. The vulnerability assessment included a GIS overlaying method for all geographically defined hazards. Using these methodologies, critical facilities and infrastructure impacted by natural hazards were determined. Detailed information on each hazard vulnerability assessment is provided in Section 4.9.

3.4 Develop Mitigation Strategy

The MJHMP is the explicit strategy that provides the blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and Glenn County and the Cities of Orland and Willows ability to expand on and improve these existing tools. Developing the mitigation plan involved developing a capabilities assessment, identifying goals, and finally identifying and prioritizing mitigation actions. This step of the MJHMP planning process is detailed in Section 5.

3.4.1 Identify Goals

The MJHMP Project Team worked closely with the MJHMP Steering Committee to develop the MJHMP goals. Based on the hazards profiles and vulnerability assessment, the MJHMP Project Team, along with the MJHMP Steering Committee decided that the goals for the MJHMP could be generally categorized into four main topics.

3.4.2 Develop Capabilities Assessment

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

3.4.3 Identify Mitigation Actions

The MJHMP Project Team and Steering Committee worked together to identify and develop mitigation actions with implementation elements. These mitigation actions were then reviewed further and

prioritized based on a set of criteria/considerations. Preliminary implementation strategies were then developed for the mitigation actions. 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.

3.5 Draft MJHMP

The hazard mitigation plan Project Team prepared the 2016 Glenn County Draft MJHMP in accordance with DMA 2000 and FEMA's guidance documents. Once the risk assessment and mitigation strategy were completed, the MJHMP Project Team incorporated the information, data, and associated narratives into the 2016 Draft Glenn County MJHMP.

3.6 Plan Review and Revision

Once the 2016 Draft Glenn County MJHMP was completed, the MJHMP Project Team submitted the document to the Steering Committee for review. Comments were then incorporated along with any comments received during a public review period and a presentation at the January 20, 2016 Planning Commission meeting into the document prior to submittal to Cal EMA and FEMA.

3.7 Plan Adoption and Submittal

The MJHMP Project Team completed FEMA's MJHMP Crosswalk and submitted it with the Plan to Cal EMA and FEMA for approval on [REDACTED], 2016.

Once FEMA approval is received, Glenn County, as well as the Cities of Orland and Willows, will adopt the 2016 Glenn County MJHMP within one year of FEMA conditional approval. A copy of the sample resolution to be submitted to the Glenn County Board of Supervisors and the City Councils of the Cities of Orland and Willows for plan adoption is provided in Appendix D. The final plan adoption resolutions are provided in Appendix F.

3.8 Steering Committee Meetings

The MJHMP Project Team met with the MJHMP Steering Committee throughout the development of the MJHMP document. Meetings were conducted in person; follow-on activities with the MJHMP Project Team and MJHMP Steering Committee members were conducted on the phone or via email. MJHMP Steering Committee meetings were conducted on April 2, 2015, May 7, 2015, July 30, 2015, October 8, 2015, and November 19, 2015.

Table 3-4 summarizes the meetings conducted throughout the planning process, including meeting date, type, and topics discussed. Meeting documentation, including agendas, PowerPoint presentations, sign-in sheets, and other relevant handouts, is provided in Appendix A.

Table 3-4: MJHMP Steering and Planning Committee Meetings

| Date | Meeting Type | Topics |
|--------------------------|--|--|
| April 2, 2015 | Internal Kick-Off Meeting | Project Overview and Schedule, and MJHMP |
| May 7, 2015 | Kick-Off Meeting (Steering Committee #1) | Steering Committee Member Guidelines Overview, Address Questions/Comments on the MJHMP Update Planning Process and Public Outreach Strategy, and MJHMP Planning Committee Issues |
| July 30, 2015 | Steering Committee Meeting #2/Public Workshop #1 | Project Overview and Timeline, MJHMP and FMP Planning Components, Overview of Existing LHMP, Participation Documents, and Risk Assessment Development |
| October 8, 2015 | Steering Committee Meeting #3 | Risk Assessment Development, Hazard Specific Discussion, and Planning Committee Hazard Focus Groups |
| November 19, 2015 | Steering Committee Meeting #4 | Vulnerability Assessment Results Review, Goal Review, and Mitigation Actions Categories |
| January 20, 2016 | Planning Commission Hearing/Public Workshop #2 | Combined format meeting. Project Overview and Summary of MJHMP document. Detailed Implementation Strategy for prioritized mitigation actions. |

3.9 Public Outreach

Public outreach is a major and required component of the MJHMP planning process. The MJHMP Project Team and the MJHMP Steering Committee brainstormed to maximize public involvement in the MJHMP planning process. In addition to the public outreach activities described below, the Glenn County MJHMP Project Lead made a presentation to the Glenn County Resource Conservation District meeting in May 2015; the agenda for this meeting is provided in Appendix B.

3.9.1 Glenn County Website

Online tools provide an efficient and easily manageable platform to inform the public on the MJHMP planning process. The MJHMP online tools consisted of the MJHMP project website. The project website provided a platform in which the public could learn about the planning process, access and review documents, and provide comments/feedback on the MJHMP. The MJHMP website is located at <http://gcppwa.net/LHMPProject.aspx>. A snapshot of the website is provided in Figure 3-2.

Figure 3-2: Glenn County MJHMP Project Webpage

PPWA
Planning & Public Works Agency

Introduction to the Multi-Jurisdiction Hazard Mitigation Plan Project

Glenn County, along with the incorporated cities of [Orland](#) and [Willows](#), is in the process of preparing a Multi-Jurisdiction Hazard Mitigation Plan (MJHMP).

The MJHMP will identify natural hazards that may affect the County, their impacts, and the desired mitigation actions to address and minimize the risk and future losses from natural hazards such as flooding, severe storms, earthquakes, and wildland fires. Additionally, the MJHMP will also serve to meet key federal planning regulations that require local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for hazard mitigation projects.

The MJHMP development is being guided by a Multi-Jurisdictional Steering Committee, which includes representation from participating communities and other key stakeholders, and will also be formed through a sustained community engagement strategy.

The Steering Committee will generally follow the planning process as shown on the flow chart here:

```

    graph TD
      A[Resource Organization  
•Build Steering Committee  
•Develop Community Engagement Strategy  
•Review/Incorporate Existing Plans, Studies, Reports, and other Technical data/information] --> B[Risk Assessment  
•Identify/Profile Hazards  
•Assess Vulnerabilities]
      B --> C[Mitigation Strategy  
•Identify Goals  
•Develop Capabilities Assessment  
•Identify/Prioritize Mitigation Actions]
      C --> D[Draft Plan  
•Background Information  
•Plan Maintenance  
•Document Authority and References  
•Appendices  
•Participating Jurisdiction Annexes]
      D --> E[Plan Review/Revision  
•Review Final Draft with Glenn County and Participating Jurisdictions]
      E --> F[Plan Submittal to Cal OES/FEMA  
•Prepare Plan Review Tool for Submittal]
      F --> G[Conditional FEMA Approval]
      G --> H[Plan Adoption]
      I[Public Outreach Workshops] --> B
      J[Public Outreach Workshops] --> E
      K[Public Outreach Workshops] --> C
  
```

3.9.2 Public Workshops

Public workshops are an essential part of the MJHMP planning process. They provide the public an opportunity to review the MJHMP and provide information pertaining to the MJHMP planning process. Public workshops were conducted in July 2015 and January 2016. Local media and public notices were posted in various community-based services and establishments. Brief summaries of the public workshops are also provided below. Public workshop materials, including agendas, PowerPoint presentations, comment forms, sign-in sheets, meeting minutes, and other relevant workshop material, are provided in Appendix B.

3.9.2.1 Publicizing the Public Workshops

The MJHMP Project Team created public notices and press releases for the MJHMP public workshops. For the July 30, 2015 and January 20, 2016 MJHMP public workshops, the public notice was published in the local newspaper. The press releases were included on the Glenn County website at www.countyofglenn.net. The public notices for the MJHMP public workshops are included in Appendix B.

3.9.2.2 July Public Workshop

The goal of the July 30, 2015 MJHMP public workshop was to provide the public an opportunity to review the hazard maps and vulnerability assessment and provide input on the MJHMP planning process. Three MJHMP Steering Committee members attended this public workshop, held at the Glenn County Office of Education. No one from the public attended the public workshop.

3.9.2.3 January Public Presentation

Due to the lack of attendance at the July 2015 public workshop, the MJHMP Project Team and Glenn County Project Manager decided to leverage the public attendance at other meetings within Glenn County. The goal of the January 20, 2016 MJHMP public workshop was to present to the public an overview of the planning process to date and a completed initial draft of the MJHMP document for review and input. The public workshop took place at the January 20, 2016 Glenn County Planning Commission meeting located in Willows, California. One member of the MJHMP Project Team and five members of the MJHMP Steering Committee attended the public workshop. No one from the public attended the Planning Commission meeting.

This page is intentionally left blank.

Section 4. Natural Hazard Risk Assessment

Natural Hazard 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 provides a foundation in which to develop and prioritize mitigation actions (see Section 5) 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 followed the methodology described in the FEMA publication, *Understanding Your Risks—Identifying Hazards and Estimating Losses* (FEMA 386-2, 2002), which outlines a four-step process:

- 1) Identify Hazards.
- 2) Profile Hazard Events.
- 3) Inventory Assets.
- 4) Estimate Losses.

Information gathered during the MJHMP planning process related to the above four steps has been incorporated into the following discussions in this chapter:

Section 4.1: Hazard Identification identifies and prioritizes the natural hazards that threaten Glenn County and the Cities of Orland and Willows. The reasoning for omitting some hazards from further consideration is also provided in this discussion.

Section 4.2 through Section 4.8: Hazard Profiles describe each of the natural hazards that pose a threat to Glenn County. Information includes the location, extent/magnitude/severity, previous occurrences, and the likelihood of future occurrences.

Section 4.9: Vulnerability Assessment presents Glenn County's exposure to natural hazards, as it identifies at-risk assets, including County- and City-owned facilities and other critical facilities.

4.1 Identifying the Hazards

Per FEMA Guidance, the first step in developing the Risk Assessment is identifying the hazards. The Glenn County MJHMP Planning Team reviewed a number of previously prepared hazard mitigation plans and other relevant documents to determine the whole universe of natural hazards that have the potential to affect the County. [Table 4.1-1](#) provides a crosswalk of hazards identified in the County's General Plan and Emergency Operations Plan, the California State Hazard Mitigation Plan, the hazard mitigation plans of neighboring counties, and City of Orland's General Plan. The City of Willows prepared and adopted an initial local hazard mitigation plan; however, it was not forwarded to FEMA for review. The Willows plan was also reviewed during this exercise.

Seventeen different hazards were identified based on a thorough document review. The crosswalk was used to develop a preliminary hazards list providing a framework for MJHMP Steering Committee members to begin thinking about which hazards were truly relevant to Glenn County and which ones were not. For example, sea level rise and tsunami were hazards considered to be of little relevance to Glenn County, while extreme weather, earthquake, and wildfire were indicated in almost all hazard documentation. It was also determined that avalanche, volcano, and landslide hazards had a minimal potential impact to Glenn County.

Table 4.1-1: Document Review Crosswalk

| Hazards | CA State HMP (2013) | Glenn County General Plan | Glenn County EOP | City of Oland General Plan | City of Willows Initial LHMP | Butte County (2014) | Lake County(2005) | Mendocino County (2014) | Tehama County (2012) | Plumas County | Colusa County (2005) |
|-------------------------------|---------------------|---------------------------|------------------|----------------------------|------------------------------|---------------------|-------------------|-------------------------|----------------------|---------------|----------------------|
| Severe Weather | ■ | | ■ | | ■ | ■ | ■ | | ■ | ■ | |
| Extreme Heat | ■ | | | | ■ | ■ | | | | | |
| Freeze/Winter Storm | ■ | | | | ■ | ■ | | | | | |
| Heavy Rain/ Hail/Lightning | | | | | | ■ | | | | | |
| Tornado | | | | | ■ | ■ | | | | | |
| Windstorm | | | | | | ■ | | | | | |
| Avalanche | ■ | | | | | | | | ■ | | |
| Dam Failure | ■ | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | |
| Drought | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | |
| Climate Change | | | | | | | | | | ■ | |
| Earthquake | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Erosion | | ■ | | ■ | ■ | ■ | | | | | |

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
 February 2016

| | | | | | | | | | | | |
|------------------------|---|---|---|---|---|---|---|---|---|---|---|
| Expansive Soils | | ■ | | ■ | | | | | | | |
| Flooding | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Landslides | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | |
| Levee Failure | ■ | | | | ■ | ■ | | | | | |
| Subsidence | | ■ | | ■ | | | | | | | |
| Tsunami | ■ | | | | | | | | | | |
| Volcano | ■ | | ■ | | ■ | ■ | ■ | | | ■ | |
| Wildfire | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

In addition to a document review, previous hazard occurrences were used to identify hazards for this hazard mitigation plan. Previous hazard occurrences provide a historical view of hazards that have affected the County and/or Cities in the past, and thus provide a window into the potential hazards that can affect the County in the future. Information about Federal and State disaster declarations in Glenn County was compiled from FEMA and Cal EMA’s databases, as shown in **Error! Reference source not found.** Though not a complete snapshot of hazard incidences in Glenn County (since not all hazard events are federally or state declared), This table provided the MJHMP Steering Committee with solidified accounts of the types and extent of disasters that have affected the County dating back to 1955 when flooding impacted entire regions of Glenn County. As indicated in [Table 4.1-2](#), large regional incidents have occurred in Glenn County. Most recently, severe winter storms were declared in Glenn County during the 2005/2006 winter season, causing extensive damage. The disaster declarations in this table provide a baseline for consideration in the hazard prioritization process.

Table 4.1-2: Federal and State Declared Disasters

| Disaster Number | Declaration Date | Disaster Type | Incident Type | Explanation |
|--|------------------|---------------|-----------------|---|
| Federal Declarations | | | | |
| Major Disaster Declarations | | | | |
| 47 | 12/23/1955 | DR | Flood | Statewide Flooding |
| 82 | 4/4/1958 | DR | Flood | Heavy rains & Flooding |
| 183 | 12/24/1964 | DR | Flood | Heavy rains & Flooding |
| 283 | 1/27/1970 | DR | Flood | Heavy winds, storms, & Flooding |
| 677 | 2/9/1983 | DR | Coastal Storm | Coastal Storms, Floods, Slides & Tornadoes |
| 758 | 2/21/1986 | DR | Flood | Severe Storms & Flooding |
| 894 | 2/11/1991 | DR | Snow | Severe Freeze |
| 1044 | 1/10/1995 | DR | Severe Storm(s) | Severe Winter Storms, Flooding, Landslides, & Mud Flows |
| 1046 | 3/12/1995 | DR | Severe Storm(s) | Severe Winter Storms, Flooding, Landslides, & Mud Flows |
| 1155 | 1/4/1997 | DR | Severe Storm(s) | Severe Winter Storms, Flooding, Landslides, & Mud Flows |
| 1203 | 2/9/1998 | DR | Severe Storm(s) | Severe Winter Storms & Flooding |
| Emergency Declarations | | | | |
| 3023 | 1/20/1977 | EM | Drought | Drought |
| 3248 | 9/13/2005 | EM | Hurricane | Hurricane Katrina Evacuation |
| CAL EMA Emergency and Disaster Proclamations/Executive Orders | | | | |
| | 5/10/2006 | | Severe Storms | Roadway Damage |

| | | | | |
|------------------------|--------------------------|--|-------------------|---|
| | 1/5/2008 to 1/14/2008 | | Winter Storms | |
| | 2/27/2009 | | Drought | 3-year State-wide Drought |
| | 1/17/2014 | | Drought | State of Emergency Declaration |
| Other Disasters | | | | |
| | 11/21/1950 | | Flood | Statewide Floods |
| | 5/20/1957 | | Heavy Rains | State of Emergency for producing areas of Northern California |
| | 2/26/1958 | | Flood | Heavy rains & Flooding |
| | 9/18/1965 | | Wildfire | Major and Widespread Fires |
| | 2/1973 | | Storms/ Floods | |
| | 1973 | | Drought | Drought conditions declared for Glenn, San Benito, and Santa Clara Counties; \$8M agricultural loss |
| | 2/9/1976 | | Drought | 1976/1977 were two of the driest years in CA history. Most severe in northern 2/3 of CA. |
| | 3/5/1980 | | Severe Storms | Rain, Winds, Mudslides, & Flooding |
| | 10/26/1982 | | Severe Storms | Rains causing agricultural losses |

Source: FEMA: California State Disaster History; CAL EMA: Emergency & Disaster Proclamations and Executive Orders by Date (November 2003-Current)

Based on the review of hazards identified in similar and relevant documents and previous incidents, as well as historical knowledge of localized events, recent worldwide events that raised awareness, and developing trends, the Planning Team refined the preliminary list of hazards to twelve (12) hazards with significant potential to occur in the County. The hazards the Planning Team focused on in this Plan include: dam failure, drought, flood, geologic hazards (earthquake, expansive soils, and subsidence), levee failure, severe weather (winter storms, heavy rains, snow, storms/floods, and severe storms), and wildfire. With a realization of limited resources to implement mitigation actions, these identified hazards were further prioritized to ensure that appropriate levels of effort were allocated to the hazards determined to have the largest potential impacts on the County.

4.1.1 Initial Prioritization of Hazards

With a review of the past occurrences, the MJHMP Steering Committee began the process of prioritizing the identified hazards. Considerations included examining the probability of future occurrences and the spatial extents of each identified hazard, if measurable. [Table 4.1-3](#), [Table 4.1-4](#), and [Table 4.1-5](#) summarize the results of the hazard prioritization process. MJHMP Steering Committee members ranked the hazards on a worksheet based on perceived notions of probability of future occurrences and spatial extent of the hazard, as well as historical events.

Table 4.1-3: Hazard Prioritization Matrix for Glenn County

| Hazard Type | Number of Declared Hazard Events 1950 to Present (FEMA & CalEMA) | Spatial Extent | Probability of Future Occurrence | Mean Ranking |
|---------------------------|--|----------------|----------------------------------|--------------|
| Levee Failure | | Significant | Occasional | 1 |
| Flooding | 5 | Extensive | Highly Likely | 2 |
| Drought | 3 | Extensive | Likely | 3 |
| Wildfire | | Limited | Likely | 4 |
| Severe Weather and Storms | 9 | Extensive | Highly Likely | 5 |
| Dam Failure | | Limited | Occasional | 6 |
| Geologic Hazards | | Limited | Occasional | 7 |

Table 4.1-4: Hazard Prioritization Matrix for City of Orland

| Hazard Type | Number of Declared Hazard Events 1950 to Present (FEMA & CalEMA) | Spatial Extent | Probability of Future Occurrence | Mean Ranking |
|---------------------------|--|----------------|----------------------------------|--------------|
| Dam Failure | | Significant | Occasional | 1 |
| Flooding | 5 | Extensive | Highly Likely | 2 |
| Severe Weather and Storms | 9 | Extensive | Highly Likely | 3 |
| Drought | 3 | Extensive | Likely | 4 |
| Wildfire | | Limited | Likely | 5 |
| Geologic Hazards | | Limited | Occasional | 6 |
| Levee Failure | | Limited | Occasional | 7 |

Table 4.1-5: Hazard Prioritization Matrix for City of Willows

| Hazard Type | Number of Declared Hazard Events 1950 to Present (FEMA & CalEMA) | Spatial Extent | Probability of Future Occurrence | Mean Ranking |
|----------------------------------|--|----------------|----------------------------------|--------------|
| Flooding | 5 | Extensive | Highly Likely | 1 |
| Severe Weather and Storms | 9 | Extensive | Highly Likely | 2 |
| Drought | 3 | Extensive | Likely | 3 |
| Geologic Hazards | | Limited | Occasional | 4 |
| Wildfire | | Limited | Likely | 5 |
| Dam Failure | | Limited | Occasional | 6 |
| Levee Failure | | Limited | Occasional | 7 |

GUIDELINES

Probability of Future Occurrence:

Spatial Extent

Highly Likely: Near 100 percent probability in next year.

Extensive: 50-100 percent of planning area

Likely: Between 10 and 100 percent probability in next year or at least one chance in ten years.

Significant: 10-50 percent of planning area

Occasional: Between 1 and 10 percent probability in next year or at least one chance in next 100 years.

Limited: Less than 10 percent of planning area

Unlikely: Less than 1 percent probability in next 100 years.

Using the Hazard Prioritization matrix and ranking input gained through MJHMP Steering Committee meetings, the Team agreed upon the seven natural hazards that have the most perceived significant impacts to Glenn County:



-Dam Failure



-Drought



-Flood



-Geologic Hazards (earthquake, expansive soils, and subsidence)



-Levee Failure



-Severe Weather (winter storms, heavy rains, snow, storms/floods, and severe storms)



-Wildfire

The hazards symbolized above, are profiled individually in this section and are presented in alphabetical order. For reference, each hazard symbol is placed at the beginning of each profile in Section 4. The hazard profiles in this section provide a baseline for the Vulnerability Assessment, where the vulnerability is quantified in terms of the community assets impacted for each of the priority hazards. Hazard profile figures and vulnerability figures are presented in Appendix C.

4.2 Dam Failure

A dam failure is usually the result of neglect, poor design, and/or structural damage caused by a major event such as an earthquake. When a dam failure occurs, a gigantic quantity of water is suddenly released, destroying infrastructure and flooding the area downstream of the dam. For example, Black Butte Reservoir has a capacity of 143,700 acre feet.



Dams are man-made structures built for a variety of uses. Uses include agriculture, flood protection, power generation, recreation, and water supply.

Dam failure can occur with little warning. As outlined by FEMA, dam failure can occur due to one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam.
- Deliberate acts of sabotage to the dam.
- Structural failure of materials used in dam construction.
- Movement and/or failure of the foundation supporting the dam.
- Settlement and cracking of concrete in the dam.
- Piping and internal erosion of soil in the dams.
- Inadequate maintenance and upkeep of the dam.

4.2.1 Regulatory Environment

Dam regulatory requirements at a federal, state, and local level are critical for the safeguarding of agriculture, economy, power supply, and quality of life in Glenn County. At the federal level, FEMA is working to protect from dam failure through the National Dam Safety Program (NDSP). The Water Resources and Development Act of 1996 formally established the NDSP. The NDSP is a partnership of the states, federal agencies, and other stakeholders to encourage individual and community responsibility for dam safety. The Dam Safety and Security Act of 2002, signed into law on December 2, 2002, reauthorized the NDSP for 4 more years and added enhancements to the 1996 Act that are designed to safeguard dams against terrorist attacks (FEMA 2010).

The U.S. Army Corps of Engineers (USACE) has maintained the National Inventory of Dams (NID) since its inception in 1972. Dams included in the NID are either greater than 25 feet high, hold more than 50 acre-feet of water, or are considered a significant hazard if they were to fail. Dams are classified based on the severity or magnitude of the potential devastation and losses of human life, economic, and environmental resources. Dam hazard classifications are defined as follows:

- High Hazard (H) - loss of one human life is likely if a dam failure should occur.
- Significant Hazard (S) - possible loss of human life and likely significant property or environmental destruction if a dam failure should occur.
- Low Hazard (L) - no probable loss of human life and low economic, and/or environmental losses if a dam failure should occur.

At a state level, laws pertaining to the California dam safety program were originally adopted in 1929. Under this program, the DWR's Division of Safety of Dams (DSOD) independently reviews and evaluates designs of new dams. DWR performs frequent inspections of dams under construction and of those recently completed to verify compliance with approved plans and specifications.

Due to the near failure of the Lower San Fernando Dam during the 1971 San Fernando earthquake, the State of California passed a law requiring dam owners to develop maps depicting areas that might be inundated due to dam failure. The State approves the dam inundation maps and distributes them to local governmental agencies, who in turn adopt emergency procedures for the evacuation and control of areas in the event of a dam failure. This law requires that each map be produced only once, without any requirements for updating.

Under the regulation of DSOD, dam owners and operators in Glenn County and neighboring counties are required to routinely inspect their facilities. These inspections and evaluations will alert owners and operators to potential dam failures and allow immediate action to remedy the problem.

4.2.2 Past Occurrences

A major dam failure event has not occurred in Glenn County. A catastrophic failure of various dams in the region would have a significant impact on Glenn County. Devastation could occur in and along creeks and rivers to several hundred feet beyond normal reaches. Water levels could be many times higher than those recorded in the worst floods.

4.2.3 Location/Geographic Extent

According to data provided by the NID, there are seven dams in Glenn County. For each dam included in the NID, inundation maps are prepared. Inundation maps were developed using engineering hydrology principals. They represent the best estimate of where the water would flow if the dam completely failed with a full reservoir. Inundation pathways are based on emptying the reservoir and do not include run-off from severe weather events.

Of the seven dams identified in [Table 4.2-1](#), one is classified as High Hazard and six as Low Hazard. In addition to dams in Glenn County, there are five dams identified in the NID, which have potential inundation impacts on the County in the event of a dam failure. As listed in [Table 4.2-2](#), these dams are in Tehama, Colusa, Shasta, and Butte Counties. See Appendix C for a figure showing dam locations and inundation areas.

Table 4.2-1: Dams within County Limits

| Name | Community | River | Owner Type | Hazard Category | Height (ft) | Storage (Acre ft) |
|---------------------|-----------------------------|----------------|------------|-----------------|-------------|-------------------|
| Upper Plaskett | Elk Creek | Plaskett Creek | Federal | L | 28 | 21 |
| Upper Plaskett Lake | Elk Creek | Plaskett Creek | Federal | L | 28 | 21 |
| Stony Gorge | Elk Creek | Stony Creek | Federal | H | 119 | 50,350 |
| E A Wright | Grindstone Indian Rancheria | Small Creek | Private | L | 38 | 650 |
| Sanhedrin Ranch | Copper City | TR Stony Creek | Private | L | 27 | 210 |

Table 4.2-2: Dams outside County Limits

| Name | County | Community | River | Owner Type | Hazard Category | Height (ft) | Capacity (Acre ft) |
|-------------|--------|-----------------------|--------------------|------------|-----------------|-------------|--------------------|
| Black Butte | Tehama | Glenn/Tehama Counties | Stony Creek | Federal | H | 156 | 143,700 |
| East Park | Colusa | Colusa | Little Stony Creek | Federal | H | 139 | 54,300 |
| Shasta | Shasta | Shasta Lake | Sacramento River | Federal | H | 602 | 4,661,860 |
| Oroville | Butte | Oroville | Feather River | Not Listed | H | 770 | 3,540,000 |

4.2.4 Magnitude/Extent

Black Butte and Stony Gorge (southeast of Elk Creek) have the greatest potential for causing loss of life and damage to the Glenn County region. Based on inundation zone mapping models of the dams, the dam failure hazard to Glenn County and the City of Willows is low; however, the severity of this hazard in the City of Orland is more severe.

4.2.5 Frequency/Probability of Future Occurrences

No quantitative information exists for a dam failure in Glenn County. However, perceived probability for dam failure is rare, between one and ten percent probability, in the next year or at least one chance in the next 100 years. When a dam is recognized to have a potential failure, the water level is reduced to

allow for a reduction in water pressure and volume behind the dam. This reduction of water level is required by the DSOD and by safety protocols established by each dam owner.

Cities of Orland and Willows

The City of Orland lies within the inundation zone for the Stony Gorge Dam and the Black Butte Dam. The Stony Gorge Dam is located on Stony Creek approximately 1.5 miles southeast of Elk Creek. Stony Gorge Dam is one of the two storage dams of the Orland Project in north-central California (the other is East Park Dam). The dam is located about 21 miles northwest of Willows, about 18 miles downstream of East Park Reservoir and 22 miles upstream of the Black Butte Dam. The Stony Gorge and Black Butte reservoirs account for most of the flood protection provided by these two dams, with storage capacities approximately one-third the annual flow in Stony Creek. Stony Creek is also known for variability in water flow as well as flash flows through communities downstream. Black Butte is fed by Upper Stony Creek and has a capacity of 137,000 acre-feet of water. It is uncommon, however, for the actual facility to reach capacity and the reservoir levels are typically lower than capacity during most of each year. The entire planning area for the City of Orland is subject to flooding should the Black Butte Dam fail.

The City of Willows is partially surrounded by an impounded irrigation canal; however, the City is located outside the inundation zone for the Stony Gorge and Black Butte Dams.

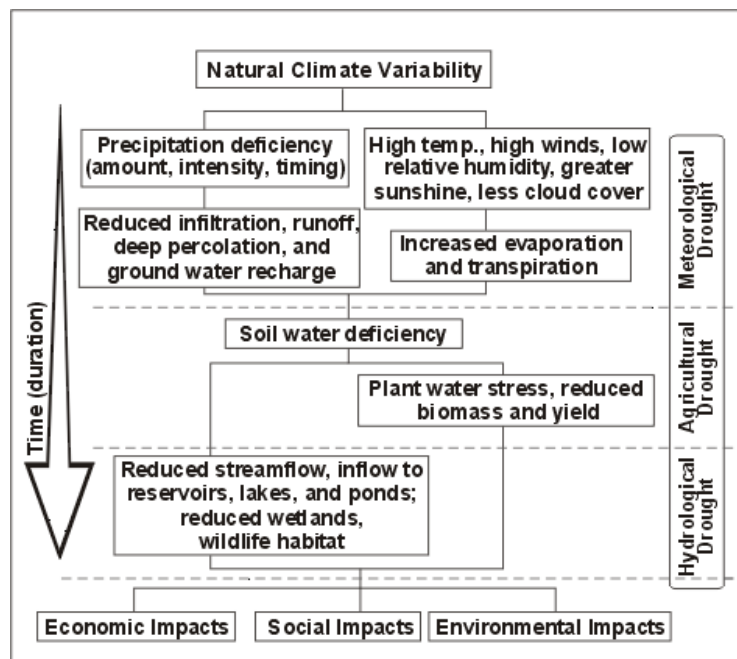
4.3 Drought

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. Drought severity depends on numerous factors, including duration, intensity, and geographic extent, as well as regional water supply demands by humans and vegetation. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity.



Drought originates from a deficiency of precipitation over an extended period, usually one or more seasons. Drought can result in a water shortage for some activity, group, or environmental sector. Drought is a complex natural hazard, which is reflected in the following four definitions commonly used to describe it:

- Agricultural – drought is defined principally in terms of naturally occurring soil moisture deficiencies relative to water demands of plant life, usually arid crops.
- Hydrological – drought is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- Meteorological – drought is defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- Socioeconomic – drought associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply as a result of weather-related supply shortfall. It may also be called a water management drought.



Although climate is a primary contributor to hydrological drought, other factors such as changes in land use (e.g., deforestation), land degradation, and the construction of dams all affect the hydrological characteristics of the basin. Since regions are interconnected by hydrologic systems, the impact of meteorological drought may extend well beyond the borders of the precipitation-deficient area. Similarly, changes in land use upstream may alter hydrologic characteristics such as infiltration and runoff rates, resulting in more variable streamflow and a higher incidence of hydrologic drought downstream. Land use change is one of the ways human actions alter the frequency of water shortage even when no change in the frequency of meteorological drought has been observed.

Due to its multi-dimensional nature, drought is difficult to define in exact terms and poses difficulties in terms of comprehensive risk assessments. Drought differs from other natural hazards in three ways. First, the onset and end of a drought are difficult to determine due to the slow accumulation and lingering effects of an event after its apparent end. Second, the lack of an exact and universally accepted definition adds to the confusion of its existence and severity. Third, in contrast with other natural hazards, the impact of drought is less obvious and may be spread over a larger geographic area. These characteristics have hindered the preparation of drought contingency or mitigation plans by many governments.

Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected resulting from natural climatic variability) and the demand people place on water supply. Human activities also exacerbate the impact of drought. Recent droughts in both developing and developed countries and the resulting economic and environmental impacts and personal hardships have underscored the vulnerability of all societies to this “natural” hazard. Droughts may cause a shortage of water for household and industrial consumption, hydroelectric power, recreation, and navigation. Water quality may also decline and the number and severity of wildfires may increase. Severe droughts may result in the loss of agricultural crops and forest products, undernourished wildlife and livestock, lower land values, and higher unemployment.

4.3.1 Regulatory Environment

A number of regulatory requirements and documents address planning for drought in Glenn County. This includes the 2006 Groundwater Coordinated Resource Management Plan, 2006 Northern Sacramento Valley Four County Regional Water Management Group, 2015 Glenn County Water Advisory Committee, 1993 Glenn County GP, and the 2015 Glenn County EOP.

2006 Glenn County Groundwater Coordinated Resource Management Plan

Drought in Glenn County is addressed through the 2006 Groundwater Coordinated Resource Management Plan. The Board of Supervisors finds that the protection of groundwater, as a resource, for its use within the County is necessary for the protection of the health, welfare, and safety of the residents of the County. The Board further declares that the maintenance of safe yield of groundwater is of critical importance of the economy of the County. The continued availability of groundwater should be protected and the extraction of groundwater should not exceed safe yield, degrade groundwater quality, or cause land subsidence.

The lack of groundwater management and monitoring may have the following negative impacts on the groundwater resource, including but not limited to:

1. Lowering of groundwater levels leading to increased energy consumption, the increased cost of deepening existing wells, and the prospect that new wells will need to be deeper and more costly than would otherwise be required.
2. Degradation of the vibrant agriculture economy and rural lifestyle of Glenn County residents.
3. Damage to public roads, bridges, canals and other structures caused by land subsidence at substantial cost to the public treasury.
4. Drying up of surface and subsurface flows leading to the potential loss of crucial riparian and wetland habitat.
5. Degradation of groundwater quality.

The purpose and intent of this management plan is to establish an effective policy concerning groundwater and coordinated resource management that will assure overall health, welfare, safety, economy and environment of the County is not adversely affected.

City of Orland Municipal Code 17.85.040

The City of Orland Municipal Code Chapter 17.85 number four declares, "Introduced vegetation shall be native, drought tolerate species compatible with the predominant natural setting of the project area." This indicates that the region has recognized the drought affecting the southwestern portion of the United States and has begun to implement measures to effectively cope with it by requiring drought tolerant vegetation is planted in areas of new vegetation.

2006 Northern Sacramento Valley Four County Regional Water Management Group

The Counties of Butte, Colusa, Glenn and Tehama have worked together on resource management issues for many years. This relationship was formalized through the Four County Memorandum of Understanding (Four County MOU) in early 2006 and the participants have become known as the Four County Group. This document was created in response to the California Department of Water Resources Regional Acceptance Process (RAP), as described in the guidelines published in December 2008, to define the way that neighboring and/or overlapping integrated regional water management plans (IRWMPs) will work together in the management of water and other natural resources throughout the State of California.

Representatives from the Four County Group have been participating in meetings with other IRWMP planning areas throughout the Sacramento River Hydrologic Area in an attempt to coordinate all efforts throughout the larger region. As the process has moved forward and additional partnerships have been formed, some of these IRWMPs have experienced changes and consolidations, much like the expansion of the Four County Group.

2015 Glenn County Water Advisory Committee

The Glenn County Water Advisory Committee was established to address drought issues in the region. The purpose of the committee is to ensure that sufficient and affordable water of good quality is available on a sustainable basis to meet the needs of agricultural, industrial, recreational, environmental,

residential, and municipal users within county, both now and in the future. Public informational meetings regarding the committee were held in February and March 2015.

1993 Glenn County General Plan

The 1993 Glenn County GP addresses drought in the Volume II-Issues Section as part of the discussion on Water Resource Opportunities, Constraints and Conclusions. The document also states that local priorities should be established for water use and placed in the General Plan and that staff should be assigned to monitor drought related actions at the State and Federal levels.

2015 Glenn County Emergency Operations Plan

The 2015 Glenn County EOP briefly addresses drought conditions. During periods of drought, emergency response measures will consist of land use planning practices consistent with water conservation goals and various water conservation measures.

4.3.2 Past Occurrences

The 2013 California State MHMP states that from 1972 to 2013, there have been ten drought State Emergency Proclamations in California. Specifically for Glenn County, there have been three drought events since 1972. The southwest region of the United States is currently experiencing a severe drought. Another State of Emergency was declared on January 17, 2014 for California and still persists. Drought occurrences including Glenn County are described as follows:

- **1972:** The worst drought to impact Glenn County in 33 years. That year also saw a severe freeze and unusually heavy fall rains.
- **1976 to 1977:** Statewide drought, with the exception of southwestern deserts. Driest two years in California's history. Drought was most severe in the northern two-thirds of the state.
- **1991:** Water year 1991 began with storage in major reservoirs at 60 percent of average due to low precipitation in the preceding years 1987 to 1990. The hardest hit region was the Central Coast, but the Tulare Lake and San Joaquin Valley areas also suffered significantly from limited precipitation.
- **2014 to present:** In January 2014, Governor Brown proclaimed a State of Emergency. The declaration 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. This declaration was prompted by record lows in California's rivers and reservoirs and a snowfall approximately 20 percent of the normal average.

Additional information about previous occurrences of droughts in California (in general) can be obtained from the California Department of Water Resources (DWR) at the following website:

<http://www.water.ca.gov/watertransfers/droughtarchive.cfm>.

4.3.3 Location/Geographic Extent

Drought can affect the entire State of California and can occur in any part of the country at any time. Shortages in precipitation in the Sierra Nevadas and decreased groundwater levels can have a pronounced impact on water supply in Glenn County. This is due to Glenn County's reliance on the region's water

supply from the Upper Sacramento River watershed. Drought has no defined geographical boundaries. As such, all of Glenn County is subject to drought.

4.3.4 Magnitude/Extent

There is no commonly accepted return period or non-exceedance probability for defining the risk from drought (such as the 100-year or one percent annual chance of flood). The magnitude of drought is usually measured in time and the severity of the hydrologic deficit. There are several resources available to evaluate drought status and estimate future expected conditions. The National Integrated Drought Information System (NIDIS) Act of 2006 (Public Law 109-430) prescribes an interagency approach for drought monitoring, forecasting, and early warning. The NIDIS maintains the U.S. Drought Portal (www.drought.gov) which is a web-based access point to several drought related resources. Resources include the U.S. Drought Monitor (USDM), shown in Figure 4.3-1 and the U.S. Seasonal Drought Outlook (USSDO).

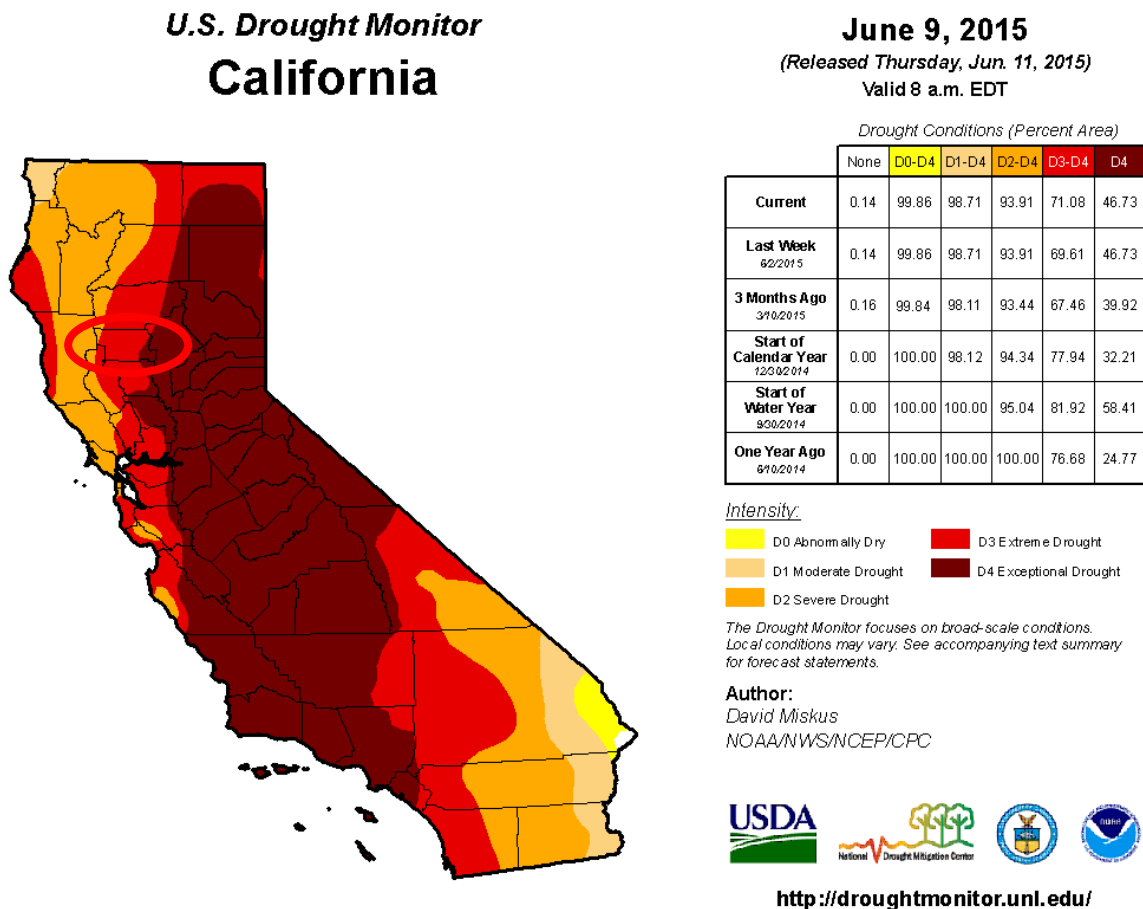


Figure 4.3-1: Drought Monitor Map for the State of California on June 9, 2015

The USDM provides a summary of drought conditions across the United States and Puerto Rico and is developed and maintained by the National Drought Mitigation Center (www.drought.unl.edu). USDM includes the U.S. Drought Monitor Map. This map is updated weekly by combining a variety of drought

database and indicators, and local expert input into a single composite drought indicator. The map denotes four levels of drought intensity (ranging from D1 - D4) and one level of "abnormal dryness" (D0). These impact indicators help communicate whether short- or long-term precipitation deficits are occurring. An example Drought Monitor Map for the State of California on June 9, 2015 is illustrated in Figure 4.3-1: Drought Monitor Map for the State of California on June 9, 2015

As shown, the majority of Glenn County was experiencing extreme drought conditions.

The USSDO, shown in Figure 4.3-2, is a three-month projection of potential drought conditions developed by the National Weather Service's Climate Prediction Center at the following website: http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html. As demonstrated, California's drought is anticipated to persist and intensify.

U.S. Seasonal Drought Outlook Drought Tendency During the Valid Period

Valid for May 21 - August 31, 2015
Released May 21, 2015

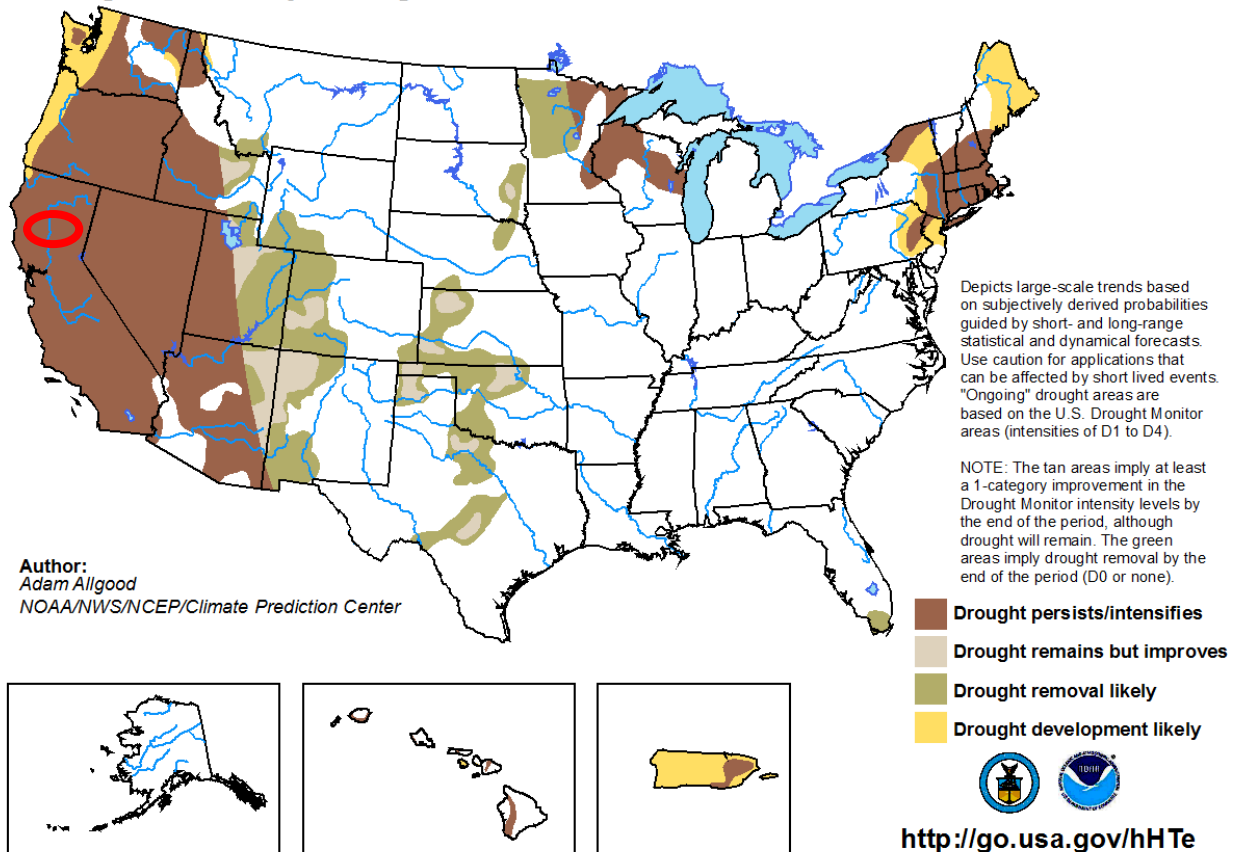


Figure 4.3-2: USSDO Drought Tendency Map (Valid from May 21, 2-15 to August 31, 2015)

A number of indices measure how much precipitation for a given period has deviated from historically established norms. The primary indicator for the USDM and USSDO for the western United States is the Palmer Drought Severity Index (PDSI). The PDSI is widely used by the USDA to determine when to grant emergency drought assistance to affected areas. PDSI is a commonly used index that measures the

severity of drought for agriculture and water resource management. It is calculated from observed temperature and precipitation values and estimates soil moisture. However, the PDSI is not considered consistent enough to characterize the risk of drought on a nationwide basis (FEMA, 1997) and is not well suited to the dry, mountainous areas in the western U.S.

For western States with mountainous terrain and complex regional microclimates, it is also useful to supplement the PDSI values with other indices such as Surface Water Supply Index and Standardized Precipitation Index (SPI). The Surface Water Supply Index takes snowpack and other unique conditions into account. The National Drought Mitigation Center (NDMC) uses the SPI to identify emerging drought months sooner than the PDSI. It is computed on various time scales to monitor moisture supply conditions. The SPI is the number of standard deviations that precipitation value would deviate from the long-term mean. As shown in Figure 4.3-3 the 72-month SPI through June 6, 2015 for Glenn County is “extreme drought.”

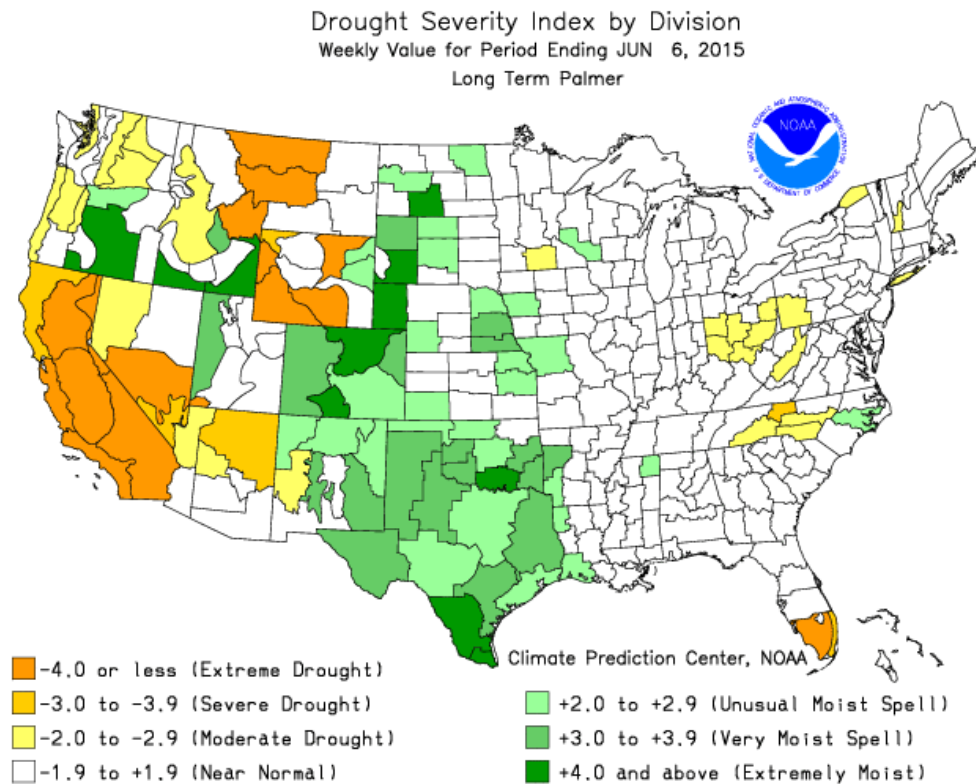


Figure 4.3-3: 72-Month SPI through June 6, 2015 for Glenn County

The Vegetation Drought Response Index, or VegDRI, is a bi-weekly depiction of vegetation stress across the contiguous United States. VegDRI is a fine resolution (1-km²) index based on remote sensing data, and incorporates climate and biophysical data to determine the cause of vegetation stress. Development

of the VegDRI map and associated products is a joint effort by the National Drought Mitigation Center (NDMC), the U.S. Geological Survey's (USGS) National Center for Earth Resources Observation and Science (EROS), and the High Plains Regional Climate Center (HPRCC). Figure 4.3-4 illustrates the VegDRI results for the northern quad of California for June 1, 2015.

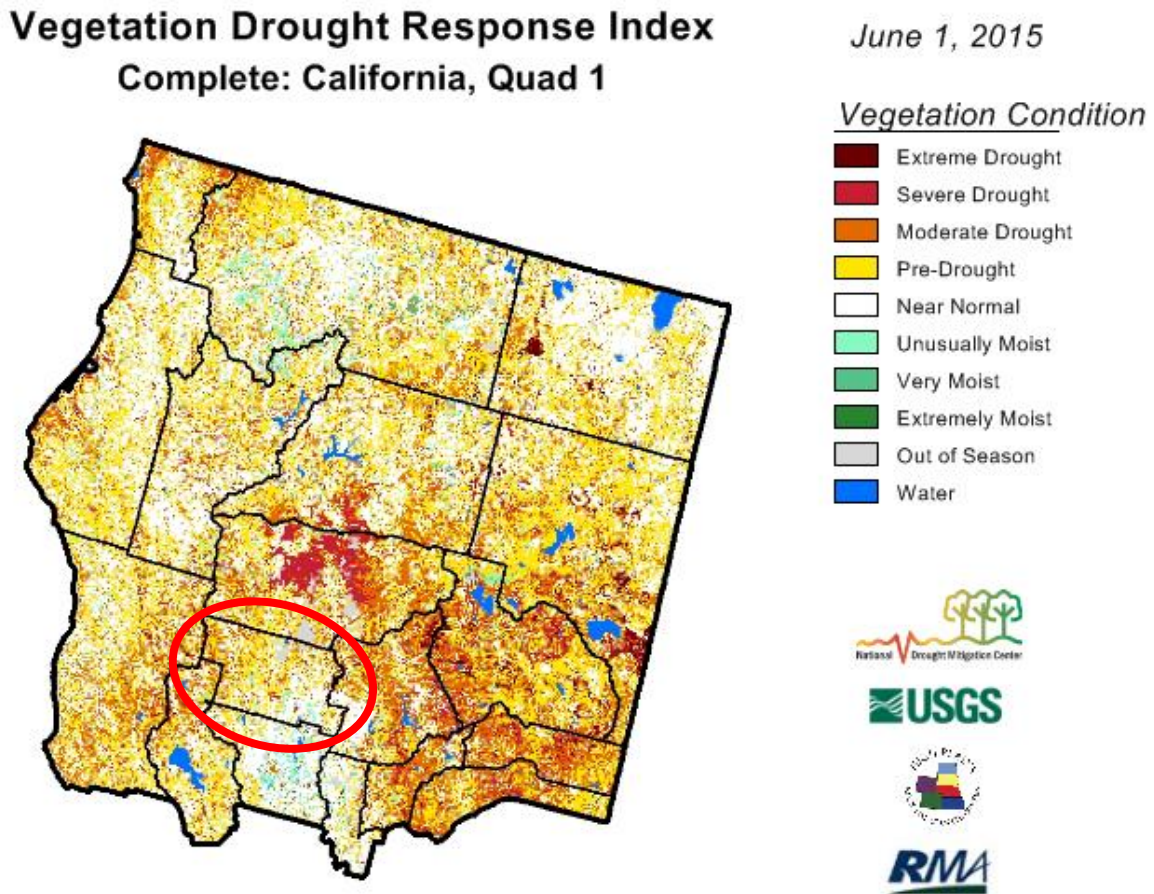


Figure 4.3-4: VegDRI results for the Northern Quad of California for June 1, 2015

4.3.5 Frequency/Probability of Future Occurrences

Currently there is no data on the probability of drought that would be comparable to the USGS effort on earthquakes in the region, or how 100-year flood maps are created. However, according to the 2007 Glenn County EOP, drought cycles occur every 7 to 11 years in Glenn County. According to the 2010 California State HMP, climate scientists studying California find that drought conditions are likely to become more frequent and persistent over the 21st century due to climate change.

Cities of Orland and Willows

Drought is a regional hazard with no defined boundaries; thus, the drought conditions in the Cities of Orland and Willows are on par with those of the rest of Glenn County. Significant drought events have affected California (and the rest of the United States) throughout history. The Cities of Orland and Willows obtain a large portion of their water from an aquifer, which is fed by deep wells some of which are located in Orland and Willows. New wells often are drilled in the region during periods of intense drought. The Cities are serviced by the California Water Service and the Bureau of Reclamation.

The Cities of Orland and Willows' climate is very warm during summer when temperatures tend to be in the 90s and cold during winter when temperatures tend to be in the 40s. The warmest month of the year is July with an average maximum temperature of 98.7 degrees Fahrenheit, while the coldest month of the year is December with an average minimum temperature of 40.2 degrees Fahrenheit. Temperature variations between night and day tend to be relatively dramatic during summer with a difference that can reach 33 degrees Fahrenheit, and moderate during winter with an average difference of 21 degrees Fahrenheit. The annual average precipitation at Willows is about 19 Inches. Rainfall is fairly evenly distributed throughout the year. The wettest month of the year is January with an average rainfall of 3.9 inches.

4.4 Flood Hazard Profile

Flood reduction, prevention, and mitigation is a major challenge to Glenn County residents and floodplain managers alike. Many areas of Glenn County are vulnerable to flooding, especially property near drainage channels and along the County's creeks the Sacramento Rivers. Due to heavy seasonal rainfall, flat terrain, and the network of canal and levee systems, flooding issues can be difficult to overcome. A majority of county flood prone properties are specifically subject to inundation as a result of heavy rainfall and resulting stream and drainage canal overflows. Localized flooding associated with creek or stream overflow occurs in Glenn County when rainfall runoff volumes exceed the design capacity of drainage facilities, or a lack of flood control structures in place, or maintenance in drainage areas which causes pinch points in flood control structures. Heavy seasonal rainfall, which typically occurs during December through February, often results in stream overflows. Flood risk is intensified in reaches along the Sacramento River.



4.4.1 Regulatory Environment

The regulatory environment for flood control at the local, state and federal level is complex, difficult to navigate, and varies based upon flood control structure, location of water bodies and local participation in state and federal programs. This section focuses on the regulations that Glenn County and the Cities of Orland and Willows use to regulate development within the floodplain. This section also highlights some of the new requirements from the State of California, as well as the National Flood Insurance Program (NFIP).

4.4.1.1 Local Building Codes

Glenn County and the Cities of Orland and Willows have a number of building codes and construction best management practices in place to reduce flood risk for newly constructed buildings. As the floodplain administrator for the County, the Building Official is appointed to administer, implement, and enforce the Glenn County Flood Plain Management Zone code by granting or denying development permits in accord with its provisions.

4.4.1.2 Local Floodplain Delineation

Upon application for a building permit, the Building Inspection Division reviews the submitted application and plans to determine whether or not the site of the proposed structure is within any Special Flood Hazard Areas (SFHA) designated by FEMA on regulatory Flood Insurance Rate Maps (FIRMs). More information on FEMA flood hazard areas is provided further in this section.

For all new construction and substantial improvements, fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of flood water.

4.4.1.3 National Flood Insurance Program (NFIP)

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. As a participating member of the NFIP, Glenn County and the Cities of

Orland and Willows are dedicated to protecting homes with policies currently in force. Like most communities participating in NFIP, FEMA has prepared a detailed Flood Insurance Study (FIS) for areas of Glenn County. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance of flood (the 100-year flood) and the 0.2-percent annual chance of flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on FIRMs. More information on location and geographic extent are provided in Section 4.4.3.

Glenn County entered the NFIP on September 3, 1980. As a participant in the NFIP, the County is dedicated to regulating development in the FEMA regulated floodplain areas in accordance with NFIP criteria. Before a permit to build in a floodplain area is issued, Glenn County ensures that two basic criteria are met:

- All new buildings and developments undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain developments must not aggravate existing flood problems or increase damage to other properties.

Structures permitted or built in the County before the NFIP regulatory requirements were incorporated into the County ordinances (before the effective date of the County's FIRM) are called "pre-FIRM" structures. For the Glenn County unincorporated areas, pre-FIRM structures are those permitted or built before September 3, 1980. The current effective date for the FIRM for Glenn County and the Cities of Orland and Willows is August 5, 2010.

Both the Cities of Orland and Willows are also NFIP participants. The City of Orland entered the NFIP on September 16, 2011, while the City of Willows entered the NFIP on June 4, 1980. The City of Orland adopted Ordinance No. 2011-03 on September 6, 2011 which in effect adopted the flood insurance study and flood insurance rate maps for Glenn County, California. Additionally, the City of Orland Municipal Code, Chapter 17.68 establishes the F-W Floodway Conservation Zone. The floodway conservation or F-W zone is intended to be applied to lands which lie within stream or drainage channels and to adjacent areas which are periodically inundated, or which will be inundated by a design flood. The design flood shall be specifically defined for each particular F-W zone on the zone map. The regulations set forth in this chapter are intended to provide for the reasonably unrestricted passage of a design flood, and to provide reasonable measures for the protection of life and property in floodway areas.

Chapter 15.65 of the Willows Municipal Code outlines the City's Floodplain Management Ordinance, and includes regulations to (a) 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; (b) Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction; (c) Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters; (d) Control filling, grading, dredging, and other development which may increase flood damage; and (e) Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas.

4.4.1.4 Central Valley Flood Protection Plan

Legislation spearheaded by California Department of Water Resources (DWR) to provide protection to people and property in areas especially prone to flooding was enacted by State Legislation in 2007 in the California Central Valley. State legislative requirements provide Glenn County local planning responsibilities for floodplain management (e.g., general plans, zoning ordinances, development agreements, tentative maps, and other actions).

Some of the requirements of the 2007 flood risk management legislation apply Statewide, while other legislation is additive and provides provisions applicable to lands within the Sacramento-San Joaquin Valley (SSJV). Other legislation is applicable to lands also within the Sacramento-San Joaquin Drainage District (SSJDD). Glenn County is within the SSJDD.

4.4.1.4.1 Government Code 65302

Government Code 65302 authorizes, but does not require, cities and counties to adopt a local hazard mitigation plan specified in the Federal Disaster Mitigation Act of 2000 in conjunction with the safety element of the general plan.

4.4.1.4.2 Government Code 8685.9

Government Code 8685.9 prohibits the State share for any eligible project under the California Disaster Assistance Act from exceeding 75 percent of total State eligible costs, unless the local agency is located within a city, county, or city and county that has adopted a local hazard mitigation plan in accordance with the Federal DMA 2000 as part of the safety element of its general plan. In other words, the Legislature may provide for a State share of local costs that exceeds 75% of total State eligible costs if the local jurisdiction/agency has an adopted local hazard mitigation plan.

4.4.2 Past Occurrences

A number of areas in the County have a long history of seasonal flooding, often resulting in significant damage. Floodwaters are a common occurrence for communities adjacent to and in the lowlands of creeks and rivers. Normally, wintertime storm floodwaters are kept within defined limits by levees, dykes, and open lowlands, causing little to no damage. Dams including Black Butte, Stony Gorge, and Shasta also help control floodwaters. But, occasionally, a combination of frequent storms, extended heavy rain, and melting snow results in floodwaters exceeding normal high-water boundaries and causing damage.

State Emergency Disaster Proclamations for flood damage as result of severe storm and heavy rains have been declared six times from 1950 to present. [Table 4.4-1](#) lists the eight Federal Flood Disaster Declarations that specifically affected Glenn County:

Table 4.4-1: Major Federal Flood Disaster Declarations

| Year | Hazard | Cause of Hazard | Date of Event | Declaration Number |
|------|---|-----------------|---------------|--------------------|
| 1998 | SEVERE WINTER STORMS AND FLOODING | WEATHER | 9-Feb-98 | 1203 |
| 1997 | SEVERE STORMS/FLOODING | WEATHER | 4-Jan-97 | 1155 |
| 1995 | SEVERE WINTER STORMS, FLOODING, LANDSLIDES, MUD FLOWS | WEATHER | 12-Mar-95 | 1046 |
| 1995 | SEVERE WINTER STORMS, FLOODING, LANDSLIDES, MUD FLOWS | WEATHER | 10-Jan-95 | 1044 |
| 1986 | SEVERE STORMS, FLOODING | WEATHER | 21-Feb-86 | 758 |
| 1983 | COASTAL STORMS, FLOODS, TORNADOES | WEATHER | 9-Feb-83 | 677 |
| 1974 | SEVERE STORMS, FLOODING | WEATHER | 25-Jan-74 | 412 |
| 1964 | HEAVY RAINS & FLOODING | WEATHER | 24-Dec-64 | 183 |

Source: FEMA Disaster Declarations, 2015

4.4.3 Location/Geographic Extent

There are two major watershed basins of the Sacramento River Watershed that extend across Glenn County: Colusa-Glenn and Shasta-Tehama. Both have inherent flood risk due to manmade and natural features within each floodway. A majority of the flood risk within Glenn County is specifically subject to inundation as a result of heavy rainfall and resulting stream and drainage canal overflows. In the unincorporated portions of Glenn County, a majority of flood risk is located near the drainage canals that are used to collect local runoff, and areas close to regional watershed floodways such as the Sacramento River. The extent of flooding associated with a one-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies, and helps identify the location and extent of flooding in areas across Glenn County. This area is also referred to as the Special Flood Hazard Area (SFHA), and is a convenient tool for assessing vulnerability and risk in flood-prone communities¹. Flood Hazard maps in Appendix C show 100-year and 500-year floodplain zones, which are estimated inundation areas based on a flood that has a one-percent (100-year) and 0.2-percent (500-year) chance of occurring in any given year. Glenn County contains over 140,000 acres of identified flood hazard areas. Table 4.4-1 provides the total area for both the 100-year and 500-year flood hazard areas.

Table 4.4-1: Special Flood Hazard Area

| Flood Hazard Type | Sum of Square Miles | Sum of Acres |
|--------------------|---------------------|----------------|
| 100-Year | 212 | 135,397 |
| 500-Year | 8 | 4,801 |
| Grand Total | 220 | 140,198 |

¹ Experience has shown that FEMA maps in the rural areas of Glenn County are not always accurate. FEMA flood insurance data is not always indicative of flood losses as not every property that floods has flood insurance.

4.4.3.1 State Awareness Zones

In addition to FEMA's SFHAs, State Flood Awareness Zones were created when DWR analyzed floodways and future projections for population growth and development in the entire State. DWR's goal was to conduct floodplain studies in areas where future growth and development might be expected. The State Flood Awareness efforts were concentrated in areas that are currently shown by default on FEMA's Digital FIRMs (DFIRMs) as Zone X with no flood risk. DWR made a major effort to do basic flood studies in each county in California's Zone X to identify overlooked flood prone areas before development begins. The concept and final mapping products are to be used by local governments within the State to control development and protect floodplains in identified awareness zones.

The State Flood Awareness Zones depicted in the flood hazard map in Appendix C are approximate flood risk areas and are meant to alert Glenn County to probable flood prone areas for potential floodplain regulation as new development approaches in these areas in the future. The State Flood Awareness Zones were developed under the pretense that as new development moved into the county jurisdiction, the county could require more detailed flood studies to assure that future flooding would be mitigated in the areas beyond the preexisting SFHAs. As development pressure increases in areas near State Flood Awareness Zones, Glenn County can work with FEMA to develop requests for re-studies as study funds become available at the Federal level.

4.4.4 Localized Flooding

In addition to the FEMA SPHA and State Awareness Zone, MJHMP Steering Committee members identified areas of localized flooding resulting from heavy rains and inadequate stormwater infrastructure. These areas are also shown in the flood hazard maps in Appendix C.

4.4.5 Repetitive Loss Properties

As mentioned previously in this section, Glenn County and the Cities of Orland and Willows are required to assemble a flood management plan that addresses areas of Repetitive Loss (RL) and Severe Repetitive Loss (SRL) claims as prescribed by the FEMA's NFIP. It is important to understand the difference between a repetitive loss *property* and a repetitive loss *area* as both are important in distinguishing an area for analysis.

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 SRL property 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 Glenn County's RL property list for a number of reasons:

- Not everyone is required to carry flood insurance. Structures carrying federally-backed mortgages that are in a SFHA are required to carry flood insurance in Glenn County.

- 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. In order to make the NFIP a viable program, the NFIP works to reduce the flood risk in the community and develop mitigation measures to reduce insurance payouts.

Extensive FEMA NFIP databases are used to track claims for every participating community including Glenn County and the Cities of Orland and Willows. Currently, there are 11 RL properties located within unincorporated Glenn County. These 11 RL properties are all residential in nature and have not been mitigated to date. Only three of these 11 RL properties are insured. The total dollar amount of claims paid to date by the NFIP is \$134,818 in structural and \$33,995 in content claims. Together, the total claims paid by the NFIP are in excess of \$168,812 for the unincorporated areas of the County.

There are total of nine RL properties located within the City of Willows. All of these RL properties are single-family homes and have not been mitigated to date. Only two of these nine RL properties are insured. The total dollar amount of claims paid to date by the NFIP is \$176,872 in structural and \$12,083 in content claims. Together, the total claims paid by the NFIP are in excess of \$188,955 for the City of Willows.

The City of Orland does not have any RL properties.

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 Glenn 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. Generalized locations of the County's repetitive loss

properties are shown on the flood hazard map in Appendix C to provide an idea of where repetitive flooding has occurred in the past and may occur in the future.

4.4.6 Magnitude/Extent

Both the Colusa-Glenn and the Shasta-Tehama sub-watersheds pose inherent flood risk to the region due to manmade and natural features within each floodway. In particular, a majority of the flood risk within Glenn County is from inundation resulting from heavy rainfall as well as stream and drainage canal overtopping. In the unincorporated portions of Glenn County, most of the flood risk is located near drainage canals utilized to collect regional runoff as well as areas close to regional watershed floodways including the Sacramento River. The flood risk in the unincorporated County as well as the Cities of Orland and Willows is considered significant, according to the hazard priority ranking exercise.

4.4.7 Flood Warning and Notification

The degree of damage from flood hazards can be reduced with longer periods of warning time and proper notification before flood waters arrive. Warning times of 12 hours or more have proven adequate for preparing communities for flood and reducing flood damage. More than 12 hours advanced warning of a flood can reduce a community's flood damage by approximately 40% in comparison with unprepared communities (Read Sturgess and Associates 2000). In addition, seasonal notification for flooding can enhance awareness for citizens at risk, and when communicated effectively advance notification can reach target audiences on a large scale. The following sections provide further information on Glenn County and the State of California Flood Warning and Flood Notification Systems.

4.4.7.1 DWR Awareness Zones Notification

DWR Levee Flood Protection Zone (LFPZ) and State Levee Flood Protection Zones Maps include both NFIP Accredited and Disaccredited Levees. DWR LFPZ maps are used to determine which property owners will receive a notice. The LFPZs include portions of Sacramento, San Joaquin, Yolo, Sutter, Yuba, Butte, Fresno, Merced, Tehama, Colusa, Glenn, Solano, Stanislaus, Lake, Placer, Plumas, and Madera Counties.

The intent of the Awareness Floodplain Mapping project is to identify all pertinent flood hazard areas by 2015 for areas that are not mapped under FEMA NFIP and to provide the community and residents an additional tool in understanding potential flood hazards not currently mapped as a regulated floodplain. The awareness maps identify the 100-year flood hazard areas using approximate assessment procedures. These floodplains will be shown simply as flood prone areas without specific depths and other flood hazard data. Awareness Floodplain Maps will be added as they become available.

DWR has launched the Flood Risk Notification Program. This innovative program is aimed at reducing the physical and financial impacts associated with potential flooding. Under State law adopted in 2007 (Water Code Section 9121), a flood risk notice must be sent each year to owners of properties located behind any State-Federal levee and within a Levee Flood Protection Zone (LFPZ). Nearly 275,000 Central Valley property owners in 17 counties receive "Flood Risk Notice" to raise flood risk awareness and encourage preventative actions to reduce flood damages and minimize losses.

Property owners may visit the program's interactive website at www.water.ca.gov/myfloodrisk and enter their address to get more detailed information about their flood risk, including the sources of flooding

and potential flood depths for their properties. This website includes the Frequently Asked Questions that may help answer some questions from affected property owners.

Cities of Orland and Willows

In the City of Orland, areas adjacent to Stony Creek and Hambright Creek are subject to flooding during heavy rainfall. Severe flooding is prevented in the Orland Planning Area by flood control dams on Stony Creek and the Sacramento River. A designated floodway has been mapped and adopted by the State Reclamation Board for Stony Creek. The State has jurisdiction within this designated floodway and supersedes local control. According to FEMA's Flood Insurance Rate Map, most of the area in the northwest portion of the City and along the northern edge of the City Planning Area is in either Flood Zone A or Flood Zone X, which means the area may be subject to flooding. Areas located directly adjacent to Stony Creek and Hambright Creek are within Flood Zone A, which is defined as area within the 100-Year Floodway. Areas located to the north and south of Stony and Hambright creeks, but not immediately adjacent to them, are generally designated as being within Flood Zone X, which is area within the 500-Year Floodway.

The City of Willows has hot, dry, summers with cool winters, similar to Orland. The mean annual rainfall is approximately 19 inches. The mean annual rainfall in the drainage area of Willow Creek is approximately 20 inches. Storms causing flooding occur in the winter seasons, generally from December through February. Snowmelt is less of a factor, versus higher elevation and snow levels, in flooding in this area. Storms of 100-year frequency from the South Fork Willows Creek and Wilson Creek will pond north of the city limits and then flows south along Highway 99 and southeast along Willow Creek. The 100-year frequency flows from South Fork Willows Creek, Wilson Creek, and Walker Creek will also pond behind the levee of the Glenn Colusa Canal northeast of the City and flow southward, causing flooding between Ventura Street to the west, the Glenn Colusa Canal on the east, and Walnut Street on the south. Local drainage from direct runoff has been a problem in the City's eastern center and in areas north of French Street, between Butte and Lassen Streets. The existing storm drain system carries this flow into the Glenn Colusa Canal. These areas are both subject to 100-year storm frequency ponding or shallow flows from South Fork Willows Creek.

4.5 Geologic Hazards Profile

Geologic Hazards in Glenn County include earthquake, expansive soils, and subsidence. These are profiled in the following discussions.



Earthquake

An earthquake is both the sudden slip on an active fault and the resulting shaking and radiated seismic energy caused by the slip (USGS 2009). The majority of major active faults in Glenn County are strike-slip faults. For this type of fault, during an earthquake event, one side of a fault line slides past the other. The rupture from this type of fault extends almost vertically into the ground.

Earthquakes are a significant concern to Glenn County. Glenn County is seismically active since it is situated on the boundary between two tectonic plates. Glenn County is on the North American Plate. A number of active faults cross Glenn County. Earthquakes can cause serious structural damage to buildings, overlying aqueducts, transportation facilities, utilities, and can lead to loss of life. Seismic shaking is by far the single greatest cause of damage from an earthquake in Glenn County, followed by liquefaction (Cascadia Subduction Zone Earthquakes, 2013). In addition, earthquakes can cause collateral emergencies including dam and levee failures, fires, and landslides.

4.5.1 Regulatory Environment

Numerous building and zoning codes exist at a state and local level to decrease the impact of an earthquake event on residents and infrastructure. Building and zoning codes include the Alquist-Priolo Earthquake Fault Zoning Act of 1972, Seismic Hazards Mapping Act of 1990, 2013 California Standards Building Code (CSBC), and 1993 Glenn County GP. To protect lives and infrastructure in Glenn County and the Cities, the Building Division of each jurisdiction ensures codes regarding hazards are met.

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. Active faults in Glenn County have been included under the Alquist-Priolo Geologic Hazards Zones Act and Seismic Hazards Mapping Act.

The 2013 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. Glenn County utilizes the 2010 CSBC to regulate the infrastructure in the County. This includes unreinforced masonry (URM) buildings. For new buildings, Glenn County includes earthquake safety provisions, with enhancements for essential services buildings, hospitals, and public schools.

The 1993 Glenn County GP includes the following policies for lowering the impacts of earthquakes on infrastructure within the County:

- Promote sound agricultural soil and development practices which conserve soil resources and avoid or mitigate impacts associated with erosion.
- Require erosion control plans for development proposed on sloping land.
- Require a site specific geological investigation prior to development within areas of high landslide risk.
- Monitor gas and water well production in order to evaluate subsidence activity.
- Enforce the requirements of the Uniform Building Code for all development in order to protect people, property, and improvements from seismic and other geologic hazards.
- Require geotechnical investigation for buildings meant for public occupancy within earthquake fault zones.
- Require geotechnical evaluation and recommendations of new development in moderate or higher-earthquake fault zones.
- Require new development to incorporate project features that avoid or minimize the impacts of earthquakes.

The 2010 City of Orland GP includes the below policies for lowering the impacts of earthquakes on infrastructure within the Cities:

- Policy 4.6.A: The City shall consider the potential for expansive soils and earthquake-related hazards when reviewing applications for developments.
- Policy 4.6.B: The City shall work with landowners and interested parties to address seismic safety concerns for older and historic buildings within the downtown area.
- Policy 4.6.C: The City shall require applications for projects that extract groundwater, oil, or gas to include a report evaluating the potential for resulting subsidence. Reports shall discuss appropriate mitigation measures to reduce the potential for subsidence.

4.5.2 Past Occurrences

Glenn County-area historical earthquake activity is significantly below California's state average; however, it is 724 percent greater than the overall United States average according to the 2015 Glenn County Operational Area Emergency Operations Plan (EOP). No federally declared earthquake event has occurred in Glenn County since 1950. In 1975, a magnitude 5.8 earthquake occurred 48.4 miles away from the county center and, in 1998, a magnitude 5.4 earthquake occurred 69.0 miles away from the county center at a 14.5 mile depth. The largest earthquake within 30 miles of Glenn County was a 5.0 magnitude, which occurred in 1995 at a depth of 13 miles. More recently, on October 30, 2015, a minor earthquake with a magnitude of 3.5 struck approximately ten miles south of Hamilton City in Glenn County.

4.5.3 Location/Geographic Extent

Fault zones are areas surrounding active faults, where future movement is likely to occur. It is in these zones where the majority of earthquakes originate. The Pacific Rim Region, which includes the state of California is one of the most active earthquake regions on earth. California's geographic features are

dominated by the juncture of two of the world's tectonic plates, the North American plate and the Pacific plate. The San Andreas Fault runs the entire length of the state, north to south. The San Andreas Fault is not the only fault system capable of causing considerable loss of life, property, and environmental damage.

Six earthquake fault systems exist within the Glenn County area. These fault systems have produced or have the potential to produce seismic events of moderate to major impact. The longest of these are the Bartlett Springs (Coast Range) Fault and the Great Valley (Willows) Fault. The Bartlett Springs Fault runs generally north and south along the western side of Glenn County within the Mendocino National Forest. The Bartlett Springs Fault System contains several faults that run through the western portion of Glenn County, Tehama County, and the eastern portions of Lake and Mendocino counties. This Fault System runs through the bottom of Black Butte Reservoir. The Great Valley Fault enters the county at the southern end and traverses the county in a north-westerly direction, sitting just west of Highway 5.

There are several small fracture faults on this system, including Stony Creek Fault, which is parallel to the reservoir and tributary of the same name and terminates in the town of Stonyford. The Corning Fault branches off from the Willows Fault where the two pass under the Colusa Canal and the Corning Fault continues up along the central part of the county following the path of Highway 5.

In the south-eastern region of the county, Indian Valley and Resort Faults have been inactive for more than 50 years but are significant enough in potential to be cause for concern. The last major seismic activity affecting Glenn County was located near the Oroville Dam area in the year 1975. This earthquake was a magnitude 5.8 and produced only minor damage in Glenn County. The earthquake hazard map located in Appendix C shows the location of faults in Glenn County.

4.5.4 Magnitude/Extent

The most common method for measuring earthquakes is magnitude, which measures the strengths of earthquake. 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 4.5-1](#), there are seven earthquake magnitude classes, ranging from great to micro. A magnitude class of great can cause tremendous damage to infrastructure in Glenn County, compared to a micro class, which results in minor damage to infrastructure. A map of shaking intensity specific to the Glenn County area is located in Appendix C. The western portion of the County has strong and very strong shaking potential while the majority of the eastern area of the county has moderate shaking potential.

Table 4.5-1: Moment Magnitude Scale

| Earthquake Magnitude Classes | | |
|------------------------------|---------------------------------|-------------------------|
| Magnitude Class | Magnitude Range (M = Magnitude) | Potential Damage |
| 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 |

The MMI Scale measures earthquake intensity as shown in Table 4.5-2. The MMI Scale has 12 intensity levels. Each level is defined by a group of observable earthquake effects, such as ground shaking and/or damage to infrastructure. Levels I through VI describe what people see and feel during a small to moderate earthquake. Levels VII through XII describe damage to infrastructure during a moderate to catastrophic earthquake.

Table 4.5-2: Modified Mercalli Scale

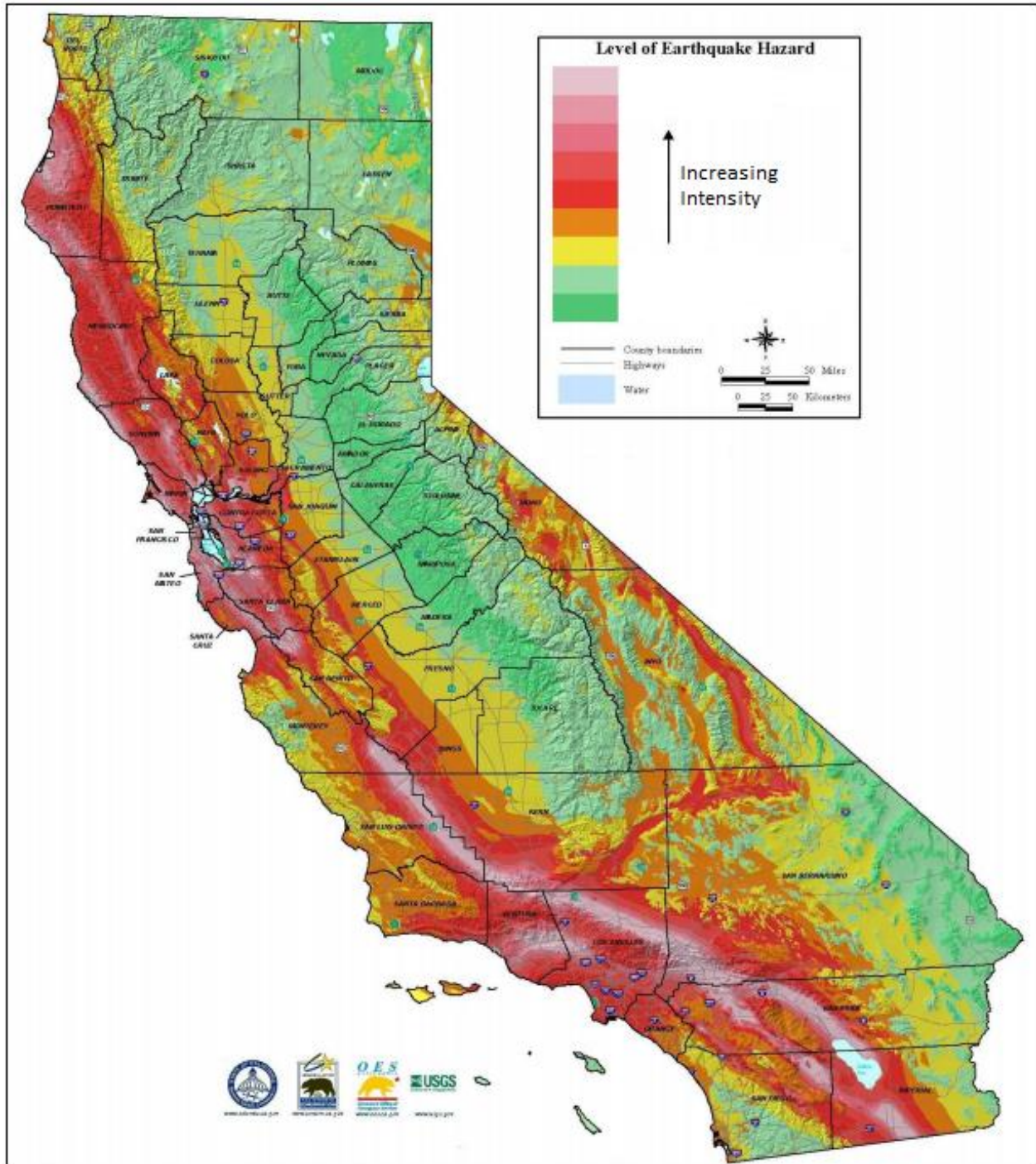
| Earthquake Magnitude and Intensity | | |
|------------------------------------|-------------------------------------|--|
| Magnitude (M _w) | Intensity (Modified Mercalli Scale) | Description |
| 1.0 – 3.0 | I | I. Not felt except by very few people under especially favorable conditions. |
| 3.0 – 3.9 | II – III | II. Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing. |
| | | III. Felt quite noticeably indoors. Many do not recognize it as an earthquake. Standing motorcars may rock slightly. |
| 4.0 – 4.9 | IV – V | IV. Felt by many who are indoors; felt by a few outdoors. At night, some awakened. Dishes, windows and doors rattle. |

| | | |
|----------------|-----------------|---|
| | | V. Felt by nearly everyone; many awakened. Some dishes and windows broken; some cracked plaster; unstable objects overturned. |
| 5.0 – 5.9 | VI – VII | VI. Felt by everyone; many frightened and run outdoors. Some heavy furniture moved; some fallen plaster or damaged chimneys. |
| | | VII. Most people alarmed and run outside. Damage negligible in well-constructed buildings; considerable damage in poorly constructed buildings. |
| 6.0 – 6.9 | VII – IX | VIII. Damage slight in special designed structures; considerable in ordinary buildings; great in poorly built structures. Heavy furniture overturned. Chimneys, monuments, etc. may topple. |
| | | IX. Damage considerable in specially designed structures. Buildings shift from foundations and collapse. Ground cracked. Underground pipes broken. |
| 7.0 and Higher | VIII and Higher | X. Some well-built wooden structures destroyed. Most masonry structures destroyed. Ground badly cracked. Landslides on steep slopes. |
| | | XI. Few, if any, masonry structures remain standing. Railroad rails bent; bridges destroyed. Broad fissure in ground. |
| | | XII. Virtually total destruction. Waves seen on ground. Objects thrown into the air. |

4.5.5 Frequency/Probability of Future Occurrences

While earthquakes occur less frequently than other primary natural hazard events, they have accounted for the greatest combined losses (deaths, injuries, and damage costs) in disasters since 1950 in California and have the greatest catastrophic disaster potential (Cal EMA 2010). The USGS database shows that there is a 60.91 percent chance of a moderate earthquake (magnitude 5.0 or greater) within 30 miles of Glenn County within the next 50 years, as demonstrated in [Figure 4.5-1](#).

Figure 4.5-1: Shasta Cascade Area Shaking Potential



Source: Department of Conservation, 2015

Expansive Soils

Expansive soils are characterized by a high clay content, which swell with increased moisture content and contract during dry periods. This change in volume, usually associated with seasonal changes, can damage building foundations, roads, and concrete pavement. On slopes, it can bury or break utility poles. Expansive soil types are also known to be associated with landslide risk and rockfall, as increased volume of expansive soil layers on slopes can create ground shifts and down-slope movement of materials. Onset of soil expansion tends to follow the seasons, with expansion occurring in the wetter months of the year and contraction over the summer. In regard to warning time, maps showing the location of expansive soils are available to guide future building and development on the potential presence of this hazard.

4.5.6 Regulatory Environment

The Safety Element of the 1993 Glenn County General Plan and the 2010 City of Orland General Plan address risks associated with the effects of seismically induced surface rupture, ground movement, and ground failure; slope instability leading to mudslides and landslides, erosion, and soil expansion. The policies it lists to cope with these issues include:

- PSP-28: Promote sound agricultural soil and development practices, which conserve soil resources and avoid or mitigate impacts associated with erosion.
- PSP-29: Protect valley stream courses from the effects of erosion.
- PSP-30: Require erosion control plans for development proposed on sloping land.
- PSP-31: Require a site specific geological investigation prior to development within areas of high landslide risk.
- PSP-33: Enforce the requirements of the Uniform Building Code for all development in order to protect people, property, and improvements from seismic and other geologic hazards.
- Policy 4.6.A: The City shall consider the potential for expansive soils and earthquake-related hazards when reviewing applications for developments.

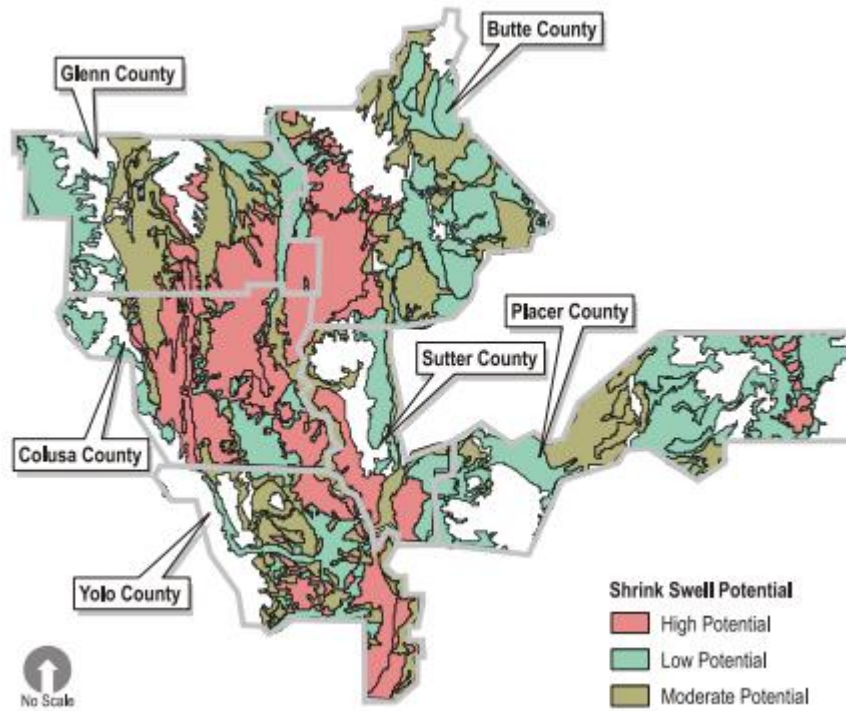
4.5.7 Past Occurrences

Expansive soils have been known to cause problems for building foundations and roads but no specific data on past occurrences and damages is available. The County and the Cities of Orland and Willows will monitor any potential expansive soils events and include this information in future iterations of the MJHMP.

4.5.8 Location/Geographic Extent

Glenn County contains soils with low, medium, and high shrink-swell potential as shown in the expansive soil hazard map in Appendix C. As shown in [Figure 4.5-1](#), Western Glenn County has soils with predominantly low to medium shrink-swell potential, while the southeastern portion of the County contains soils with higher expansive potential.

Figure 4.5-1: Glenn County Regional Shrink Swell Potential



Source: USDA, Soil Conservation Service

4.5.9 Magnitude/Severity

Expansive soils are soils with the potential to experience considerable changes in volume, either shrinking or swelling, with changes in moisture content. The shrinkswell capacity of the soil refers to the potential of soil to shrink when desiccated and swell or expand when rehydrated. Shrinking and swelling can damage roads, dams, building foundations, and other structures and can also harm plant roots (Soil Conservation Service 1986). The magnitude of shrink or swell in expansive soils is influenced by a number of factors:

- Amount of expansive silt or clay in the soil;
- Thickness of the expansive soil zone;
- Thickness of the active zone (depth at which the soils are not affected by dry or wet conditions); and
- Climate (variations in soil moisture content as attributed to climatic or man-induced changes).

Soils composed primarily of sand and gravel are not considered expansive soils (the soil volume does not change with a change in moisture content). Soils containing silts and clays may possess expansive characteristics. The Natural Resource Conservation Service classifies these soils as low, moderate, and high potential for volume changes (Sutter County 1996):

- Low - This class includes sands and silts with relatively low amounts of clay minerals. Sandy clays may also have low expansion potential if the clay is kaolinite. Kaolinite is a common clay mineral.
- Moderate - This class includes silty clay and clay textured soils if the clay is kaolinite and also includes heavy silts, light sandy clays, and silty clays with mixed clay minerals.
- High - This class includes clays and clay with mixed montmorillonite, a clay mineral which expands and contracts more than kaolinite.

4.5.10 Frequency/Probability

A soil's potential to shrink and swell depends on the amount and types of clay in the soil. Certain types of clays expand when wet and disproportionately shrink when dry. Although this hazard is widespread across the County, it is unlikely to cause loss of life. Certain standard building practices can be used to mitigate damage caused by expansive soils. The impacts of this hazard are likely to increase in the future due to the increasing development in these areas.

Subsidence

Land subsidence occurs within the Glenn County. It is most often caused by the withdrawal of large volumes of fluids from underground reservoirs, but it can also be caused by the addition of surface water to certain types of soils (hydrocompaction). Subsidence from any cause accelerates maintenance problems on roads, lined and unlined canals, and underground utilities. Subsidence has and causes gradient changes in canals, resulting in the need for canal banks to be raised and bridges elevated at significant expense.

4.5.11 Regulatory Environment

The 1993 Glenn County GP and the 2010 City of Orland GP state that geologic hazards in the County include the potential for landslides, erosion, and subsidence. The associated policies to deal with these hazards are the following:

- PSP-30: Require erosion control plans for development proposed on sloping land.
- PSP-31: Require a site specific geological investigation prior to development within areas of high landslide risk.
- PSP-32: Monitor gas and water well production in order to evaluate subsidence activity.
- PSP-33: Enforce the requirements of the Uniform Building Code for all development in order to protect people, property, and improvements from seismic and other geologic hazards.
- Policy 4.6.C: The City shall require applications for projects that extract groundwater, oil, or gas to include a report evaluating the potential for resulting subsidence. Reports shall discuss appropriate mitigation measures to reduce the potential for subsidence.

4.5.12 Past Occurrences

Extensive groundwater pumping of San Joaquin Valley aquifers is increasing the rate of and subsidence affecting the Northern Sacramento Valley region. Between 1926 and 1970, groundwater pumping caused widespread aquifer compaction and resultant land subsidence in the valley. Subsidence in some areas of Southern California exceeded 28 feet (USGS 2013). Increased pumping has caused additional land

subsidence as well as land shifting in areas most impacted by subsidence. Exact data on past occurrences and damages is not available.

4.5.13 Location/Geographic Extent

The geologic structure of the land area in the southern, central and eastern sections of Glenn County is almost completely based in a mixture of old and new alluvium and old stream channel and fan deposits. This makes for rather loose, unconsolidated soil with a potential for strong ground surface subsidence and displacement. A significant phenomenon that is most responsible for potential loss of life and property damage is ground failure (subsidence/liquefaction). The County and the Cities of Orland and Willows will monitor any potential subsidence events and include this information in future iterations of the MJHMP. The subsidence hazard map in Appendix C shows the location of potential subsidence hazards.

4.5.14 Magnitude/Extent

Subsidence occurs at great depths below the surface when subsurface pressure is reduced by the withdrawal of fluids (i.e., groundwater and natural gas). A vacuum may be created that gradually results in sinking of the ground. The primary cause of subsidence in this region would be from overdrafting of groundwater; currently, no area of serious overdraft has been identified in the area. In the hazard prioritization exercise, subsidence was ranked as low-hazard for all three jurisdictions.

4.5.15 Frequency/Probability

Now that the hazard is recognized and understood, subsidence from ground water withdrawal has generally slowed since the 1970's in the Northern Sacramento Valley due to reductions in ground water pumping. Current drought conditions, however, could increase frequency of subsidence events in the region. Long-term subsidence is expected to continue, but at a slower rate than it has in the past. Even though water levels have stabilized in the past decades, subsidence continues due to past stresses on aquifer systems. Continued population growth, higher water demands, and uncertain water supplies will likely continue the trend of groundwater withdrawal and continued subsidence around the Glenn County region.

Cities of Orland and Willows

Maps from the California Geologic Survey indicate that the City of Willows lies within the portion of the state that has no record of damaging shaking events during the last century. No earthquakes in recent history have had epicenters in the Cities of Orland and Willows. One earthquake fault that could potentially impact these cities is the Corning Fault, which overlays the I-5 freeway for more than 30 miles. The City of Orland is susceptible to violent shaking from periodic earthquakes or faults in the region. Both Orland and Willows are located along the I-5 corridor and could suffer transportation interruptions if I-5 was damaged by ground shaking.

There have been no significant incidents of subsidence reported in Orland and the City planning area has low to high potential for expansive soils according to the 1993 Glenn County General Plan.

The soils in the City of Willows can be generally considered to be shallow. Clays have the potentials for expansion and contraction when they go through wet-dry cycles. Foundations based on clay soils have

the potential for being impacted by the associated changes in the soil volumes over time. This phenomenon can be most directly observed by areas of roadway failure that are commonly evidence by repeated patching over the years. Clays also have significant shrink-swell potential. I-5 sections passing through the Cities of Orland and Willows are built upon fine silt and alluvium, which has the potential to subside causing subsidence areas along the roadway.

4.6 Levee Failure

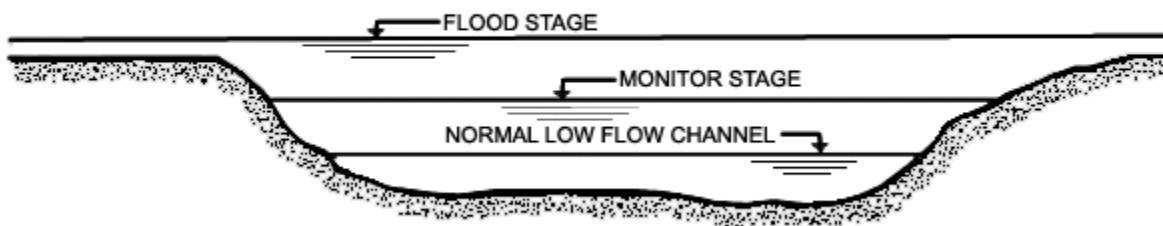
Levees and floodwalls are man-made structures designed to protect specific areas from flooding. These structures fail when floodwaters exceed the height of the structure, or when the maximum pressure exerted by the floodwaters against the levee/floodwall exceeds its capability (FEMA 2013).



River Stage Definitions

These definitions are used by the California Department of Water Resources (DWR) Flood Center in Sacramento in correspondence and alerts provided to local governments and posted on the California Data Exchange Center (CDEC) and National Oceanic and Atmospheric Administration (NOAA) Webpages.

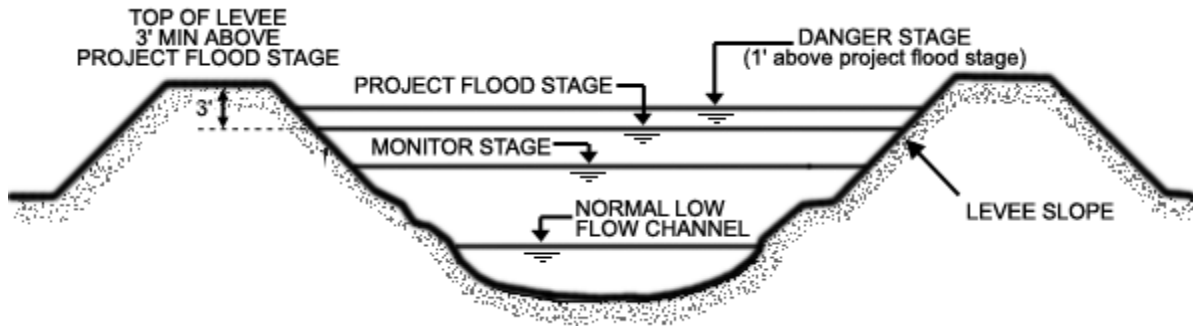
MONITOR - FLOOD - DANGER STAGES



CROSS SECTION - TYPICAL NON-LEVEEED STREAM

MONITOR STAGE - The Stage at which initial action must be taken by concerned interests (livestock warning, removal of equipment from lowest overflow areas, or simply general surveillance of the situation). This level may produce over-bank flows sufficient to cause minor flooding of low-lying lands and local roads.

FLOOD STAGE - The Stage at which over-bank flows are of sufficient magnitude to cause considerable inundation of land and roads and/or threat of significant hazard to life and property.



CROSS SECTION-TYPICAL LEVEED STREAM

MONITOR STAGE - The Stage at which patrol of flood control project levees by the responsible levee maintaining agency becomes mandatory, or the Stage at which flow occurs into bypass areas from project overflow weirs.

PROJECT FLOOD STAGE - The Stage at which the flow in a flood control project is at maximum design capacity (US Army Corps of Engineers "Project Flood Plane"). At this level there is a minimum freeboard of 3 feet to the top of levees.

DANGER STAGE - The Stage at which the flow in a flood control project is greater than maximum design capacity and where there is extreme danger with threat of significant hazard to life and property in the event of levee failure. This is generally 1 foot above project flood stage.

Every year flooding results in the loss of life and causes millions of dollars of damage to property. Except in the case of flash flooding, the onset of most floods is a relatively slow process with a buildup period of several days. This buildup period provides an opportunity for emergency responders to reduce the damage that the flooding will cause.

4.6.1 Regulatory Environment

The U.S. Department of Homeland Security (DHS) considers levees to be part of the Nation's critical infrastructure and collaborates with corresponding public and private partners to identify levees that present the greatest risk to the Nation. DHS also coordinates corresponding protective programs that utilize an all-hazards approach to risks (considering manmade and natural incidents). This collaboration highlights the importance of protecting and ensuring the safety of the Nation's levees with contribution from all levels of government and the private sector.

Levee regulatory requirements at a federal, state, and local level are critical for the safeguarding of agriculture, economy, power supply, and quality of life in the unincorporated areas of Glenn County. One local policy pertaining to levees in Glenn County is listed in the 1993 General Plan. CDP-16 states:

Recognize that due to discrepancies arising from the original land surveys conducted in the State, which resulted in acreage shortages in sections of land, the existence of physical barriers such as canals, roads, streams, levees, etc., and parcel configuration, exceptions to minimum parcel size for properties zoned to exclusive agricultural categories may be necessary and appropriate to promote the spirit and intent of the General Plan.

A slow-rise flood situation resulting from a levee breach could evolve through a series of four stages. Emergency actions will be based on the four stages of response actions:

- Stage 1 – Planning & Preparation (Incoming storms, flooding possible)
- Stage 2 - Monitor Stage (High water levels)
- Stage 3 – Emergency Stage (Flood Stage)
- Stage 4 – Danger Stage (Extensive flooding is imminent)

4.6.2 Past Occurrences

Portions of Hamilton City and the surrounding area flooded in 1974. Extensive flood fighting has been necessary in 1983, 1986, 1995, 1997, and 1998 to avoid failure of the private 100 year-old 'J' levee. Residents of the town were evacuated six times in the past 20 years: 1983, 1986, twice in 1995, 1997, and 1998 (Sacramento River Conservation Area Forum 2003).

A catastrophic failure of various levees along the Sacramento River in the region would have a significant impact on portions of Glenn County. Various historical crests have occurred along the Sacramento River in Hamilton City:

- (1) 150.92 ft. on 01/02/1997
- (2) 150.80 ft. on 01/24/1970
- (3) 150.77 ft. on 03/01/1983
- (4) 150.65 ft. on 01/10/1995
- (5) 150.53 ft. on 02/18/1986

Additional historical crests have occurred along the Sacramento River at Butte City:

- (1) 96.87 ft. on 02/07/1942
- (2) 96.70 ft. on 02/20/1958
- (3) 95.89 ft. on 03/02/1983
- (4) 95.17 ft. on 02/12/1941
- (5) 95.15 ft. on 02/04/1998

And, historical crests along the Sacramento River at Ord Ferry include:

- (1) 121.70 ft. on 02/28/1940
- (2) 121.20 ft. on 02/06/1942
- (3) 121.10 ft. on 12/11/1937
- (4) 120.10 ft. on 02/25/1958
- (5) 119.79 ft. on 01/24/1970

4.6.3 Location/Geographic Extent

Breaching of levees along the Sacramento River in various locales could have potentially catastrophic impacts on areas of Glenn County, most significantly along the west bank of the Sacramento River where Hamilton City is located. The community of Hamilton City relies on the existing 'J' levee to contain flows in the Sacramento River. The 'J' levee does not meet USACE or any other levee construction standards and could fail at river levels well below the top of the levee.

Additional levees in Glenn County are located along Butte Creek, Elk Creek, French Creek, Grindstone Creek, Hambright Creek, Logan Creek, Stony Creek, Walker Creek, Wilson Creek, and Willow Creek, as well as smaller tributaries. Additionally, the Glenn-Colusa Canal and Tehama-Colusa Canal are sites where levees could potentially fail and impact surrounding communities. The levee failure inundation zones are shown in the levee failure hazard map in Appendix C. This shows the areas that would be flooded in the event of a levee failure in the County.

4.6.4 Magnitude/Extent

Despite coordination and collaboration amongst relevant federal agencies, it was demonstrated during Hurricane Katrina in 2005 that breaching of levees and subsequent flooding is still a possibility regardless of elaborate protection and safety programs. Historic crests at various locations along the Sacramento River demonstrate the magnitude that could result in levee failure.

4.6.5 Frequency/Probability of Future Occurrences

No quantitative information exists for a levee failure in Glenn County. Levees are monitored and checked on a periodic basis. When a levee is recognized to have a potential failure site, monitoring protocols and notification procedures for communicating levee status to emergency response personnel are carried out. The Hazard Priority Ranking exercise for Glenn County and the Cities of Orland and Willows indicated that levee failure is the highest risk hazard to the unincorporated County but the lowest risk hazard to both the incorporated Cities.

Cities of Orland and Willows

Flooding caused by levee failure is a greater risk to the City of Orland than that of flooding caused by levee breach. Levee failure is considered a secondary hazard for the region. The 100- year-old "J" Levee upstream of Hamilton City is currently undergoing renovation to protect Hamilton City from flooding when the Sacramento River surges its banks. Portions of this area have flooded on several occasions since 1974 (Sacramento River Forum, 2015). This multipurpose project area includes Hamilton City and the

surrounding rural area. The boundaries are the Sacramento River to the east and the Glenn Colusa Canal to the west and extends about two miles north and six miles south of Hamilton City. The project area lies just north of the existing Sacramento River Flood Control Project levees and within the area of extent of the Chico Landing to Red Bluff bank protection project. The project will construct a setback levee, degrade an existing levee and revegetate the setback area to restore 1,145 acres of riparian woodland, 261 acres of riparian shrub, and 70 acres of floodplain meadow. This project will reduce flood risk for the town of Hamilton City and bordering agricultural lands (Hamilton City Justification Sheets, 2011). Figure 4.6-1 and Figure 4.6-2 show a diagram and aerial photograph of the "J" Levee along the Sacramento River near Hamilton City.

Figure 4.6-1: Diagram of "J" Levee along Sacramento River

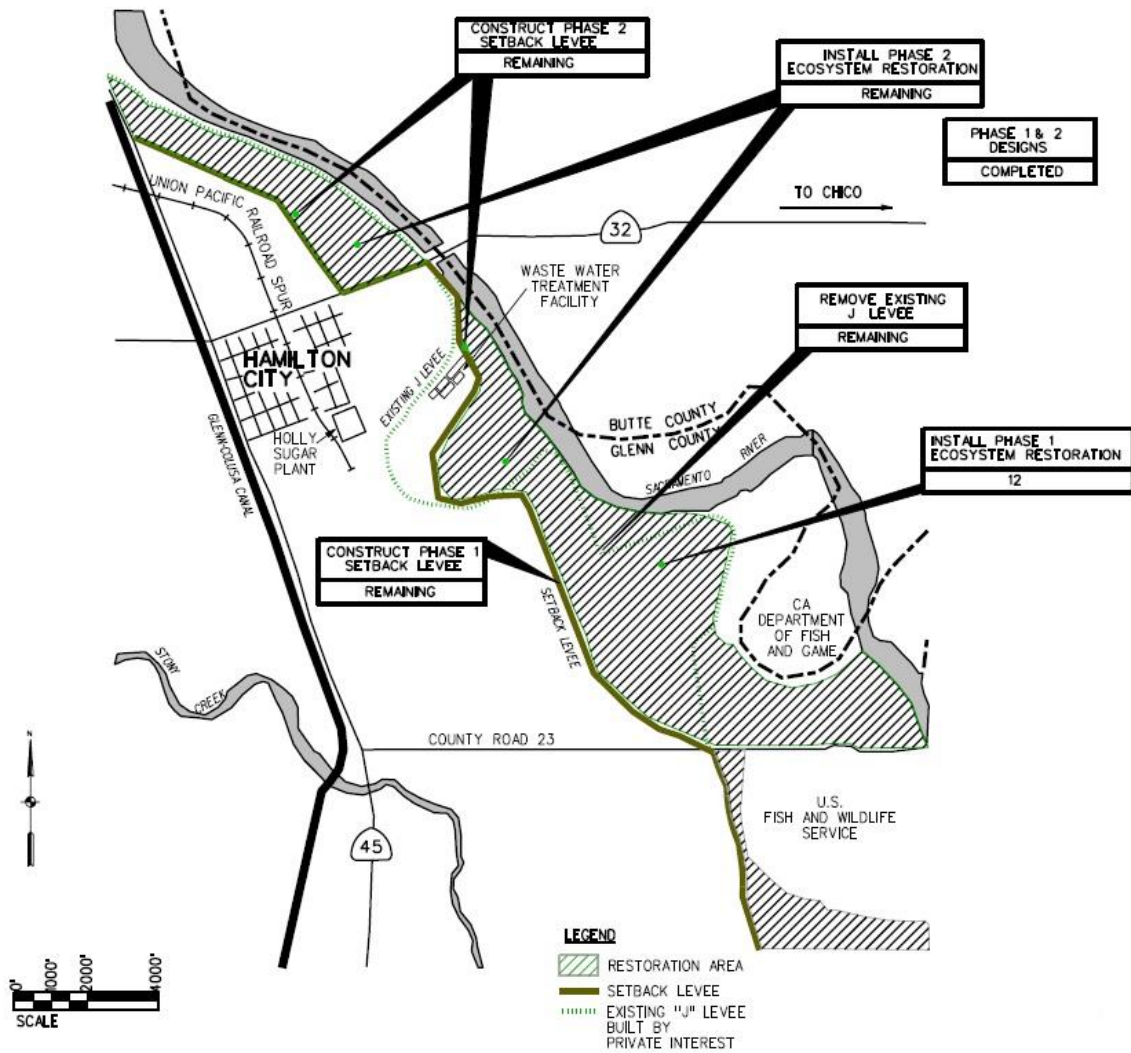


Figure 4.6-2: Aerial Photograph of “J” Levee along Sacramento River



Source: www.orovillemr.com/news

Unlike dam failure, levee breaches do have the potential to impact the City of Willows. The Glenn Colusa Canal was constructed through the City of Willows in the late 1800s and water began flowing in the canal in 1905 once construction was completed. The main canal is earth lined and is 64 miles long. It begins north of Hamilton City running south and ending, south of the city limits of City of Williams in Colusa County. Historical records have shown only minor seepage problems have occurred, which were repaired immediately with no impacts to the City of Willows. The canal has many safety benefits built into the design to include: safety dams, yearly maintenance and Glenn Colusa Irrigation District Emergency Response Plan. Safety dams are located at Walker Creek and Willow Creek and are manually controlled. Yearly maintenance procedures include rodent control, herbicide application to control weed growth and bank inspections performed continually along the main canal. There is no history of significant levee failure affecting the City of Willows.

4.7 Severe Weather

Severe weather is any destructive weather event, which has the potential to damage property or cause loss of life. Additionally, excessive localized precipitation over a short period of time may result in related flash floods threatening life and property. Severe weather is generally any destructive weather event, but usually occurs in Glenn County as localized storms that bring heavy rain, hail, lightning, and strong winds. A few instances of extreme heat have been recorded; however, winter storms are a major part of the severe weather hazard profile documented in this section.



4.7.1 Regulatory Environment

There are very few formal regulations that pertain to severe weather events in general.

4.7.2 Past Occurrences

Since 1950, 12 federally declared major severe weather events have occurred in Glenn County as shown in Table 4.7-1. These events include: one coastal storm (moved inland and resulted in flooding, landslides, and tornadoes), one severe freeze, and five severe storm events. According to Cal EMA Emergency and Disaster Proclamations Executive Orders (November 2003 to present), one severe storm event occurred in Glenn County in 2006 and one winter storm occurred in 2008 lasting for several days. Other weather-related disasters affecting Glenn County include flooding, heavy rains, and severe storms.

Table 4.7-1: Past Disaster Declarations, Proclamation and Other Recorded Events

| Past Disasters in Glenn County | | | | |
|--------------------------------|------------------|---------------|-----------------|---|
| Disaster Number | Declaration Date | Disaster Type | Incident Type | Explanation |
| Federal Declarations | | | | |
| 47 | 12/23/1955 | DR | Flood | Statewide Flooding |
| 82 | 4/4/1958 | DR | Flood | Heavy rains & Flooding |
| 145 | 2/26/1963 | DR | Flood | Flooding & Rainstorms |
| 183 | 12/24/1964 | DR | Flood | Heavy rains & Flooding |
| 283 | 1/27/1970 | DR | Flood | Heavy winds, storms, & Flooding |
| 677 | 2/9/1983 | DR | Coastal Storm | Coastal Storms, Floods, Slides, & Tornadoes |
| 758 | 2/21/1986 | DR | Flood | Severe Storms & Flooding |
| 894 | 2/11/1991 | DR | Snow | Severe Freeze |
| 1044 | 1/10/1995 | DR | Severe Storm(s) | Severe Winter Storms, Flooding, Landslides, & Mud Flows |
| 1046 | 3/12/1995 | DR | Severe Storm(s) | Severe Winter Storms, Flooding, Landslides, & Mud Flows |
| 1155 | 1/4/1997 | DR | Severe Storm(s) | Severe Winter Storms, Flooding, Landslides, & Mud Flows |
| 1203 | 2/9/1998 | DR | Severe Storm(s) | Severe Winter Storms & Flooding |

| Emergency Declarations | | | | |
|---|--------------------------|----|----------------|---|
| 3023 | 1/20/1977 | EM | Drought | Drought |
| 3248 | 9/13/2005 | EM | Hurricane | Hurricane Katrina Evacuation |
| Cal EMA Emergency and Disaster Proclamations / Executive Orders | | | | |
| | 5/10/2006 | | Severe Storms | Roadway Damage |
| | 1/5/2008 to 1/14/2008 | | Winter Storms | |
| | 2/27/2009 | | Drought | 3-year State-wide Drought |
| | 1/17/2014 | | Drought | State of Emergency Declaration |
| Other Disasters | | | | |
| | 11/21/1950 | | Flood | Statewide Floods |
| | 5/20/1957 | | Heavy Rains | State of Emergency for producing areas of Northern California |
| | 2/26/1958 | | Flood | Heavy rains & Flooding |
| | 9/18/1965 | | Wildfire | Major and Widespread Fires |
| | 2/1973 | | Storms/ Floods | |
| | 1973 | | Drought | Drought conditions declared for Glenn, San Benito, and Santa Clara Counties; \$8M agricultural loss |
| | 2/9/1976 | | Drought | 1976/1977 were two of the driest years in CA history. Most severe in northern 2/3 of CA. |
| | 3/5/1980 | | Severe Storms | Rain, Winds, Mudslides, & Flooding |
| | 10/26/1982 | | Severe Storms | Rains causing agricultural losses |

4.7.2.1 SHEL DUS Data

Data from the Spatial Hazards Events and Losses Database for the United States (SHEL DUS) was used to develop the **Error! Reference source not found.**¹³ SHEL DUS is a county-level data set for the United States that tracks 18 types of natural hazard events (or a combination of) along with associated property and crop losses, injuries, and fatalities for the period 1960-2010. Produced by the Hazards Research Lab at the University of South Carolina, this database combines information from several sources, including the National Climatic Data Center (NCDC). Only events that generated more than \$50,000 in damage were included in Table 4.7-2. For events that covered multiple counties, the dollar losses, deaths, and injuries were equally divided among the affected counties (e.g., if four counties were affected, then a quarter of the dollar losses, injuries, and deaths were attributed to each county). Events that were reported by the NCDC with a specific dollar amount are included in SHEL DUS.

Table 4.7-2: SHELUDS Severe Weather Hazard Data 1960-2005*

| Severe Weather Type | Count of Hazard Type | Fatalities | Injuries | Property Damage** | Crop Damage** |
|---|----------------------|-------------|--------------|---------------------|----------------------|
| Flooding | 8 | 2.22 | 6.54 | \$33,173,136 | \$1,575,308 |
| Flooding - Thunder Storm | 2 | 0 | 0 | \$452,309 | \$187,385 |
| Flooding - Thunder Storm - Wind | 1 | 0 | 0 | - | \$11,241,379 |
| Flooding - Winter Weather | 2 | 0 | 0 | \$32,121 | - |
| Hail | 2 | 0 | 0 | - | \$168,227 |
| Hail, Thunder Storm, Wind, Winter Weather | 1 | 0.03 | 0.02 | \$665 | - |
| Heat | 1 | 0.03 | 1.03 | - | - |
| Lightning | 4 | 0.57 | 7.29 | \$7,333,083 | - |
| Lightning – Severe Storm, Thunder Storm | 1 | 0 | 0 | \$1,377 | \$1,377 |
| Lightning - Wind - Winter Weather | 1 | 0 | 0.07 | \$9,153 | \$915 |
| Thunder Storm | 9 | 0.8 | 0.3 | \$5,653,594 | \$126,536 |
| Thunder Storm - Wind | 10 | 1.18 | 3.77 | \$2,181,618 | \$286,674 |
| Thunder Storm - Wind - Winter Weather | 3 | 0.03 | 0 | \$111,980 | \$60,127 |
| Thunder Storm - Winter Weather | 2 | 0 | 0 | \$27,266 | - |
| Tornado | 5 | 0 | 0 | \$605,086 | 422,319 |
| Wildfire | 1 | 0 | 0 | \$1,584,741 | - |
| Wind | 23 | 0.28 | 0.61 | \$2,938,327 | \$19,085 |
| Wind - Winter Weather | 2 | 0 | 0 | \$4,370 | \$0.24 |
| Winter Weather | 12 | 0.21 | 0.86 | \$522,192 | \$262,557,257 |
| Grand Total | 90 | 5.35 | 23.19 | \$54,631,018 | \$276,646,589 |

Source: SHELUDS, Hazards Research Lab, University of South Carolina, www.sheldus.org/

*Events may have occurred over multiple counties, so damage may represent only a fraction of the total event damage and may be not specific to Glenn County

**Property and Crop Damage are adjusted for 2015.

The NCDC and SHELUDS tables above summarize severe weather events that occurred in Glenn County. Only a few of the events actually resulted in state and federal disaster declarations. It is further interesting to note that different data sources capture different events during the same time period, and often display different information specific to the same events. While these inconsistencies are recognized, the value this data provides a direction in the County’s — “big picture” severe weather hazard environment.

4.7.2.2 National Climatic Data Center (NCDC) Events

In addition to the federally declared events in Glenn County, and SHELUDS, the National Oceanic and Atmospheric Administration’s NCDC has been tracking severe weather in Glenn County from 2006 through 2015. NCDCs Storm Events Database contains detailed data on several severe weather events for Glenn County. The information below summarizes the magnitude and severity of three of these events.

4.7.3 Location/Geographic Extent

Severe weather affects all areas of Glenn County as the particular hazard has no geographical boundaries. Throughout the unincorporated areas of the County, there are slight variations in the average amount of rainfall received due to terrain differences.

4.7.4 Magnitude/Extent

Glenn County experiences what climatologists classify as a Mediterranean type of climate. This climate regime is typified by nearly 90 percent of the annual precipitation occurring a relatively narrow window of about 16 weeks. The most severe storms occur during the late fall to early spring. The climate pattern can generate severe and prolonged periods of heavy rain. Glenn County experiences periods of heavy rains on an annual recurring basis. Some of these severe winter storms may also contain embedded thunderstorms. Thunderstorms are typically few in number and are more likely to appear in the spring or late fall.

Though difficult to capture magnitude and severity of severe storms in a generalized region, two data sources can be used to develop a general sense of the magnitude and severity of severe storms within Glenn County. Data from both SHELDUS and NCDC Storm Events Database can be used to develop the big picture regarding weather in Glenn County. Wind gusts of 50 to 60 mph have been reported in heavy rainstorms and gusts have reached 75 to 85 mph in the region. Freezing temperatures in the region have been known to cause snow storms and extremely high temperatures, 90 to 100 degrees Fahrenheit, for prolonged periods coupled with high winds can cause wildfires in the area. Average rainfall varies throughout different regions of the County, but the equivalent of 2 to 3 inches of rainfall in the northern Central Valley and 4 to 11 inches in the mountainous areas have been reported in heavy rainstorms and blizzards in higher elevations.

According to the hazard prioritization exercise discussed in Section 4.1, the potential for severe storms in Glenn County and the City of Orland is significant. For the City of Willows, it is ranked as high.

Event One: Blizzard

In January of 2008, a powerful Pacific storm brought widespread winds gusting to 60 mph and in some areas to more than 80 mph across interior Northern California, causing extensive damage and numerous power outages. Rainfall and liquid equivalent amounts ranged from 2 to 3 inches in the northern Central Valley and 4 to 11 inches in the mountains. Snowfall totals of 3 to 11 feet were reported in the northern Sierra Nevada Mountains, with winds up to and possibly exceeding 100 mph coupled with heavy snow bringing blizzard conditions. The snow level was down to near 3000 feet with one to two feet of snow falling at the higher elevations. Wind gusts reached 75 to 85 mph causing whiteout conditions for an extended period of time.

Event Two: Heavy Rain

In December of 2014, an atmospheric river event beginning early December 11th brought periods of heavy rainfall, flooding from overly saturated grounds and high river/stream water levels, and heavy snow above

7000 feet. Windy conditions persisted through the event, causing trees and tree branches to fall down and localized power outages affecting hundreds of thousands of homes across Northern California. Snowfall of one to two feet caused travel problems at Sierra passes. 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. Heavy rain caused closures on County Road 99W between County Roads 33 and 48, and portions of County Roads 33, 35, 48, as well as County Road D west of Willows.

Event Three: Extreme Heat/Wildfire

In July of 2014, a warming trend developed Friday, July 11th and into the weekend from a warm high pressure system building westward over California. This resulted in temperatures in the 90s to low 100s with dry weather. Weather conditions combined with very dry fuels allowed the ignited Bully Fire to grow rapidly over several days. The recent Bully Fire in nearby Shasta County began on the afternoon of July 11th as weather conditions were becoming drier and warmer. The fire was ignited by a vehicle driving over dry vegetation. Fires in this region, like the Bully Fire, frequently spread rapidly across County lines. By the time it was contained, the fire grew 12,661 acres, destroyed 20 structures, injured 21 people, and resulted in 1 death. The fire was estimated to have resulted in approximately 20 million dollars in damage and fire suppression efforts.

4.7.5 Frequency/Probability of Future Occurrences

Severe weather will continue to occur annually throughout Glenn County. The frequency and probability of future occurrences is highly likely (near 100 percent probability in the next year). Due to past existing weather patterns and global warming, increases in the probability of future occurrences of severe weather events in unincorporated areas of the County are anticipated.

Cities of Orland and Willows

Like the rest of Glenn County, the Cities of Orland and Willows are subject to a variety of winter or seasonal weather and storm hazards. Typical storms associated with the rainy season (late fall, winter, early spring) cause different issues depending on elevations. Severe enough weather to cause damage in the region can occur any time of the year, but usually occurs during the rainy season (which generally runs from mid-fall through spring).

Weather-related damage to properties and infrastructure varies depending on the nature of the storm. Intense localized rainfall causes localized flooding due to the lack the of storm-drain capacity to process and remove the water. Strong winds have damaged buildings roofs and caused other structural problems. Severe wind has brought down trees on top of buildings, power lines, or caused other significant property damage.

4.8 Wildfire

As defined in the California Fire Protection (CAL FIRE) 2010 Strategic Fire Plan, a wildfire event is an unwanted wildland fire including unauthorized human-caused fires, escaped wildfire use events, escaped prescribed wildfire projects, and all other wildfires.



Wildfire hazard is a significant and recurrent threat in Glenn County and has the potential to destroy buildings, cause damage to vital infrastructure, injure people, and can result in loss of life, agricultural land, and animals. As described in the 2015 Glenn County EOP, wildfires pose the greatest danger in the Western region of the County, which overlaps with the Mendocino National Forest. Wildfire season commences in early spring through late fall every year during the hotter, dryer months. Topography, weather, and vegetation provide the ingredients for destructive wildfires that can spread rapidly throughout the County. In Glenn County, development activities within wildfire hazard areas have exacerbated the risk by placing people into these areas. This action has disrupted natural wildfire processes, and allowed the buildup of flammable brush and vegetation. Such development has also moved the urban wildland interface (the area where human development meets undeveloped wildland) closer to higher-risk, wildfire hazard areas, increasing the number of people and buildings at risk as illustrated in Figure 4.8-1.

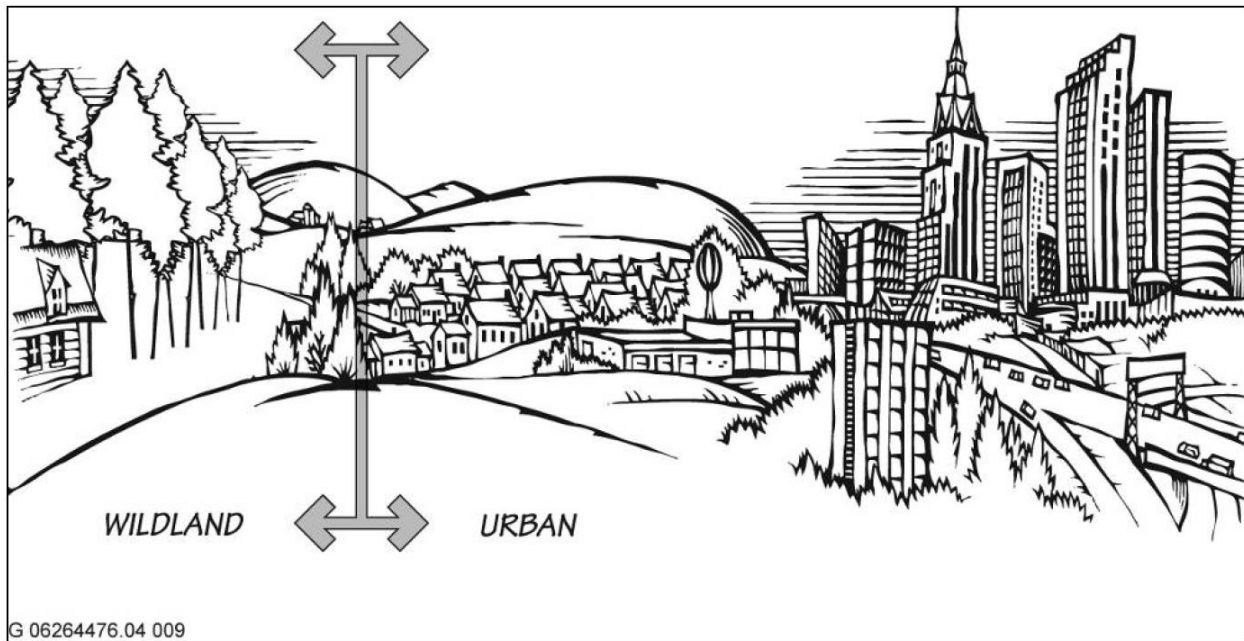


Figure 4.8-1: Urban Wildland Interface

4.8.1 Regulatory Environment

Wildfire regulatory requirements are mandated by the State of California and Glenn County. Wildfire State Responsibility Area (SRA) Fire Safe Regulations outline basic wildland fire protection standards for local jurisdictions. SRA Fire Safe Regulations (if acted on or policed) can decrease the risk of wildfire events in the wildland interface. SRA Fire Safe Regulations do not supersede local regulations, which equal or

exceed minimum state regulations. The State statute for wildfire protection is Public Resources Code, Section 4290. Requirements in the code include information on the following (CA Fire Alliance, 2009):

1. Road Standards for Fire Equipment Access
2. Standards for Signs Identifying Streets, Roads and Buildings
3. Minimum Private Water Supply Reserves for Emergency Fire Use
4. Fuel Breaks and Greenbelts

Glenn County building codes include elements of Public Code 4291. The City of Orland also has two policies pertaining to fire protection listed in the 2010 GP. Policy 4.3.A states that the City shall maintain current levels of fire protection by continuing to require development to provide and/or fund fire protection facilities, operations, and maintenance and Policy 4.3.B states that the City shall continue to support the needs of the Orland Volunteer Fire Department and shall provide assistance as necessary to maintain an efficient and functional fire service operation. Additionally, the City of Orland also has a volunteer fire department committed to assisting the people of the community in times of need. For the City of Willows, ordinance 17.44.100.D sets out requirements for fire hydrant flow amounts for commercial, industrial, residential, and public served water agency areas (Willows Fire Protection District, 2008).

The local County fire protection districts (Elk Creek, Bear Valley-Indian Valley, Orland Rural, Capay, Hamilton City, Willows Rural, Artois, Ord, Bayliss, Kanawha, Glenn-Codora, and Glenn-Colusa) have the authority for wildfire protection in the unincorporated areas of Glenn County. County Officials or Officers can alert the applicable fire protection district to the existence of flammable material or conditions on vacant or improved parcels. Fire protection districts have the responsibility to control hazardous conditions on private properties among other public safety duties, and may clear or order the clearing of land, including removal of dry grass, stubble, brush, rubbish, litter, or other flammable material.

4.8.2 Past Occurrences

Wildfire events are of major concern to Glenn County fire districts and residents. Since 2012, five wildfire events have occurred in Glenn County. These events range from 125 acres to more than 226 acres (CAL FIRE 2013). Of these documented occurrences, two were more than 200 acres. The first, known as the 306 wildfire (due to its proximity to County Road 306), occurred in May of 2013 and lasted for more than four days in steep and inaccessible terrain making access for fire-fighting equipment difficult. It burned property within two miles of the south side of the community of Elk Creek. The 306 wildfire required 221 firefighters, six fire engines, and 11 fire crews at its peak. No one was killed in the blaze and the cause of the fire remains under investigation (CAL FIRE 2013).

The second, known as the Daves wildfire, took place in June of 2013. 226 acres were burned in the eastern Mendocino National Forest and the fire burned within 15 miles of the northwest portion of Elk Creek (CAL FIRE 2013). Other recent significant wildfire occurrences in Glenn County are listed in [Table 4.8-1](#) as well as the numbers of acres burned for each recorded wildfire event in Glenn County. Of note from the region's fire history shown in [Figure 4.8-1](#), the majority of fires in the Glenn County region occur in the

areas of the County located west of I-5 – in and adjacent to Mendocino National Forest and in the areas with larger amounts of vegetation and greater slopes. Table 4.8-2 shows the number of fire events and acres burned by decade in Glenn County.

Table 4.8-1: Glenn County Recent Wildfire Occurrences

| Year | Fire Name | Date/Time | Acres Impacted |
|------|--------------------|-----------------|-----------------|
| 2012 | THUNDER | July 7/12:13PM | 167 |
| | ELK | August 29/4:40 | 125 |
| 2013 | 306 | May 1/7:00PM | 217 |
| | LIGHTNING ACTIVITY | June 10/12:46AM | 60+ small fires |
| | DAVES | June 12/3:17PM | 226 |

Source: California Department of Forestry and Fire Protection (2013)

Figure 4.8-1: Fire History

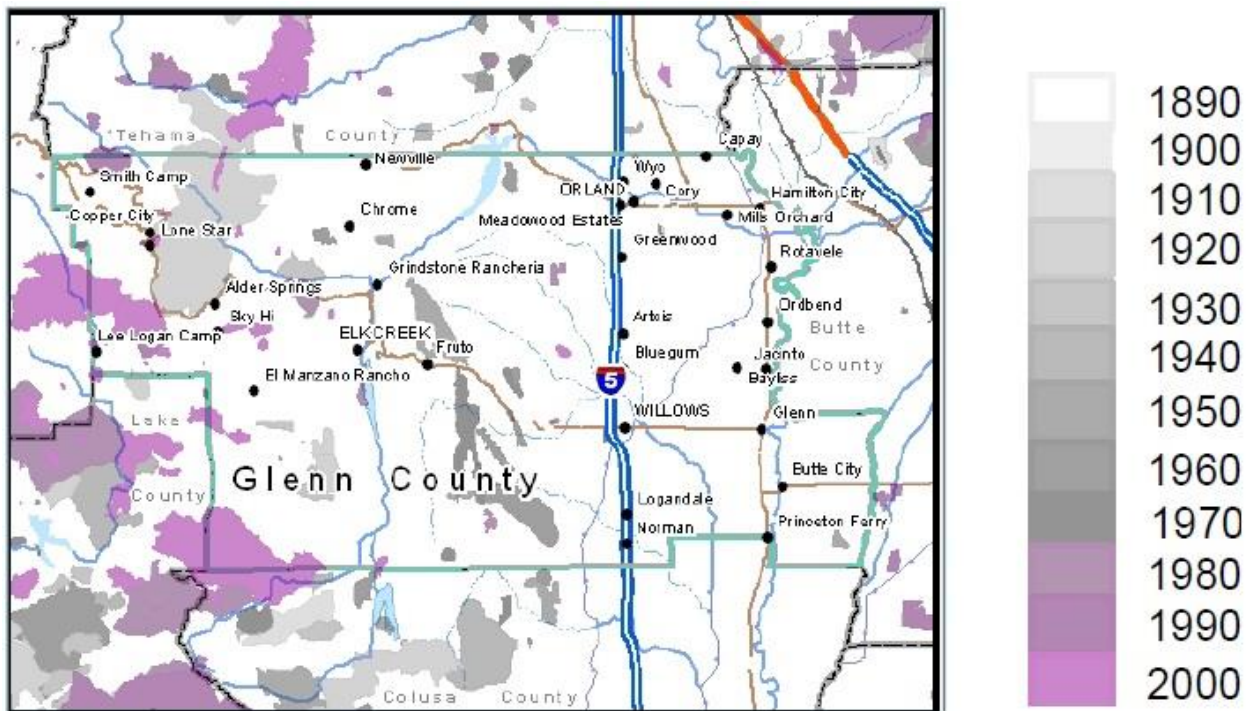


Table 4.8-2: Glenn County Historic Fire Acreages by Decade

| Decade | 1900 | 1920 | 1930 | 1940 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | Total |
|--------------------|------|--------|--------|--------|--------|-------|---------|--------|--------|--------|----------------|
| No. of Fire Events | 1 | 7 | 12 | 32 | 18 | 12 | 8 | 11 | 17 | 14 | 132 |
| No. of Acres | 948 | 59,518 | 61,254 | 59,914 | 13,234 | 5,758 | 103,188 | 12,023 | 12,892 | 10,844 | 339,213 |

Source: California Department of Forestry and Fire Protection (2013)

4.8.3 Location/Geographic Extent

Using information from the California Department of Forestry and CAL FIRE, the wildfire hazard map in Appendix C illustrates the areas at risk to a wildfire event. The areas with the highest risk of wildfire are in the western portions of Glenn County. The western portion of Glenn County contains an eastern section of the Mendocino National Forest. This encompasses Smith Camp, Copper City, Lone Star, Alder Springs, Sky Hi, Lee Logan Camp, and El Manzano Rancho – all of which are designated as very high-risk fire areas (Glenn County CWPP, 2011). The Elk Creek region of the County (west-central portion) is home to Newville, Chrome, Grindstone Rancheria, and Fruto. These areas are primarily designated as high-risk. The eastern, more developed valley portion of the County (home to Willows, Orland, Hamilton City, and other small cities) is mainly designated non-fuel, the lowest level of fire threat.

4.8.4 Magnitude/Extent

CAL FIRE adopted Fire Hazard Severity Zone maps for SRA in November 2007. Fire Hazard mapping is a way to measure the physical fire behavior to predict the damage a fire is likely to cause. Fire hazard measurement includes vegetative fuels, probability of speed at which a wildfire moves the amount of heat the fire produces, and most importantly, the burning fire brands (burning wood or debris) that the fire sends ahead of the flaming front.

Fire severity also depends on topography, especially the steepness of the slopes (fires burn faster as they burn up-slope.). Weather (temperature, humidity, and wind) also has a significant influence on fire behavior. As a result, vast areas in the SRAs shown in the Fire Hazard Map are rated as high, very high and extreme fire hazard in the unincorporated areas of the County. The areas depicted as high, very high and extreme in the fire hazard map in Appendix C are of particular concern.

4.8.5 Frequency/Probability of Future Occurrences

Potential fire risk in areas of Glenn County and surrounding regions are constantly increasing as human development and the wildland urban interface areas expand. There have been many notable wildfire occurrences affecting Glenn County, and structure fires in the Cities of Orland and Willows in recent decades. The fire hazard map in Appendix C indicates that more than half of the County is located within moderate, high, and very high risk fire zones. Wildfire is ranked as a significant hazard according to the hazard prioritization results detailed in Section 4.1.

Cities of Orland and Willows

Three types of fires have the potential for resulting in major losses in and around the Cities of Orland and Willows. These include fire or explosion at one of the local agricultural processing plants, major operational failure of the rail service or interstate that pass through Orland, and urban conflagration (multiple simultaneous structural fires). The most likely fire threat in Orland would be a structural fire within a residence or small business. An area of Arundo and/or Tamarisk poses a potential fire hazard risk associated with the rural/urban interface between the City and surrounding open spaces. This was identified through discussions with MJHMP Steering Committee members and area depicted in the wildfire hazard map in Appendix C. The threat of wildland fire is considered to be minimal within the City based on land uses, however, areas adjacent to the Arundo and/or Tamarisk have higher hazard potential, surrounding the City. Fire protection services within Orland are provided by the Orland Volunteer Fire Department. The City Department has a mutual aid agreement with the Orland Rural Fire District which is a separate special district that provides fire protection services to greater Orland's surrounding, unincorporated county area. Both of these fire protection services are staffed by volunteers.

The City of Willows has 1,815 acres in its planning area of which 220 acres are undeveloped around the outskirts of the City and, therefore, more susceptible to wildfire. Through Willows' history, there have been four major fires, which have brought a beginning to the Willows Fire Department, and changed the city entirely. On May 30, 1882 the most destructive fire occurred in Willows' history, which nearly destroyed out the entire downtown at that time. Thirty-three buildings were lost in the fire, most of them being thriving businesses, with an estimated loss of \$200,000 (est. \$4.5 million current). In 1887 the Willows Fire Department was established with two hose companies. Each company was supplied with carts holding various fire equipment, including axes, ladders, nozzles and hose. The Willows Fire Department has grown from the bucket brigade and hose companies, to having a combined nine apparatuses between the rural and city departments. There is a total of five paid staff, which includes the Chief, a Captain, and three Engineers.

4.9 Vulnerability Assessment

The vulnerability assessment provides an explicit representation of what a community stands to lose in a disaster. This is useful for County and Cities' staff and other decision makers who will need to balance the costs of mitigation against the potential harm to residents and damage to property. It provides comparable measurements of community natural hazard exposure¹ and assists in determining which hazards and/or what areas of the County and Cities to focus on making resilient to disaster first. Based upon possible assets at risk, hazard mitigation resources can be directed where need be, in-part, by a vulnerability assessment and information found in hazard profiles presented in Sections 4.2 to 4.8.

The vulnerability assessment is developed by providing hazard mitigation analysts with quantitative and qualitative information for each hazard. Through an exposure analysis, quantitative data is developed for each hazard. An exposure analysis provides quantities of assets at risk to particular hazards. Qualitative data has been developed and presented in this section for hazards without measurable data. Qualitative data provides information beyond quantities of assets at risk, but rather a description of how the hazard could affect the region.

The hazard exposure analysis has been developed with best available data and follows methodology described in the FEMA How to Guide #2 (Publication No. 386-2) "Understanding Your Risks—Identifying Hazards and Estimating Losses."

4.9.1 Methodology

A vulnerability assessment was conducted for each of the hazards profiled in Sections 4.2 to 4.8. Geospatial data is essential in determining 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 Glenn County, dam failure; flood; geologic hazards, including earthquake, expansive soil, and subsidence; levee failure; and wildfire have known geographic extents and corresponding spatial information about each hazard.

Several sources of data are necessary to conduct a vulnerability analysis. County and Cities' asset data was used to provide a snapshot of how County and Cities assets are affected by natural hazards. For purposes of this study, asset data includes critical infrastructure within the County and Cities' 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. The MJHMP Project Team compiled a list of the critical facilities data was developed from a variety of sources including County and Cities-owned and maintained data, state and federal government datasets, and private industry datasets. The MJHMP Steering Committee reviewed this list and provided input and feedback. The final list includes 112 community assets and critical facilities, as shown in Tables Table 4.9-1 through Table 4.9-5.

¹ Elements at risk; Risk inventory; Exposure encompasses all elements, processes, and subjects that might be affected by a hazardous event. Consequently, exposure is the presence of social, economic, environmental or cultural assets in areas that may be impacted by a hazard.

A critical infrastructure spatial database was developed to translate critical facilities information into geo-referenced² points. Critical facility points are overlaid with the spatial hazard layers to develop a list of “at risk” critical facilities. The County and City critical facilities that intersect with natural hazards are referred to facilities with hazard “exposure”. Exposure results are presented later in this section.

The vulnerability and potential impacts from profiled hazards that do not have specific mapped areas nor the data to support additional vulnerability analyses are discussed in more general terms.

Table 4.9-1: County/City Government Critical Facilities Located in the Unincorporated Glenn County, and the Cities of Orland and Willows

| County/City Government Critical Facilities in the City of Orland (16) | County/City Government Critical Facilities in the City of Willows (14) | County Facilities in Unincorporated Glenn County (5) |
|--|--|---|
| Glenn County Superior Court Road Division Community Recovery Wellness Center Orland Veterans' Memorial Hall Transition Age Youth Center Harmony House Glenn County Health Service Agency (WIC) Recreation Department Orland Library Orland City Hall Carnegie Community Center Transitional Age Youth (Dept of Beh. Health) Glenn County Sheriff's Posse Spence Park Library Park Lely Park | Health and Human Services Agency Assessor - Department of Finance County Court District Attorney Child Support Service Facilities Shop Civic Memorial Building Adult & Juvenile Probation Services County Jail City of Willows Civic Center Museum Jensen Park Sycamore Park Central Park | Glenn County Agricultural Commissioner Planning and Public Works Agency Fleet Services Road Department Glenn County Sheriff's Posse |

² 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.

Table 4.9-2: Educational Facilities in Glenn County

| Educational Facilities in Glenn County, including the Cities of Orland and Willows (33) | |
|--|---|
| Orland Unified School District | Willows Intermediate School |
| North Valley High School | Willows Community High School |
| Fairview Elementary School | Butte College |
| Price Intermediate School | Glenn County Office of Education |
| Orland Community Day School | Princeton Elementary School |
| Mill Street School | Elk Creek Elementary School |
| Capay Joint Union Elementary School | Learning Center South |
| Hamilton Elementary School | Walden Academy |
| Hamilton High School | Hamilton State Preschool |
| Hamilton Community Day School | Hamilton Adult School |
| Lake District School | Ella Barkley High School |
| Plaza Elementary School | North Valley High (Continuation) |
| Elk Creek High School | Success One! Charter School/Glenn Adult Program |
| Office of Education | River Valley Christian School |
| Princeton High School | North Valley Christian Schools |
| Murdock Elementary School | William Finch Charter School |
| Willows High School | |

Table 4.9-3: Medical Facilities in Glenn County

| Medical Facilities in Glenn County (9) |
|---|
| Glenn Medical Center |
| Ampla Health Orland |
| Glenn Medical Center-Family Care Clinic |
| Glenn Family Medical Group |
| Willows Care Center |
| Northern Valley Indian Health |
| Westside Ambulance |
| West Haven Assisted Living |
| Ampla Health Hamilton |

Table 4.9-4: Fire and Police Department Facilities in Glenn County

| Fire and Police Department Facilities in Glenn County (15) | |
|---|---------------------------|
| Ord Fire Department | Willows Police Department |
| Willows Fire Department | Orland Police Department |
| Hamilton Fire Department | Sheriff's Department |
| Glenn-Colusa Fire Department | |
| Glenn-Codora Fire Department | |
| Elk Creek Fire Department | |
| Artois Fire Fire Department | |
| Orland Fire Department | |
| Capay Fire Department | |
| Bayliss Fire Department | |
| Kanawha Fire Department | |
| Elk Creek Fire Station Cal Fire | |

Table 4.9-5: Other Critical Facilities/Infrastructure in Glenn County

| | |
|--------------------------------------|--|
| Airports (2) | Willows Glenn County Airport Orland Haigh Field Airport |
| Hazardous Materials Sites (7) | Wilbur Ellis Company 1 Wilbur Ellis Company 2 Simplot Growers Solutions Gandy-Staley Oil Co Burrows Oil Company Orland Cleaners (State Response) (Hazardous Waste and Substances Site) Helena Chemical Company |
| Cell Towers (7) | Chrome Hamilton City Butte City Orland Willows Princeton Elk Creek |
| Dams (1) | Stony Gorge |
| Other Infrastructure (3) | Willows Waste Water Treatment Plant Orland Waste Water Treatment Plant Hamilton City Waste Water Treatment Plant |

4.9.2 Hazard Specific Vulnerability

FEMA Disaster Mitigation Act regulations require that the Glenn County and the Cities of Orland and Willows evaluate the risks associated with each of the hazards identified in the hazard mitigation planning process. This section summarizes the possible impacts and quantifies, where data permits, the County and Cities' vulnerability to each of the priority hazards identified in Sections 4.2 to 4.8. Estimated community vulnerability from each hazard is provided in each hazard-specific section that follows.

Vulnerability can be quantified in instances where there is a known hazard area, such as a mapped floodplain or high fire hazard area. The MJHMP Steering Committee identified five hazards in the planning area for which specific geographical hazard areas have been defined and for which sufficient data exists to support a vulnerability analysis: dam failure; flood; geologic hazards, including earthquake, expansive soil, and subsidence; levee failure; and wildfire. Hazards with spatial extents have discrete hazard risk areas; their risk varies and will affect people and assets differently. For hazards with spatial extents, assets were inventoried by hazard area. To the extent possible, assets are quantified to define vulnerability in identified hazard areas. Results of the vulnerability assessment of the community assets and critical infrastructure in Glenn County and the Cities of Orland and Willows overlaid with the geographical hazard boundaries are shown in Table 4.9-6.

The vulnerability analysis includes general hazard-related impacts, overall community impact, and assets and critical facilities at risk. Together, this information conveys the vulnerability of particular assets. In addition, it allows hazard mitigation planning to prioritize resources accordingly.

Table 4.9-6: Vulnerability Assessment Results for Community Assets and Critical Facilities in Glenn County

| Facility Category | Facility Name | Hazard Vulnerability | | | | | | | | |
|--|--|---------------------------|------------------------------|--|----------------------|----------------------------|------------------------------------|------------------------------------|--------------------------------|--------------------|
| | | Wildfire Hazard | Flood Hazard | | Geologic Hazards | | | Dam Failure Hazard | Levee Failure Hazard | |
| | | Fire Hazard Severity Zone | Flood Zone | Flood Zone Description | Earthquake Intensity | Expansive Soils | Land Subsidence | Located Within Inundation Zone | Within Area Protected by Levee | Within Leveed Area |
| County/City Facilities in the City of Willows | Health and Human Services Agency | Urban Unzoned | AH | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Assessor - Department of Finance | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | County Court | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | District Attorney | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Child Support Service | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Facilities Shop | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Civic Memorial Building | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Adult & Juvenile Probation Services | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | County Jail | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | City of Willows Civic Center | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Museum | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Jensen Park | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Sycamore Park | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| Central Park | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | | |
| County/City Facilities in the City of Orland | Glenn County Superior Court | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Road Division | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Community Recovery Wellness Center | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Orland Veterans' Memorial Hall | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Transition Age Youth Center | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Harmony House | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Glenn County Health Service Agency (WIC) | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Recreation Department | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Orland Library | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Orland City Hall | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Carnegie Community Center | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Transitional Age Youth (Dept of Beh. Health) | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Spence Park | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Library Park | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| Lely Park | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | | |
| County Facilities in Unincorporated Glenn County | Glenn County Agricultural Commissioner | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | Moderate (3 - 6) | High | | | |
| | Planning & Public Works Agency | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | Moderate (3 - 6) | High | | | |
| | Fleet Services | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | Moderate (3 - 6) | High | | | |
| | Road Department | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | Moderate (3 - 6) | High | | | |
| | Glenn County Sheriff's Posse | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | | | |

Table 4.9-6: Vulnerability Assessment Results for Community Assets and Critical Facilities in Glenn County

| Facility Category | Facility Name | Hazard Vulnerability | | | | | | | | |
|--------------------------------|---|---------------------------|--|------------------------------------|----------------------|----------------------------|------------------------------------|------------------------------------|--|--|
| | | Wildfire Hazard | Flood Hazard | | Geologic Hazards | | | Dam Failure Hazard | Levee Failure Hazard | |
| | | Fire Hazard Severity Zone | Flood Zone | Flood Zone Description | Earthquake Intensity | Expansive Soils | Land Subsidence | Located Within Inundation Zone | Within Area Protected by Levee | Within Leveed Area |
| Educational Facilities | Orland Unified School District | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | North Valley High School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Fairview Elementary School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Price Intermediate School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Orland Community Day School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Mill Street School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Capay Joint Union Elementary School | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | | | |
| | Hamilton Elementary School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | Hamilton High School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | Hamilton Community Day School | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | Lake District School | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | Plaza Elementary School | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Elk Creek High School | Very High | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | Low (0 - 3) | Data not available | Within Dam Failure Inundation Area | | |
| | Office of Education | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Princeton High School | | | | | | High | | Within area protected by a Levee | Within Leveed Area determined by USACE |
| | Murdock Elementary School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Willows High School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Willows Intermediate School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Willows Community High School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Butte College | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Glenn County Office of Education | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Princeton Elementary School | | | | | | High | | Within area protected by a Levee | Within Leveed Area determined by USACE |
| | Elk Creek Elementary School | High | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Moderate (3 - 6) | | | | |
| | Learning Center South | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Walden Academy | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Hamilton State Preschool | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | Hamilton Adult School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | Ella Barkley Highschool | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | North Valley High (Continuation) | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Success One! Charter School/Glenn Adult Program | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| River Valley Christian School | Non-Wildland/Non-Urban | A | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | Within area protected by a Levee | Within Leveed Area determined by USACE | |
| North Valley Christian Schools | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | | |
| William Finch Charter School | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | | |
| Medical Facilities | Glenn Medical Center | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Ampla Health Orland | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Glenn Medical Center-Family Care Clinic | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Glenn Family Medical Group | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Willows Care Center | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Northern Valley Indian Health | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Westside Ambulance | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | West Haven Assisted Living | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Ampla Health Hamilton | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |

Table 4.9-6: Vulnerability Assessment Results for Community Assets and Critical Facilities in Glenn County

| Facility Category | Facility Name | Hazard Vulnerability | | | | | | | | |
|---------------------------------|--|---------------------------|------------------------------|--|----------------------|----------------------------|--------------------|------------------------------------|----------------------------------|--|
| | | Wildfire Hazard | Flood Hazard | | Geologic Hazards | | | Dam Failure Hazard | Levee Failure Hazard | |
| | | Fire Hazard Severity Zone | Flood Zone | Flood Zone Description | Earthquake Intensity | Expansive Soils | Land Subsidence | Located Within Inundation Zone | Within Area Protected by Levee | Within Leveed Area |
| Fire Department Facilities | Ord Fire Department | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Willows Fire Department | Urban Unzoned | AH | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Hamilton Fire Department | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |
| | Glenn-Colusa Fire Department | Moderate | A | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Moderate (3 - 6) | High | Within Dam Failure Inundation Area | Within area protected by a Levee | Within Leveed Area determined by USACE |
| | Glenn-Codora Fire Department | Non-Wildland/Non-Urban | A | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Moderate (3 - 6) | High | Within Dam Failure Inundation Area | Within area protected by a Levee | Within Leveed Area determined by USACE |
| | Elk Creek Fire Department | Very High | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | Low (0 - 3) | Data not available | Within Dam Failure Inundation Area | | |
| | Artois Fire Fire Department | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Moderate (3 - 6) | High | | | |
| | Orland Fire Department | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Capay Fire Department | | | | | | Low to Medium | | | |
| | Bayliss Fire Department | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | High (6 - 9) | High | Within Dam Failure Inundation Area | | Within Leveed Area determined by USACE |
| | Kanawha Fire Department | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | Low (0 - 3) | High | | | |
| Elk Creek Fire Station Cal Fire | Very High | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | Moderate (3 - 6) | | | | | |
| Police Department Facilities | Willows Police Department | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Orland Police Department | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Sheriff's Department | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| Airports | Willows Glenn County Airport | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Orland Haigh Field Airport | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| Hazardous Materials Sites | Wilbur Ellis Company 1 | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Wilbur Ellis Company 2 | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Moderate (3 - 6) | High | Within Dam Failure Inundation Area | | Within Leveed Area determined by USACE |
| | Simplot Growers Solutions | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Gandy-Staley Oil Co | Urban Unzoned | AH | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Burrows Oil Company | Urban Unzoned | X | 0.2 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | Moderate (3 - 6) | High | | | |
| | Orland Cleaners (State Response) (Hazardous Waste and Substances Site) | Urban Unzoned | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Not rated or not available | High | Within Dam Failure Inundation Area | | |
| | Helena Chemical Company | Non-Wildland/Non-Urban | A | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Moderate (3 - 6) | High | Within Dam Failure Inundation Area | Within area protected by a Levee | Within Leveed Area determined by USACE |
| Cell Towers | Chrome | Very High | D | | VI (Strong) | Moderate (3 - 6) | | | | |
| | Hamilton City | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Butte City | Non-Wildland/Non-Urban | A | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Moderate (3 - 6) | Low to Medium | Within Dam Failure Inundation Area | | Within Leveed Area determined by USACE |
| | Orland | Moderate | X | AREA OF MINIMAL FLOOD HAZARD | V (Moderate) | Low (0 - 3) | | | | |
| | Willows | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | High (6 - 9) | High | | | |
| | Princeton | | | | | | High | | Within area protected by a Levee | Within Leveed Area determined by USACE |
| Dams | Elk Creek | Very High | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | Low (0 - 3) | | | | |
| | Stony Gorge | Moderate | A | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | VI (Strong) | Not rated or not available | | | | |
| Other Critical Infrastructure | Willows Waste Water Treatment Plant | Non-Wildland/Non-Urban | X | AREA OF MINIMAL FLOOD HAZARD | VI (Strong) | Not rated or not available | High | | | |
| | Orland Waste Water Treatment Plant | Non-Wildland/Non-Urban | | | V (Moderate) | Low (0 - 3) | High | Within Dam Failure Inundation Area | | |
| | Hamilton City Waste Water Treatment Plan | Non-Wildland/Non-Urban | A | SPECIAL FLOOD HAZARD AREA/1 PCT ANNUAL CHANCE FLOOD HAZARD | V (Moderate) | Low (0 - 3) | Low to Medium | Within Dam Failure Inundation Area | | |

This page is intentionally left blank.

4.9.2.1 Dam Failure

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 for the Black Butte Dam were used to identify at-risk critical County/Cities assets and critical facilities. Of the total 112 community assets/critical facilities, 57 facilities are located within the dam inundation area and would be impacted by a failure of the Black Butte Dam, as shown in Table 4.9-7.

Table 4.9-7: Dam Failure Hazard Vulnerability Assessment Summary

| Facility Category | Number Located Within the Dam Inundation Zone |
|--|---|
| County/City Facilities in the City of Willows | 0 |
| County/City Facilities in the City of Orland | 15 |
| County Facilities in Unincorporated Glenn County | 0 |
| Educational Facilities | 21 |
| Medical Facilities | 4 |
| Fire Department Facilities | 7 |
| Police Department Facilities | 1 |
| Airports | 1 |
| Hazardous Materials Sites | 4 |
| Cell Towers | 2 |
| Dams | 0 |
| Other Critical Infrastructure | 2 |
| TOTAL | 57 |

The most vulnerable properties are those closest to the downstream side of the dam as they would experience the largest, most destructive surge of water.

The most significant issue associated with dam failure involves the properties and populations in the inundation zones. Flooding as a result of a dam failure would significantly impact these areas. There is often limited warning time for dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard. Important issues associated with dam failure include the following:

- Federally-regulated dams have an adequate level of oversight and sophistication in the development of emergency action plans for public notification in the unlikely event of failure; however, the protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.
- Mapping for federally-regulated dams is already required and available; however, mapping for non-federal-regulated dams that estimates inundation depths is needed to better assess the risk associated with dam failure from these facilities.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. Mapping of dam failure scenarios for non-federally-regulated dams that are less extreme than the probable maximum flood, but have a higher probability of occurrence, can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness actions.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.

Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.

4.9.2.2 Drought

Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected) and the demand humans place on the water supply.

Due to the lack of defined geographical boundaries, the vulnerability assessment for drought differs from other natural hazards discussed earlier. The impacts of drought can be categorized as economic, environmental, or social. The incidence of forest and range fires increases substantially during extended droughts, which in turn places humans and critical facilities at higher levels of risk.

Drought vulnerability is primarily measured by its potential impact to sectors of the County's economy and natural resources. The County's agricultural economic sector is reliant on the availability of water. In

the event of continued drought in which water availability for agriculture may become extremely limited, the County's agricultural economy would be severely impacted, resulting in losses in production. In 2014, the County's total agricultural production was valued at \$825 million (Glenn County Agricultural Commissioner's Office, 2014).

Other potential impacts to the economy include the following:

- Decreased municipal and industrial water supply;
- Loss of recreation/tourism.

Direct costs such as increased pumping due to lowering of groundwater levels and costs to expand water infrastructure to compensate for reduced yields or to develop alternative water sources are a significant factor. Social impacts mainly involve public safety, health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief.

4.9.2.3 Flooding

As described in the flood hazard profile, flooding and stormwater management is a substantial problem in Glenn County. Vulnerability to flooding is primarily during the winter months when drainage systems are overwhelmed and soil is saturated from heavy rainfall. During the winter rains, storm drainage and flood control devices have difficulty moving water away from structures and roadways. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage to property. In residential areas, flooding in low-lying areas is a persistent problem due to the lack of flood control structures. Flooding occurs on a continual basis throughout the County both within the FEMA identified 100-year floodplain (1 percent annual chance of flooding) and in other localized areas.

To determine the possible vulnerability to flood damage, GIS was used to estimate the possible impact across the County and in the Cities. FEMA regulatory Digital Flood Insurance Rate Map (DIFRM) data along with the County and Cities asset data was utilized to quantify possible losses as a result of flooding. The information in this section describes flood vulnerability methodologies for determining community assets and critical facilities at risk of flooding due to their location within the 100- and 500-year flood zones.

Table 4.9-8 provides a summary of the flood vulnerability of the community assets and critical facilities in Glenn County.

Table 4.9-8: Flood Vulnerability Assessment Summary

| Facility Category | Number Located in the Special Flood Hazard Area (100-year Flood Zone) | Number Located in the 0.2 Percent Annual Chance Flood Hazard Area (500-year Flood Zone) | Number Located in an Area of Minimal Flood Hazard |
|--|---|---|---|
| County/City Facilities in the City of Willows | 1 | 3 | 10 |
| County/City Facilities in the City of Orland | 0 | 0 | 15 |
| County Facilities in Unincorporated Glenn County | 0 | 4 | 1 |
| Educational Facilities | 1 | 2 | 28 |
| Medical Facilities | 0 | 2 | 7 |
| Fire Department Facilities | 3 | 2 | 6 |
| Police Department Facilities | 0 | 1 | 2 |
| Airports | 0 | 1 | 1 |
| Hazardous Materials Sites | 2 | 1 | 4 |
| Cell Towers | 1 | 0 | 4 |
| Dams | 1 | 0 | 0 |
| Other Critical Infrastructure | 1 | 0 | 1 |
| TOTAL | 10 | 16 | 79 |

Community assets and critical facilities information was used in a spatial overlay analysis to determine the type and number of facilities within the 100- and 500-year floodplain. Flooding poses numerous risks to critical facilities and 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.
- Bridges washed out or blocked by floods or debris from floods also can cause isolation.
- Creek or river floodwaters can back up drainage systems causing localized flooding.
- Floodwaters can get into drinking water supplies causing contamination.
- Sewer systems can be backed up causing waste to spill into homes, neighborhoods, rivers and streams.
- Underground utilities can also be damaged.

4.9.2.4 Geologic Hazards

Geologic hazards in the Glenn County MJHMP include earthquakes, expansive soils, and land subsidence. Vulnerability to geologic hazards is a function of location, type of human activity, use, and frequency of events. The effects of geologic hazards on people and structures can be lessened by total avoidance of susceptible hazard areas or by restricting, prohibiting, or imposing conditions on hazard-zone activity. Glenn County and the Cities of Orland and Willows can reduce the impacts of geologic hazards through land-use policies and regulations. County/City residents can reduce their exposure to hazards by educating themselves on the past hazard history of a site and by making inquiries to planning and engineering departments of their local government.

The following discussions provide more specific information on the vulnerabilities in Glenn County and the Cities of Orland and Willows to these specific hazards.

4.9.2.4.1 Earthquakes

Major impacts from earthquakes are primarily the probable number of casualties and damage to infrastructure occurring from ground movement along a particular fault (USGS 2009). The degree of infrastructure damage depends on the magnitude, focal depth, distance from fault, duration of shaking, type of surface deposits, presence of high groundwater, topography, and the design, type, and quality of infrastructure construction.

Glenn County is not located within an Alquist-Priolo Earthquake Fault Zone. While there are no known major active faults residing within or near the County limits, seismic-related events (i.e., groundshaking, etc.) may occur and can potentially impact County residents and property. Seismic hazard mapping indicates that the County has low seismic hazard potential. To analyze the seismic risk in Glenn County, USGS shake maps³ and Probabilistic Seismic Hazards Maps were used in an overlay method. Exposure results for community assets and critical facilities were developed to provide a tool for planners to describe community vulnerability. Almost all of the 112 community assets and critical facilities fell within

³ One USGS shake map was used to develop the potential damage spatial layers. Shake maps from USGS replicated a 5.37 Magnitude event on November 26th, 1998. From this event GIS analysts used Peak Spectral Acceleration (PSA) and Peak Ground Velocity (PVG) from those events to provide potential damage estimates based on building type and local soil conditions.

either a moderate or a strong earthquake intensity zone. Table 4.9-9 provides a summary of the flood vulnerability of the community assets and critical facilities in Glenn County.

Table 4.9-9: Earthquake Vulnerability Assessment Summary

| Facility Category | Number Located in Strong Earthquake Intensity Zone | Number Located in Moderate Earthquake Intensity Zone |
|--|--|--|
| County/City Facilities in the City of Willows | 14 | 0 |
| County/City Facilities in the City of Orland | 15 | 0 |
| County Facilities in Unincorporated Glenn County | 4 | 1 |
| Educational Facilities | 9 | 22 |
| Medical Facilities | 5 | 4 |
| Fire Department Facilities | 4 | 7 |
| Police Department Facilities | 2 | 1 |
| Airports | 1 | 1 |
| Hazardous Materials Sites | 3 | 4 |
| Cell Towers | 3 | 3 |
| Dams | 1 | 0 |
| Other Critical Infrastructure | 1 | 2 |
| TOTAL | 62 | 45 |

Critical facilities data was spatially overlaid with earthquake hazard data to determine the type and number of facilities vulnerable to earthquake hazard classifications. Earthquakes pose numerous risks to critical facilities and infrastructure. Seismic risks, or the harm 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.

The impact to the community could be great if these critical facilities were damaged or destroyed during a large earthquake event. Earthquake events can significantly impact roads, overpasses, and bridges 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. Since most of the County's bridges provide access across water courses, most are at least somewhat vulnerable to earthquakes. Key factors in the degree of vulnerability are the bridge's age and type of construction which indicate the standards to which the bridge was built.

Linear utilities and transportation infrastructure would likely suffer considerable damage in the event of a very strong earthquake. During these events major water and waste water lines running through the the County and the Cities of Orland and Willows may be damaged. Due to the amount of infrastructure and sensitivity of utility data, linear utilities are difficult to analyze without further investigation of individual system components.

4.9.2.4.2 Expansive Soils/Land Subsidence

Although a portion of the area is vulnerable to expansive soils, estimated losses are difficult to calculate because there is no apparent repository of data regarding losses associated with expansive soils. Local governments also do not specifically record damage to water conveyance and transportation infrastructure according to damage associated with expansive soils; it is typically rolled into maintenance costs. Developed areas were overlain on a soil swelling potential layer and a calculation was conducted to determine the square miles where the intersection of developed areas and moderate to very high soil swelling potential soils existed. Table 4.9-10 provides a summary of the expansive soils hazard vulnerability of the community assets and critical facilities in Glenn County.

Community assets and critical facilities data were intersected or overlaid with 2014 estimated potential land subsidence data to determine the type and number of facilities within the high, medium to high, low to medium, and low potential areas.

Table 4.9-11 provides a summary of the land subsidence hazard vulnerability of the community assets and critical facilities in Glenn County.

Table 4.9-10: Expansive Soils Hazard Vulnerability Assessment Summary

| Facility Category | Number Located in High Expansive Soil Potential | Number Located in Moderate Expansive Soil Potential | Number Located in Low Expansive Soil Potential |
|--|---|---|--|
| County/City Facilities in the City of Willows | 14 | 0 | 0 |
| County/City Facilities in the City of Orland | 0 | 0 | 5 |
| County Facilities in Unincorporated Glenn County | 0 | 4 | 1 |
| Educational Facilities | 8 | 5 | 18 |
| Medical Facilities | 5 | 0 | 3 |
| Fire Department Facilities | 2 | 4 | 4 |
| Police Department Facilities | 2 | 0 | 0 |
| Airports | 1 | 0 | 1 |
| Hazardous Materials Sites | 2 | 3 | 1 |
| Cell Towers | 1 | 2 | 3 |
| Dams | 0 | 0 | 0 |
| Other Critical Infrastructure | 0 | 0 | 2 |
| TOTAL | 35 | 18 | 38 |

Table 4.9-11: Land Subsidence Hazard Vulnerability Assessment Summary

| Facility Category | Number Located in High Land Subsidence Potential | Number Located in Medium to High Land Subsidence Potential | Number Located in Low to Medium Land Subsidence Potential | Number Located in Low Land Subsidence Potential |
|--|--|--|---|---|
| County/City Facilities in the City of Willows | 14 | 0 | 0 | 0 |
| County/City Facilities in the City of Orland | 15 | 0 | 0 | 0 |
| County Facilities in Unincorporated Glenn County | 5 | 0 | 0 | 0 |
| Educational Facilities | 23 | 0 | 8 | 0 |
| Medical Facilities | 8 | 0 | 1 | 0 |
| Fire Department Facilities | 8 | 0 | 2 | 0 |
| Police Department Facilities | 3 | 0 | 0 | 0 |
| Airports | 2 | 0 | 0 | 0 |
| Hazardous Materials Sites | 7 | 0 | 0 | 0 |
| Cell Towers | 3 | 0 | 1 | 0 |
| Dams | 0 | 0 | 0 | 0 |
| Other Critical Infrastructure | 2 | 0 | 1 | 0 |
| TOTAL | 90 | 0 | 13 | 0 |

Expansive soils and subsidence areas pose a small risk to critical facilities and infrastructure as compared to other hazards in the County. However, if these hazards were to occur the potential damage could consume County/City resources and equipment. Some of the potential outcomes of expansive soils and subsidence could include:

- Roads or railroads that are damaged/blocked can prevent access throughout the area and can isolate residents and emergency service providers needing to reach vulnerable populations or to make repairs.

- Damage could potentially present danger to nearby people and structures.
- Disrupt water mains, sewers, power lines and other utility lines.

Most of the significant damages associated with subsidence are typically related to the causal effects of subsidence as it relates to flooding events and fissure development. Other attributable costs and damages include:

- Uneven or differential subsidence across agricultural fields requiring expensive re-leveling efforts.
- Well damage and protruding well casings in both agricultural and urban areas.
- Replacement of gravity based irrigation systems due to flow reversal.

The increased incidence of local riverine flooding caused by reduction of elevation and changes of topographic gradients are the most costly impacts of land subsidence. No estimates of loss to Glenn County facilities have been determined at this time. It is anticipated that future iterations of the Glenn County MJHMP will build upon this initial assessment of land subsidence to provide a more accurate picture of the hazard as more data and studies become available.

4.9.2.5 Levee Failure

In the event of levee failure or breach, areas protected by levees would be susceptible to flooding. Additionally, leveed areas, defined as areas protected from flood water by levee systems in the US Army Corps of Engineers program. These areas have nothing to do with the 1 percent annual chance of flood, as defined in FEMA's FIRMs. Leveed areas would also be flooded if there was a levee failure or breach. Table 4.9-12 provides a summary of the land subsidence hazard vulnerability of the community assets and critical facilities in Glenn County.

Consequences of levee failure could cause significant loss of life and could destroy property, infrastructure, and the vitality of the region as a whole. Levees by their very nature adversely affect properties that are upstream, downstream, adjacent to, or across the waterway. Levees transfer flood waters onto other property, interfere with the natural attenuation of flows, cause backwaters, generally increase depth and velocity of flood waters, and encourage channel degradation and eventual bank erosion. In addition, if the levee is located immediately adjacent to the bank or the stream edge, as is common practice, important riparian vegetation is often destroyed either directly during the construction phase, or as a result of the high velocities, erosion, or sedimentation that result from the river's being narrowed by the presence of the levees. Impacts of a levee failure would be very similar to the impacts resulting from a flood event.

Table 4.9-12: Levee Failure Hazard Vulnerability Assessment Summary

| Facility Category | Number Located in Area Protected by Levees | Number Located in Leveed Areas |
|--|--|--------------------------------|
| County/City Facilities in the City of Willows | 0 | 0 |
| County/City Facilities in the City of Orland | 0 | 0 |
| County Facilities in Unincorporated Glenn County | 0 | 0 |
| Educational Facilities | 3 | 3 |
| Medical Facilities | 0 | 0 |
| Fire Department Facilities | 2 | 3 |
| Police Department Facilities | 0 | 0 |
| Airports | 0 | 0 |
| Hazardous Materials Sites | 1 | 2 |
| Cell Towers | 1 | 2 |
| Dams | 0 | 0 |
| Other Critical Infrastructure | 0 | 0 |
| TOTAL | 7 | 10 |

4.9.2.6 Severe Weather

According to historical hazard data, severe weather is an annual occurrence in Glenn County. Many of the historical severe weather events were state- and federally-declared disasters and have resulted in damages. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future. Heavy rain, hail, and snow are the most frequent type of severe weather occurrences in the region. The secondary hazards caused by severe weather include floods and landslides, resulting in tree damage in Glenn County.

Severe weather includes heavy rains or heavy snow and ice, often accompanied by strong winds, or hail. Heavy rains or snow, coupled with low temperatures or other severe weather conditions, can result in increases in traffic accidents, disruptions in transportation, government, and education; and cause

damage to buildings and communication towers. Most commonly severe weather incidents can cause prolonged utility outages due to falling trees or other debris.

Environmental impacts of cold temperatures and heat include damage to shrubbery and trees and other vegetation. Personal property such as cars, RVs, and small equipment is extremely vulnerable to severe weather hazards especially hail and damage as a result of fallen trees and other storm debris.

Extreme heat can increase water supply demands and cause health risks to vulnerable populations. During periods of extreme heat emergencies, the elderly and the very young are more vulnerable to the loss of cooling systems requiring power sources.

Extreme heat emergencies are often slow to develop. It could take a number of days of oppressive heat for a heat wave to have a significant or quantifiable impact. Heat waves do not strike victims immediately, but rather their cumulative effects slowly take the lives of vulnerable populations. As temperatures rise, County and City residents will face greater risk of death from dehydration, heat stroke/exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat.

Though heat does not cause much or damage to the built environment, the number of people it has killed underscores the importance of mitigating its impacts. Extreme heat events highlight the importance of social vulnerability. While changes to the built environment can greatly alter vulnerability to different hazards, social vulnerability and resiliency are especially important during heat events.

Socially isolated elderly persons are especially vulnerable. Increased use of air conditioners during heat waves can lead to power outages, which makes the events even more deadly due the loss of cooling systems requiring power sources. Those who rely on electric power for life-saving medical equipment, such as respirators, are extremely vulnerable to power outages. Any mitigation efforts aimed at reducing heat losses will focus on ways to reduce social isolation as well as changes to the built environment.

4.9.2.7 Wildfire

Risk to residents and property from wildfire is of significant concern. Wildfire danger is a major threat across the forested fuel rich area. High fuel loads in the wooded areas, along with geographical and topographical features create the potential for both natural and human-caused fires that can result in loss of life and property damage. These factors, combined with natural weather conditions common to the area, including periods of drought, low relative humidity, and significant winds can result in frequent and sometimes catastrophic fires. Any fire, once ignited, has the potential to quickly become large and out-of-control. Community assets and critical facilities data were overlaid with fire hazard severity zone data to determine the type and number of facilities within each risk classification. Table 4.9-13 provides a summary of critical facilities located within each wildfire severity zone.

Table 4.9-13: Wildfire Hazard Vulnerability Assessment Summary

| Facility Category | Number Located in Very High Fire Severity Zone | Number Located in High Fire Severity Zone | Number Located in Moderate Fire Severity Zone | Number Located in Non-Wildland/Non-Urban Area | Number Located in Urban Unzoned Area |
|--|--|---|---|---|--------------------------------------|
| County/City Facilities in the City of Willows | 0 | 0 | 0 | 0 | 14 |
| County/City Facilities in the City of Orland | 0 | 0 | 0 | 1 | 14 |
| County Facilities in Unincorporated Glenn County | 0 | 0 | 0 | 1 | 4 |
| Educational Facilities | 1 | 1 | 0 | 6 | 23 |
| Medical Facilities | 0 | 0 | 0 | 1 | 8 |
| Fire Department Facilities | 2 | 0 | 1 | 4 | 4 |
| Police Department Facilities | 0 | 0 | 0 | 0 | 3 |
| Airports | 0 | 0 | 0 | 0 | 2 |
| Hazardous Materials Sites | 0 | 0 | 0 | 3 | 4 |
| Cell Towers | 2 | 0 | 1 | 3 | 0 |
| Dams | 0 | 0 | 1 | 0 | 0 |
| Other Critical Infrastructure | 0 | 0 | 0 | 3 | 0 |
| TOTAL | 5 | 1 | 3 | 22 | 76 |

Potential losses from wildfire include human life, structures and other improvements, natural and cultural resources, and recreational opportunities. Short and long-term economic losses could also result due to loss of business and other economic drivers. Smoke and air pollution from wildfires can be a severe health hazard. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the subsequent rainy season.

4.9.3 Final Risk Factors

The MJHMP Steering Committee assigned risk factors for each hazard profiled through a facilitated group exercise. During the group exercise, risk factor (RF) criteria worksheets were used to examine each identified hazard for potential risk. This RF approach uses hazard data, local knowledge, and consensus opinions to produce numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). The final RF developed can be used to evaluate hazards and classify perceived hazard risk in the County and the Cities of Orland and Willows. Final RF values were obtained by assigning numerical criteria index values to five risk assessment categories: *probability, impact, spatial extent, warning time, and duration*. To obtain RF for each hazard, the MJHMP Steering Committee assigned a numerical range (1-4) to each risk assessment category, as shown in Table 4.9-14.

Based upon unique concerns for the planning area, a weighting factor was agreed upon for each RF category. The RF weighting scheme is used to establish a higher degree of importance to selected risk assessment categories. To calculate the RF value for a given hazard, the MJHMP Steering Committee developed the RF weighting scheme below:

$$\text{RF Value} = [(\text{Probability} \times .30) + (\text{Impact} \times .30) + (\text{Spatial Extent} \times .20) + (\text{Warning Time} \times .10) + (\text{Duration} \times .10)]$$

Table 4.9-14: Risk Factor Criteria

| Risk Assessment Category | Degree of Risk | Level | Criteria Index | Weight Value |
|--|----------------------|---|----------------|--------------|
| PROBABILITY What is the likelihood of a hazard event occurring in a given year? | UNLIKELY | LESS THAN 1% ANNUAL PROBABILITY | 1 | 30% |
| | POSSIBLE | BETWEEN 1 & 10% ANNUAL PROBABILITY | 2 | |
| | LIKELY | BETWEEN 10 & 100% ANNUAL PROBABILITY | 3 | |
| | HIGHLY LIKELY | 100% ANNUAL PROBABILITY | 4 | |
| IMPACT <i>In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?</i> | MINOR | VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES. | 1 | 30% |

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

| Risk Assessment Category | Degree of Risk | Level | Criteria Index | Weight Value |
|---|-------------------------|---|----------------|--------------|
| | 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. | 2 | |
| | 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. | 3 | |
| | 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. | 4 | |
| SPATIAL EXTENT <i>How large of an area could be impacted by a hazard event? Are impacts localized or regional?</i> | NEGLIGIBLE | LESS THAN 1% OF AREA AFFECTED | 1 | 20% |
| | SMALL | BETWEEN 1 & 10% OF AREA AFFECTED | 2 | |
| | MODERATE | BETWEEN 10 & 50% OF AREA AFFECTED | 3 | |
| | LARGE | BETWEEN 50 & 100% OF AREA AFFECTED | 4 | |
| WARNING TIME <i>Is there usually some lead time associated with the hazard event? Have warning measures been implemented?</i> | MORE THAN 24 HRS | SELF DEFINED | 1 | 10% |
| | 12 TO 24 HRS | SELF DEFINED | 2 | |
| | 6 TO 12 HRS | SELF DEFINED | 3 | |
| | LESS THAN 6 HRS | SELF DEFINED | 4 | |

| Risk Assessment Category | Degree of Risk | Level | Criteria Index | Weight Value |
|--|------------------|--------------|----------------|--------------|
| DURATION <i>How long does the hazard event usually last?</i> | LESS THAN 6 HRS | SELF DEFINED | 1 | 10% |
| | LESS THAN 24 HRS | SELF DEFINED | 2 | |
| | LESS THAN 1 WEEK | SELF DEFINED | 3 | |
| | MORE THAN 1 WEEK | SELF DEFINED | 4 | |

Final RF scores determine *High*, *Moderate*, or *Low* risk designations based upon an agreed-upon risk factor value designation, as shown in Table 4.9-15.

Table 4.9-15: Risk Factor Value Designation

| Risk Factor Value Designation |
|-----------------------------------|
| HIGH RISK (2.5 – 4.0) |
| MODERATE RISK (2.0 – 2.49) |
| LOW RISK (0.1 – 1.99) |

The RF results assist planners to classify risk for each hazard regardless of hazard type. For the purposes of this plan, the following classifications are used:

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

It should be noted that although some hazards are classified as posing “Low Risk”, their occurrence of varying or unprecedented magnitudes is still possible and will continue to be re-evaluated during future updates of this plan. Due to the inherent errors possible in any disaster risk assessment, the results of the risk assessment should only be used for planning purposes and in developing projects to mitigate potential losses. Risk factor results for Glenn County, the City of Orland, and the City of Willows are shown in Tables Table 4.9-16, Table 4.9-17, and Table 4.9-18, respectively.

Table 4.9-16: Risk Factor Results for Glenn County

| Natural Hazards | Probability | | Impact | | Spatial Extent | | Warning Time | | Duration | | RF Factor | Hazard Priority |
|-----------------------|-------------|------|--------|------|----------------|------|--------------|------|----------|------|-------------|-----------------|
| | | | | | | | | | | | | |
| Flood | 3.03 | 0.91 | 2.00 | 0.6 | 2.86 | 0.57 | 1.86 | 0.19 | 3.43 | 0.34 | 2.61 | High Risk |
| Dam Failure | 1.03 | 0.31 | 3.14 | 0.94 | 2.29 | 0.46 | 3.43 | 0.34 | 2.43 | 0.24 | 2.29 | Moderate Risk |
| Levee Failure | 2.00 | 0.6 | 3.00 | 0.9 | 2.57 | 0.51 | 3.57 | 0.36 | 3.00 | 0.3 | 2.67 | High Risk |
| Drought | 2.93 | 0.88 | 1.57 | 0.47 | 3.71 | 0.74 | 1.00 | 0.1 | 4.00 | 0.4 | 2.59 | High Risk |
| Severe Weather/Storms | 2.71 | 0.81 | 2.00 | 0.6 | 3.29 | 0.66 | 1.43 | 0.14 | 2.57 | 0.26 | 2.47 | Moderate Risk |
| Wildfire | 2.64 | 0.79 | 2.14 | 0.64 | 2.43 | 0.49 | 2.86 | 0.29 | 3.57 | 0.36 | 2.56 | High Risk |
| Geologic Hazards | 1.07 | 0.32 | 1.86 | 0.56 | 2.43 | 0.49 | 3.71 | 0.37 | 1.14 | 0.11 | 1.85 | Low Risk |

Table 4.9-17: Risk Factor Results for the City of Orland

| Natural Hazards | Probability | | Impact | | Spatial Extent | | Warning Time | | Duration | | RF Factor | Hazard Priority |
|-----------------------|-------------|------|--------|------|----------------|------|--------------|------|----------|------|-------------|-----------------|
| | | | | | | | | | | | | |
| Flood | 2.86 | 0.86 | 2.00 | 0.6 | 2.57 | 0.51 | 2.00 | 0.2 | 3.00 | 0.3 | 2.47 | Moderate Risk |
| Dam Failure | 1.00 | 0.3 | 3.14 | 0.94 | 2.86 | 0.57 | 3.43 | 0.34 | 2.43 | 0.24 | 2.40 | Moderate Risk |
| Levee Failure | 1.14 | 0.34 | 1.57 | 0.47 | 1.71 | 0.34 | 2.86 | 0.29 | 2.14 | 0.21 | 1.66 | Low Risk |
| Drought | 2.57 | 0.77 | 1.43 | 0.43 | 3.00 | 0.6 | 1.00 | 0.1 | 4.00 | 0.4 | 2.30 | Moderate Risk |
| Severe Weather/Storms | 2.86 | 0.86 | 2.00 | 0.6 | 3.00 | 0.6 | 1.29 | 0.13 | 2.86 | 0.29 | 2.47 | Moderate Risk |
| Wildfire | 2.43 | 0.73 | 2.00 | 0.6 | 2.00 | 0.4 | 2.71 | 0.27 | 3.14 | 0.31 | 2.31 | Moderate Risk |
| Geologic Hazards | 1.00 | 0.3 | 1.86 | 0.56 | 2.57 | 0.51 | 3.86 | 0.39 | 1.57 | 0.16 | 1.91 | Low Risk |

Table 4.9-18: Risk Factor Results for the City of Willows

| Natural Hazards | Probability | | Impact | | Spatial Extent | | Warning Time | | Duration | | RF Factor | Hazard Priority |
|-----------------------|-------------|------|--------|------|----------------|------|--------------|------|----------|------|-------------|-----------------|
| | | | | | | | | | | | | |
| Flood | 3.14 | 0.94 | 2.29 | 0.69 | 2.86 | 0.57 | 1.71 | 0.17 | 3.14 | 0.31 | 2.69 | High Risk |
| Dam Failure | 1.00 | 0.3 | 2.00 | 0.6 | 2.00 | 0.4 | 3.00 | 0.3 | 2.29 | 0.23 | 1.83 | Low Risk |
| Levee Failure | 1.29 | 0.39 | 1.57 | 0.47 | 1.71 | 0.34 | 3.00 | 0.3 | 2.67 | 0.27 | 1.77 | Low Risk |
| Drought | 2.57 | 0.77 | 1.43 | 0.43 | 3.00 | 0.6 | 1.00 | 0.1 | 4.00 | 0.4 | 2.30 | Moderate Risk |
| Severe Weather/Storms | 2.86 | 0.86 | 2.14 | 0.64 | 2.86 | 0.57 | 1.29 | 0.13 | 2.86 | 0.29 | 2.49 | Moderate Risk |
| Wildfire | 1.71 | 0.51 | 1.43 | 0.43 | 1.71 | 0.34 | 2.57 | 0.26 | 3.00 | 0.3 | 1.84 | Low Risk |
| Geologic Hazards | 1.00 | 0.3 | 1.71 | 0.51 | 2.71 | 0.54 | 3.86 | 0.39 | 1.57 | 0.16 | 1.90 | Low Risk |

A summary of each participating jurisdictions high, moderate, and low risk hazards is provided in Table 4.9-19. The County and the Cities of Orland and Willows decided that they would focus on the high risk and moderate risk hazards in the mitigation action strategy.

Table 4.9-19: Summary of Hazard Risk

| | Glenn County | City of Orland | City of Willows |
|----------------------|---|--|--|
| High Risk | Flood Levee Failure Drought Wildfire | | Flood |
| Moderate Risk | Severe Weather/Storms Dam Failure | Drought Wildfire Dam Failure Severe Weather/Storms Flood | Drought Severe Weather/Storms |
| Low Risk | Geologic Hazards | Geologic Hazards Levee Failure | Geologic Hazards Wildfire Dam Failure Levee Failure |

Section 5. Mitigation Strategy

The intent of the mitigation strategy is to provide Glenn County, and the incorporated Cities, the tools that will serve as guiding principles for future hazard mitigation policy and project administration. The development of the mitigation strategy includes the creation of a Mitigation Action Strategy, which includes a prioritization process for selected mitigation actions. The mitigation action plan represents the key outcomes of the MJHMP planning process.

5.1 Hazard Mitigation Goals

Goals are broad policy statements representing Glenn County and the Cities' desire for long-term hazard mitigation results. The MJHMP Steering Committee brainstormed and reviewed community and mitigation goals from various community documents and the 2013 California State Hazard Mitigation Plan during the July 30th, 2015 meeting. Each Steering Committee member submitted the top three or four mitigation goals they believed were most important for the County and Cities. These mitigation goals were then grouped into broader categories and refined to create the overall hazard mitigation goals for the three jurisdictions. They are as follows:

- Reduce or eliminate hazard related loss of life and injuries
- Reduce or eliminate hazard-related damage to critical/essential facilities and public services, infrastructure, and property
- Promote collaboration/coordination amongst jurisdictions and agencies within Glenn County to reduce or eliminate the impacts of natural hazards
- Improve and maintain Glenn County capabilities (i.e., planning/regulatory personnel capacity, funding accessibility, etc. to implement mitigation activities

A discussion on the goals continued in the November 19th, 2015 Steering Committee meeting, and concluded with the MJHMP Steering Committee agreeing to the overarching goals. The MJHMP Steering Committee decided on these goals as they address all aspects of hazard mitigation planning. Each

5.2 Capabilities Assessment

In preparing the mitigation actions, the Glenn County MJHMP Steering Committee members were asked to consider their overall capability to mitigate identified hazards. The mitigation strategy includes an assessment of Glenn County and the Cities of Orland and Willows' regulatory, administrative/technical, and fiscal capabilities to complete the identified mitigation actions.

5.2.1 Regulatory Mitigation Capabilities

Glenn County and the Cities of Orland and Willows have several plans and programs in place that guide the County's/Cities' mitigation of development in hazard-prone areas. The following table lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Glenn County and the Cities of Orland and Willows.

Table 5-1: Glenn County's Regulatory Mitigation Capabilities

| Regulatory Tool (Ordinances, codes, plans, etc.) | Y/N | Comments |
|--|-----|--|
| General Plan | Y | 1993, Housing Element 2014 |
| Comprehensive/Master Plan | Y | Orland and Willows Airports MP |
| Capital Improvements Plan | Y | For airports and transportation |
| Zoning Ordinance | Y | Glenn County Code Title 15 (countyofglenn.net) |
| Subdivision Ordinance | Y | Glenn County Code § 15.230 |
| Floodplain Ordinance | Y | Glenn County Code § 15.540, "FP" Floodplain Management Zone |
| Other Special Purpose Ordinances (e.g., stormwater, steep slope, wildfire, etc.) | Y | Glenn County Code § 2.520, Emergency Services & Organization |
| Building Code | Y | Version: 2013 CA Building code |
| BCEGS Rating | Y | Class 3 of 10; top 18%; letter April 2014 |
| Fire Department ISO Rating | Y | Rating: Variable – Willows (3 City/6 Rural) |
| Site Plan Review Requirements | Y | Glenn County Code § 15.130 |
| Erosion or Sediment Control Program | Y | Glenn County Code § 15.560.060 and § 15.640.170 |
| Transportation Plan | Y | Glenn County Regional Transportation Plan (RTP) 2015 |
| Community Wildfire Protection Plan | Y | Glenn County Resource Conservation District (RCD) 2011 |
| Other Special Plans | Y | Wilson Creek Detention Facility |
| Stormwater Management Program | Y | SWPP (Glenn County Landfill), Northeast Willows CSD |
| Site Plan Review Requirements | Y | Glenn County Code § 15.650 (Public Improvement Standards Drainage) |
| Capital Improvements Plan | Y | See above (Airport and Transportation Plans) |
| Economic Development Plan | Y | Glenn County Economic Development Strategy |
| Local Emergency Operations Plan | Y | Glenn Operational Area EOP |

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

| | | |
|--|---|--|
| Flood Insurance Study or Other Engineering Study for Streams | Y | CA Flood Protection Board (CVFPB) Sacramento River, Stony Creek, Butte Basin, Colusa Drain |
| Elevation Certificates | Y | Within a Flood Zone |

Table 5-2: City of Orland's Regulatory Mitigation Capabilities

| Regulatory Tool (Ordinances, Codes, Plans) | Yes/No | Comments |
|--|---------------|--|
| General Plan | Y | http://www.cityoforland.com/govt/dept/planning/forms.asp |
| Comprehensive/Master Plan | Y | Water Master Plan, Sewer Master Plan, Storm Drainage Master Plan; http://www.cityoforland.com/govt/dept/public_works/forms.asp |
| Capital Improvements Plan | N | |
| Zoning Ordinance | Y | http://www.cityoforland.com/govt/municipal_code.asp |
| Subdivision Ordinance | Y | http://www.cityoforland.com/govt/municipal_code.asp |
| Floodplain Ordinance | Y | Chapter 17.68 of Municipal Code |
| Other special purpose ordinance (stormwater, steep slope wildfire) | Y | Stormwater ordinance |
| Building Code | Y | Version: 2013 California Building Code |
| (BCEGS Rating | | |
| Fire Department ISO Rating | Y | Rating: 4 |
| Site plan review requirements | Y | http://www.cityoforland.com/govt/dept/planning/forms.asp |
| Erosion or Sediment Control Program | N | Use standard mitigation from SVRWQCB |
| Transportation Plan | Y | General Plan Circulation Element |
| Community Wildfire Protection Plan | N | |
| Stormwater Management Program | N | |
| Site Plan Review Requirements | Y | http://www.cityoforland.com/govt/dept/planning/forms.asp |

| | | |
|--|---|--|
| Capital Improvements Plan | N | |
| Economic Development Plan | Y | Economic Development Committee 2015 Work Plan, Orland 5-year plan includes economic development projects. Quarterly meetings with Glenn County Cities/County EDC |
| Local Emergency Operation Plan | Y | Operated by the Orland Police Department |
| Flood Insurance Study or other engineering study for streams | Y | City engineer has this information and uses it for project analysis |
| Elevation certificates | N | |

Table 5-3: City of Willow’s Regulatory Mitigation Capabilities

| Regulatory Tool (Ordinances, Codes, Plans) | Yes/No | Comments |
|---|--------|--|
| General Plan | Y | Old Plan/Housing update 2005/land use 2000 |
| Comprehensive/Master Plan | | |
| Capital Improvements Plan | | |
| Zoning Ordinance | Y | |
| Subdivision Ordinance | Y | |
| Floodplain Ordinance | Y | |
| Other special purpose ordinance (stormwater, steep slope wildfire) | Y | Floodplain Management Code Sec 15.65.010 |
| Building Code | Y | Version: 2013 CA. Building Code |
| (BCEGS Rating | Y | Class 3 |
| Fire Department ISO Rating | Y | Rating: 3 |
| Site plan review requirements | Y | |
| Erosion or Sediment Control Program | Y | |
| Transportation Plan | Y | |
| Community Wildfire Protection Plan | N | |

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

| | | |
|--|---|------------------------------|
| Stormwater Management Program | Y | SWPP |
| Site Plan Review Requirements | Y | |
| Capital Improvements Plan | N | |
| Economic Development Plan | | |
| Local Emergency Operation Plan | Y | County Wide Plan |
| Flood Insurance Study or other engineering study for streams | Y | File in Building Dept. |
| Elevation certificates | Y | Required for Building Permit |

5.2.2 Administrative/Technical Capabilities

Glenn County Sheriff's Office is dedicated to the safety and well-being of all persons within Glenn County. The Dispatch Center dispatches law enforcement and fire services for several agencies within the operational area. It also handles coordination of air ambulance for scene calls to all areas of the county (city or county), coordination of all mutual aid for the county and out of county requests. They handle after hours water problems for Flood Control, after hours contact for the Coroner's office, County Roads, Public Works, Communications, Building and Grounds, SWAT, Chaplain, DA's, Probation/Parole, Reserves and numerous others.

The following tables identify the County and City personnel responsible for activities related to mitigation.

Table 5-4: Glenn County Administrative and Technical Mitigation Capabilities

| Personnel Resources | Y/N | Department/Position |
|--|-----|---|
| Planner/Engineer with knowledge of land development/land management practices | Y | Department of Planning and Public Works |
| Engineer/Professional trained in construction practices related to buildings and/or infrastructure | Y | Department of Building Inspection |
| Planner/Engineer/Scientist with an understanding of natural hazards | Y | Department of Disaster Preparedness/Public Health |
| Personnel skilled in GIS | Y | Department of Information Technology |
| Full-time Building Official | Y | Department of Building Inspection |

| | | |
|---|---|---|
| Floodplain Manager | Y | Department of Flood Control |
| Emergency Manager | Y | Department of Disaster Preparedness/Public Health |
| GIS data – Hazard Areas | Y | Department of Information Technology |
| GIS data – Critical Facilities | Y | Department of Information Technology |
| GIS data – Land Use | Y | Department of Information Technology |
| GIS data – Assessor’s Data | Y | Department of Information Technology |
| Warning Systems/Services (Reverse 9-1-1, Cable Override, Outdoor Warning Signals) | Y | Office of Disaster Preparedness/Public Health |

Table 5-5: City of Orland Administrative and Technical Mitigation Capabilities

| Personnel Resources | Yes/No | Department/Position | Comments |
|---|--------|-----------------------------|---|
| Planning Commission | Y | | Twice per month meetings |
| Mitigation Planning Committee | N | | |
| Maintenance programs to reduce risk (e.g. tree trimming, clearing drainage systems) | Y | Public Works | tree trimming, clearing drainage systems, greenwaste pickup |
| Mutual aid agreements | Y | Police and Fire | |
| Hazard data and information | N | | |
| Grant writing | Y | Public Works | |
| HAZUS analysis | N | | |
| Planner/Engineer with knowledge of land development/land management practices | Y | City Planner/ City Engineer | Both the City planner and city engineer are contact staff |
| Engineer/Professional trained in construction practices related to building and/or infrastructure | Y | City Planner/ City Engineer | |
| Planner/Engineer/Scientist with an understanding of natural hazards | Y | City Planner/ City Engineer | |
| Personnel skilled in GIS | Y | Contract service | Contract with Chico State GIS |

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

| | | | |
|--|---|---------------------|--|
| Full time building official | Y | Building Department | Jeff Powell |
| Floodplain Manager | N | | |
| Emergency Manager | N | | |
| Grant writer | N | | |
| GIS Data – Hazard Areas | N | | |
| GIS Data – Critical facilities | | | |
| GIS Data – Building footprints | N | | |
| GIS Data – Land Use | Y | Planning Department | Contract with Chico State GIC |
| GIS Data – Links to Assessor’s data | Y | Planning Department | Parcel Quest subscription |
| Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals) | Y | Police Department | Outdoor warning signal, also use social media |

Table 5-6: City of Willows Administrative and Technical Mitigation Capabilities

| Personnel Resources | Yes/No | Department/Position | Comments |
|---|---------------|---|-----------------|
| Planning Commission | y | | |
| Mitigation Planning Committee | | | |
| Maintenance programs to reduce risk (e.g. tree trimming, clearing drainage systems) | y | City Public works | |
| Mutual aid agreements | y | Work with County Departments, Public Works, Sheriff, Fire | |
| Hazard data and information | | | |
| Grant writing | | | |
| HAZUS analysis | | | |
| Planner/Engineer with knowledge of land development/land management practices | y | John Wanger, City Eng. Coastland Engineering | |

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

| | | | |
|---|---|-----------------------------|-------------------------------|
| Engineer/Professional trained in construction practices related to building and/or infrastructure | y | Coastland Engineering | |
| Planner/Engineer/Scientist with an understanding of natural hazards | y | Coastland Engineering | |
| Personnel skilled in GIS | y | | Work with the County of Glenn |
| Full time building official | y | Clay Dawley | |
| Floodplain Manager | y | Clay Dawley | |
| Emergency Manager | | | |
| Grant writer | | | |
| Other personnel | | | |
| GIS Data – Hazard Areas | | | |
| GIS Data – Critical facilities | | | |
| GIS Data – Building footprints | | | |
| GIS Data – Land Use | | | |
| GIS Data – Links to Assessor’s data | | | |
| Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals) | y | Glenn County Sheriff Office | |
| Other | | | |

In addition to the departments/agencies described above, other departments/agencies that play a role in hazard mitigation in the County include:

- Glenn County Agricultural Commissioner
- Glenn County Community Wildfire Protection District
- Glenn County Resource Conservation District
- Glenn-Colusa Irrigation District
- Reclamation District
- Glenn County Water Advisory Committee
- Glenn Economic Development Commission

A number of state and federal agencies and programs also exist to provide technical and financial assistance to local communities for hazard mitigation. These include:

Table 5-7: State and Federal Agencies with Administrative/Technical Capabilities

| State Agencies | Federal Agencies |
|---|---|
| California Emergency Management Agency | US Army Corps of Engineers |
| California Department of Forestry and Fire Protection | Bureau of Land Management |
| California Department of Fish and Game | US Fish and Wildlife Service |
| California State Lands Commission | US Environmental Protection Agency (Region IX) |
| California Department of Food and Agriculture | Federal Emergency Management Agency (Region IX) |
| California Department of Water Resources | Bureau of Reclamation |
| California Environmental Protection Agency | National Park Service |
| California State Parks and Recreation Department | USDA Natural Resources Conservation Service |
| California Department of Transportation | US Geological Survey |
| UC Davis | |

5.2.3 Fiscal Capabilities

This section identifies the financial tools or resources that the County and the Cities of Orland and Willows could potentially use to help fund mitigation activities. These include County/City-specific capabilities, as well as state and federal resources. It is also important to note that funding can also be sourced from participating agencies/organizations that collaborate with the County in the implementation of mitigation actions.

The County has the ability to incur debt through general obligation bonds, special tax bonds, and private activities, as well as withhold spending in hazard-prone areas.

Table 5-8: Glenn County’s Fiscal Capabilities

| Financial Resources | Accessible/Eligible to use (Y/N) | Comments |
|--|----------------------------------|----------|
| Community Development Block Grants | Y | |
| Capital improvements project funding | Y | |
| Authority to levy taxes for specific purposes | Y | |
| Fees for water, sewer, gas, or electric services | | |
| Impact fees for new development | Y | |
| Stormwater utility fee | Y | |
| Incur debt through general obligation bonds | | |
| Incur debt through special tax bonds | | |
| Incur debt through private activities | | |
| Other federal funding programs | Y | |
| State funding programs | Y | |
| Withhold spending in hazard prone area | | |

Table 5-9: City of Orland’s Fiscal Capabilities

| Financial Resources | Accessible/Eligible to use (Y/N) | Comments |
|--|----------------------------------|----------------------|
| Community Development Block Grants | Y | |
| Capital improvements project funding | Y | |
| Authority to levy taxes for specific purposes | Y | |
| Fees for water, sewer, gas, or electric services | Y | Water and sewer only |
| Impact fees for new development | Y | |
| Stormwater utility fee | N | |
| Incur debt through general obligation bonds | Y | |
| Incur debt through special tax bonds | Y | |

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

| | | |
|--|---|----------------------------------|
| Incur debt through private activities | Y | |
| Other federal funding programs | Y | |
| State funding programs | Y | |
| Withhold spending in hazard prone area | N | No hazard prone areas identified |

Table 5-10: City of Willow's Fiscal Capabilities

| Financial Resources | Accessible/Eligible to use (Y/N) | Comments |
|--|----------------------------------|--------------------------|
| Community Development Block Grants | Y | |
| Capital improvements project funding | Y | |
| Authority to levy taxes for specific purposes | 218 vote | |
| Fees for water, sewer, gas, or electric services | Y | Sewer Fees |
| Impact fees for new development | Y | |
| Stormwater utility fee | Y | One time development Fee |
| Incur debt through general obligation bonds | Y | |
| Incur debt through special tax bonds | Y | |
| Incur debt through private activities | N | |
| Other federal funding programs | Y | |
| State funding programs | Y | |
| Withhold spending in hazard prone area | | |

5.2.3.1 State and Federal Funding Resources

The following table provides a list of potential funding programs and resources provided by state and federal agencies/programs the County and the Cities can tap into for hazard mitigation activities. Please note that the information provided below is not exhaustive.

Table 5-11: Potential Funding Programs/Grants from State and Federal Agencies

| Agency | Potential Programs/Grants |
|--|--|
| Department of Homeland Security – Federal Emergency Management Agency | Homeland Security Grant Program, Emergency Management Performance Grants Program, Transit Security Grant Program, Assistance to Fire Fighter Grants, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, Flood Mitigation Assistance Program, Severe Repetitive Loss Program |
| US Department of Housing and Urban Development | Community Development Block Grants |
| US Department of the Interior | Coast Impact Assistance Program, US Geological Survey Research and Data Collection |
| US Department of Defense – US Air Force | Training Requirements Funding |
| US Department of Health and Human Services/California Department of Health Services | Grants for Public Health Emergency Preparedness |
| US Department of Commerce | Coastal Resilience Networks |
| California Emergency Management Agency | Regional Catastrophic Preparedness Grant Program, Interoperable Emergency Communications Center Grant Program, Proposition 1B Grant, Citizens Corps Program, Metropolitan Medical Response System Program, Earthquake and Tsunami Grants Program |
| California Department of Housing and Community Development | Disaster Recovering Initiative |
| California Department of Forestry and Fire Protection | Western States WUI Fire Assistance Grant |

5.3 Mitigation Actions

With the results of the hazard risk assessment finalized, mitigation goal established, and capabilities assessed, the County and the Cities then set out to identify mitigation actions that would reduce the impacts of the focused natural hazards. A brief description of the different mitigation action categories is provided below, followed by a discussion of the process undertaken to identify and prioritize mitigation actions.

5.3.1 Mitigation Action Categories

Mitigation actions are based on the hazard risk assessment results and FEMA’s six hazard mitigation actions categories. Mitigation actions categories include local planning and regulations, structure, and

infrastructure projects, natural systems protection, and education and awareness programs. FEMA’s four hazard mitigation categories are described below:

- **Local Planning and Regulations:** Government administrative or regulatory actions (authorities, policies, or codes) or processes that influence the way land and buildings are developed and built.
- **Structure and Infrastructure Projects:** Actions that involve modifying or removing existing buildings or infrastructure to protect them from a hazard. Mitigation projects intended to lessen the impact of a hazard by using structures to modify the environment.
- **Natural Resource Protection:** Actions that, in addition to minimizing hazard damage/losses also preserve or restore the functions of natural systems.
- **Public Education and Awareness:** Actions to inform and educate citizens, elected/public officials, and property owners about potential risks from hazards and potential ways to mitigate them.

5.3.2 Identification and Prioritization of Mitigation Actions

As mentioned previously, the County and Cities will focus their efforts on developing mitigation actions to address the hazards deemed as being high or moderate risk, as shown in Table 5-12. MJHMP Steering Committee members, with guidance from the MJHMP Project Team, consulted with other County and Cities staff to develop and refine mitigation actions.

Not all identified mitigation actions are implementable in the 5-year plan cycle, due to technical feasibility, political acceptance, lack of funding, or other constraints. Once the mitigation actions for each participating jurisdiction were identified, they were evaluated and prioritized (high, medium, low) to identify the most suitable mitigation actions for each participating jurisdictions to implement. The STAPLEE method was used to evaluate and prioritize the mitigation actions. Criteria and considerations in this evaluation/prioritization process are identified in Table 5-13.

Table 5-12: Hazards by Region Ranked according to Risk Levels

| | Glenn County | City of Orland | City of Willows |
|----------------------|---|--|--|
| High Risk | Flood Levee Failure Drought Wildfire | | Flood |
| Moderate Risk | Severe Weather/Storms Dam Failure | Drought Wildfire Dam Failure Severe Weather/Storms Flood | Drought Severe Weather/Storms |
| Low Risk | Geologic Hazards | Geologic Hazards Levee Failure | Geologic Hazards Wildfire Dam Failure Levee Failure |

Table 5-13: STAPLEE Method for Evaluating and Prioritizing Mitigation Actions

| Evaluation Category | Discussion "It is important to consider..." | Considerations |
|-----------------------------|--|--|
| <u>S</u>ocial | The public support for the overall mitigation strategy and specific mitigation actions. | Community acceptance Adversely affects population |
| <u>T</u>echnical | If the mitigation action is technically feasible and if it is the whole or partial solution. | Technical feasibility Long-term solutions Secondary impacts |
| <u>A</u>ministrative | If the community has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary. | Staffing Funding allocation Maintenance/operations |
| <u>P</u>olitical | What the community and its members feel about issues related to the environment, economic development, safety, and emergency management. | Political support Local champion Public support |
| <u>L</u>egal | Whether the community has the legal authority to implement the action, or whether the community must pass new regulations/ | Local, State, and Federal authority Potential legal challenge |
| <u>E</u>conomic | If the action can be funded with current or future internal and external sources, and if enough information is available to complete a FEMA Benefit-Cost Analysis. | Benefit/cost of action Contributes to other economic goals Outside funding required |
| <u>E</u>nvironmental | The impact on the environment because of public desire for a sustainable and environmentally healthy community. | Effect on local flora and fauna Consistent with community environmental goals Consistent with local, state, and Federal laws |

The Action Implementation Plan in Tables 5-14, 5-15, and 5-16 for Glenn County, the City of Orland, and the City of Willows, respectively, presents the identified mitigation actions, along with the prioritization and implementation elements. At a minimum, per FEMA requirements, for each mitigation action, the following elements are described:

- **Responsible Agency** – Department or agency is most appropriate to lead each mitigation action
- **Potential funding resources** – Funding mechanisms and other resources that are available or that will be pursued to implement each mitigation action. Sources of local funding may include the general operating budget, capital improvement budgets, staff time, impact fees, special assessment districts, and more.
- **Timeframe** – Identifies when each mitigation action will be started and fully implemented.

The more information that can provide for the implementation strategy for each mitigation, the easier it will be to develop project scopes of work, schedules, and budgets for FEMA mitigation grant applications. Each mitigation action includes the following additional action implementation elements:

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

- Goals addressed
- Partner agencies/organizations
- Estimated budget /cost estimates, where available
- Steps for Implementation

Including this additional information, which is above and beyond FEMA requirements, provide the start-up information the County and the Cities need to begin the preparation of project applications for potential grant funding and implementation as soon as possible.

Implementing identified mitigation actions can be overwhelming for any community, especially with limited staffing and fiscal resources. To ensure that this MJHMP reflects a reality of what Glenn County and the Cities of Orland and Willows can do with its available resources prioritized into varying risk levels. Only those hazards deemed to be high or moderate risk will have mitigation actions to address the potential impacts.

Table 5-14: Glenn County Mitigation Actions

| Mitigation ID | Mitigation Project Title | Preliminary Implementation Steps | Hazard Addressed | Issues/ Background | Mitigation Goals Addressed | Responsible Agency | Partner Agencies/ Organizations | Estimated Budget/Cost Estimates | Potential Funding Source | Timeframe | Priority (High, Medium, Low) |
|---------------|---|--|------------------|--|--|---|---|---------------------------------|---------------------------|-------------------------|------------------------------|
| GC-1 | New Slip Liner in 42" Pipe Trunk Line that Runs from Glenwood Pump Station to Cemetery Pump Station | Review for potential grants, finding, etc. | Flood | Flooding occurs in storm events of heavy rain. | Reducing Exposure to Losses, Life, and Personal Property | Glenn County PPWA, City of Willows Public Works | Glenn Colusa Irrigation District | Undetermined | FEMA Grants | 1-2 years | High |
| GC-2 | Stream Cleaning/Debris Removal throughout the County | Update Maintenance Agreements | Flood | Flooding occurs in storm events of heavy rain. | Reducing Exposure to Losses, Life, and Personal Property | Glenn County PPWA | Property owners, permitting agencies | Undetermined | General Fund, FEMA Grants | 1-2 years, re-occurring | High |
| GC-3 | Replace Box Culvert with A Bridge or Larger Culvert at Hunter Creek on County Road D, south of County Road 68 | Review for potential grants, finding, etc. | Flood | Flooding occurs in storm events of heavy rain. | Reduce or eliminate hazard-related damage to critical/essential facilities and public services, infrastructure, and property | Glenn County PPWA | | Undetermined | FEMA Grants | 1-2 years | High |
| GC-4 | Fill in the Road Dip on County Road Y, South of County Road 50 | Review for potential grants, finding, etc. | Flood | Flooding occurs in storm events of heavy rain. | Reduce or eliminate hazard-related damage to critical/essential facilities and public services, infrastructure, and property | Glenn County PPWA | | Undetermined | FEMA Grants, Caltrans | 3-5 years | Medium |
| GC-5 | Increase Natural Hazard Education and Risk Awareness | Public Meetings and Web Domain | Multi-Hazard | Glenn County is potentially affected by numerous natural hazards. | Reducing Exposure to Losses, Life, and Personal Property | Glenn County PPWA, Glenn County Sheriff's Office, Elected Officials | | Undetermined | General Fund, Grants | 1-2 years, re-occurring | Medium |
| GC-6 | Improve Household Disaster Preparedness | Public Meetings and Web Domain | Multi-Hazard | Glenn County is potentially affected by numerous natural hazards. | Reducing Exposure to Losses, Life, and Personal Property | Glenn County PPWA, Glenn County Sheriff's Office, Elected Officials | Multiple Agencies | Undetermined | General Fund, Grants | 1-2 years, re-occurring | Medium |
| GC-7 | Monitor Drought Conditions | Public Reports and Web Domain | Drought | CA has been in a state of extreme drought, which can impact Glenn County's agricultural sector and its water supply and water supply infrastructure. | Collaboration | Glenn County PPWA, Glenn County Agricultural Department | Glenn County Water Advisory Committee, Glenn County Sheriff's Office, Elected Officials | Undetermined | General Fund, Staff time | 1-2 years, re-occurring | High |

| | | | | | | | | | | | |
|--------------|---|---|---------------------|--|--|---|---|--------------|---|---|--------|
| GC-8 | Develop and enforce water conservation measures during drought conditions | Water Advisory Committee to develop protocols | Drought | CA has been in a state of extreme drought, which can impact Glenn County's agricultural sector and its water supply and water supply infrastructure. | Promote collaboration/coordination amongst jurisdictions and agencies within Glenn County to reduce or eliminate the impacts of natural hazards | Glenn County PPWA, Glenn County Agricultural Department | Glenn County Water Advisory Committee, Glenn County Sheriff's Office, Elected Officials | Undetermined | General Fund, Staff time | 1-2 years, re-occurring | High |
| GC-9 | Implement and Maintain Fuels Management Program | Review/Implement Community Wildfire Protection Plan | Wildfire | Areas in Glenn County are categorized as very high and high fire severity zones, making them susceptible to wildfire risks. | Reduce or eliminate hazard-related damage to critical/essential facilities and public services, infrastructure, and property | Glenn County PPWA | Local Fire Districts, Glenn County Resource Conservation District | Undetermined | General Fund, FEMA Grants, Other Grants | 1-2 years, re-occurring | High |
| GC-10 | Work with Dam Owners to develop Dam Failure Study to improve upon flood inundation data in Glenn County and develop/update emergency action plans, as appropriate | Bureau of Reclamation Corrective Action Study, similar to Stony Gorge Dam | Flood/Dam Failure | A number of dams in the vicinity of Glenn County have the potential to fail and flood areas of Glenn County. | Promote collaboration/coordination amongst jurisdictions and agencies within Glenn County to reduce or eliminate the impacts of natural hazards | Glenn County PPWA, Glenn County Sheriff's Office, City of Orland Public Works, City of Orland Police Department | US Bureau of Reclamation, Local Dam Owners | Undetermined | General Fund, FEMA Grants, Other Grants | 3-5 years | Medium |
| GC-11 | Hamilton City Flood Control and Ecosystem Restoration Project | Implement construction phase | Flood/Levee Failure | Hamilton City has been threatened by flooding from the Sacramento River for over 100 years. A new levee is approved and partially funded. | Reducing Exposure to Losses, Life, and Personal Property | RD 2140, Glenn County PPWA, Hamilton City Community Services District | The Nature Conservancy, RD 2140, Untied States Bureau of Reclamation | \$56 million | Federal/State and Local 10% match (FEMA Grants, US Army Corps of Engineers, CA DWR) | 1-2 years Ground breaking in Spring 2016 - completion in 2018 | High |
| GC-12 | Small Communities Flood Risk Reduction | Undertake Flood Reduction Study | Flood/Levee Failure | Small Communities in Glenn County are within the State Levee Flood Protection Zone and according to FEMA within the 100 year Flood Zone. | Reducing Exposure to Losses, Life, and Personal Property by removing (via map revision or other method) infrastructure from the 100 year flood zone) | Glenn County PPWA, Levee Protection Districts, Department of Water Resources (DWR), | Department of Water Resources (DWR), Levee Protection Districts | Undetermined | DWR Flood Risk Reduction Grants | 1-2 year | High |

Table 5-15: City of Orland Mitigation Actions

| Mitigation ID | Mitigation Project Title | Preliminary Implementation Steps | Hazard Addressed | Issues/ Background | Mitigation Goals Addressed | Responsible Agency | Partner Agencies/ Organizations | Estimated Budget/Cost Estimates | Potential Funding Source | Timeframe | Priority (High, Medium, Low) |
|---------------|---|---|------------------|--|---|--|---------------------------------|---------------------------------|---|-----------|------------------------------|
| OR-1 | Eradicate Arundo in Stony Creek | Work with Glenn County for the remove of this plant species in Stony Creek | Wildfire | Arundo is a very robust reed that grows quickly and is very flammable vegetation in the hot summer months and is located around Stony Creek. This area is located adjacent to the City on private land and is not under the jurisdiction of the City. As such, the City has no control over the eradication of this vegetation although it does present a possible hazard to the city's residents. Cooperation form Glenn County to remove this hazard would be helpful to the City. | Removal of wildfire hazard, protection of property and people | Orland Public Works, property owners, Glenn County PPWA | | Undetermined | General Fund, FEMA Grants, Other Grants | 1-2 years | High |
| OR-2 | Flood Potential Reduction Along Stony Creek | All new construction located in identified flood area required to build 1 foot higher than 100-year flood level water | Flood | Small areas of the City are identified to be in the 100-yr flood zone. Much of this area is identified as Open Space in the Orland General Plan. However, there area areas identified as Low | Protection of property and people | City of Orland Planning Department, City of Orland Building Department | | Program in Place | Staff time; technical assistance, FEMA grants | On-going | Low |

| | | | | | | | | | | | |
|------|--|---|--------------------|--|---|--|--|--|--|-----------|--------|
| | | | | Density Residential. | | | | | | | |
| OR-3 | Black Butte Dam Failure Inundation | Work with Dam Owners to develop Dam Failure Study to improve upon flood inundation data in Glenn County and develop/update emergency action plans, as appropriate | Flood/Dam Failure | Larger dams that would inundate significant portions of Orland include the Shasta Dam (in Shasta County) and Black Butte Dam on Stony Creek. | Protection of property and people | Glenn County PPWA, Glenn County Sheriff's Office, City of Orland Public Works, City of Orland Police Department | | Undetermined | General Fund, FEMA Grants, Other Grants | 1-2 years | Low |
| OR-4 | Improve and Maintain Stormwater Drainage System Capacity | Mitigate through drainage system maintenance and new construction requirements such as drainage basins | Flood/Severe Storm | A severe rainstorm has caused localized flooding to the City in the recent past. While this storm was a 100-year plus event, it did illustrate the need for a sufficient storm drainage system and the maintaining of this system in the city. | Protection of property and people | City of Orland Public Works, City of Orland Planning Department | | Replacement of existing facilities is on a per linear foot cost. Total cost for this replacement is unknown at this time. New infrastructure is estimated to cost approximately \$1,014,720. | General Fund, Development Impact Fees, FEMA Grants | 1-2 years | Medium |
| OR-5 | Drought Awareness | Enforce water conservation measures through water conservation program implementation and water use monitoring | Drought | California is in a severe drought. | Reduction of water use | Orland Public Works, Orland Planning Department | | Undetermined | Staff time | On-going | High |
| OR-6 | Increase Natural Hazard Education and Risk Awareness | Provide public workshops and informational brochures at City Hall and Library | Multi-Hazard | Glenn County is potentially affected by numerous natural hazards. | Public knowledge and preparation, Life Safety | City of Orland Police Department, City of Orland Public Works Department, City of Orland Planning Department, City of Orland Elected Officials | | Undetermined | General Fund, Grants | 1-2 years | Medium |
| OR-7 | Improve Household Disaster Preparedness | Provide public workshops and informational brochures at City Hall and Library | Multi-Hazard | Glenn County is potentially affected by numerous natural hazards. | Public knowledge and preparation, Life Safety | City of Orland Police Department, City of Orland Public Works Department, City of Orland Planning Department, City of Orland Elected Officials | | Undetermined | General Fund, Grants | 1-2 years | Medium |

Table 5-16: City of Willows Mitigation Actions

| Mitigation ID | Mitigation Project Title | Preliminary Implementation Steps | Hazard Addressed | Issues/ Background | Mitigation Goals Addressed | Responsible Agency | Partner Agencies/ Organizations | Estimated Budget/Cost Estimates | Potential Funding Source | Timeframe | Priority (High, Medium, Low) |
|---------------|--|----------------------------------|------------------|--|--|---|----------------------------------|---------------------------------|--------------------------|----------------|------------------------------|
| WI-1 | Increase Natural Hazard Education and Risk Awareness | | Multi-Hazard | Glenn County is potentially affected by numerous natural hazards. | Public knowledge and preparation, Life Safety | City of Willows Public Works Department, City of Willows Planning Department, City of Willows City Manager/City Clerk | | Undetermined | General Fund, Grants | 1-2 years | Medium |
| WI-2 | Improve Household Disaster Preparedness | | Multi-Hazard | Glenn County is potentially affected by numerous natural hazards. | Public knowledge and preparation, Life Safety | City of Willows Public Works Department, City of Willows Planning Department, City of Willows City Manager/City Clerk | | Undetermined | General Fund, Grants | 1-2 years | Medium |
| WI-3 | Drought Awareness - Educate City Residents on Water Saving Techniques/Water Conservation Measures | | Drought | Region experiences drought, on a varying pattern or cycle. Public needs to be made aware of water conservation measures. The best means to reach out is through print and broadcast media. | Helps to preserve groundwater supplies by lessening pumping impacts through conservation | City of Willows City Manager/City Clerk | | Undetermined | General Fund, Grants | During drought | Medium |
| WI-4 | Slip Liner in 42" Storm Drain Pipe Glenwood to GCID Canal (Cemetery Pump Station) 8500 Linear Feet | | Flood | Flooding in the Glenwood and French Street areas of the City of Willows. Flooding occurs in these areas during sustained heavy rain events. Homes are inundated with water, sanitary sewer system can be impacted causing potential public health issues. High wind and power outage | Life Safety, Protect Property | Glenn County PPWA, City of Willows Public Works | Glenn Colusa Irrigation District | Undetermined | FEMA Grants | 1-2 years | High |

| | | | | | | | | | | | |
|-------------|--|--|-------|---|---|------------------------------|----------------------------------|--------------|-------------|-----------|--------|
| | | | | generally occur during these sustained rain events causing other public safety issues, flooded streets limit public safety personnel access to address these issues. | | | | | | | |
| WI-5 | Siphon Under GCID Canal at Sacramento Street (Co Rd 51) Storm Pump Station | | Flood | <p>Flooding in the southeast portion of the City of Willows. Flooding occurs in these areas during sustained heavy rain events. Homes are threatened with inundation, sanitary sewer system can be impacted causing potential public health issues. High wind and power outage generally occur during these sustained rain events causing other public safety issues, flooded streets limit public safety personnel access to address these issues.</p> | Life Safety, Protect Property; A siphon would eliminate the need to pump storm water into the GCID canal increasing storm system capacity and reducing personnel time monitoring pumps. | City of Willows Public Works | Glenn Colusa Irrigation District | Undetermined | FEMA Grants | 1-2 years | Medium |

This page is intentionally left blank

Section 6. Plan Implementation and Maintenance

As this document is a living document, it is important that it becomes a tool in the County's and Cities' resources to ensure minimal damage in the event of natural disaster event. This section discusses plan adoption and implementation, as well as the processes for monitoring, evaluating, and updating the MJHMP, to ensure that the MJHMP remains relevant and continues to address the changing environment in the County and Cities. In addition, this section describes the incorporation of the MJHMP into existing Glenn County and Cities of Orland and Willows planning mechanisms, as well as how the County/Cities will continue to engage the public.

6.1 Plan Adoption

To comply with DMA 2000, Glenn County, the City of Orland, and the City of Willows will officially adopt the 2016 Glenn County MJHMP within one year of receiving FEMA approval pending adoption status. The adoption of the MJHMP recognizes the County's and Cities' commitment to reducing the impacts of natural hazards in the areas of Glenn County. An example adoption resolution is presented in Appendix D.

6.2 Implementation

This section describes the role of the MJHMP Steering Committee in the implementation of the MJHMP.

6.2.1 Future Participation

The Glenn County MJHMP Steering Committee, established for this plan, will become a permanent advisory body to administer and coordinate the implementation and maintenance of the MJHMP. The Associate Planner for the Glenn County Planning and Public Works Agency, in coordination with the staff from the Cities of Orland and Willows, will lead the MJHMP Steering Committee in all associated MJHMP maintenance requirements. On an annual basis, the MJHMP Steering Committee will report to the Planning Commission and/or Board of Supervisors and the public on the status of plan implementation and mitigation opportunities in the County. Other duties include reviewing and promoting mitigation opportunities, informing and soliciting input from the public, and hearing and addressing stakeholder concerns about hazard mitigation.

The input required for effective periodic evaluations will come from local government officials and other interested stakeholders.

6.3 Monitoring, Evaluating, and Updating the MJHMP

This section describes the schedule and process for monitoring, evaluating, and updating the MJHMP.

6.3.1 Schedule

Monitoring the progress of the mitigation actions will be on-going throughout the five-year period between the adoption of this MJHMP and the next update. The MJHMP Steering Committee will meet on an annual basis to monitor the status of the implementation of mitigation actions.

As mentioned, one of the duties of the MJHMP Steering Committee is to report to the Board of Supervisors and City Councils on the status of plan implementation. This annual review will take place each year on

or near the anniversary of the adoption of the plan. Approximately one month prior to this annual review, the MJHMP Steering Committee will meet to prepare the evaluation of the MJHMP.

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 2016 MJHMP. However, should a significant disaster occur within the County, the MJHMP Steering Committee will reconvene within 30 days of the disaster to review and update the MJHMP, as appropriate. The Glenn County Board of Supervisors and the City Councils of Orland and Willows will adopt written updates to the MJHMP.

6.3.2 Process

The MJHMP Steering Committee will also 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 Steering Committee on an annual basis. Working with the MJHMP Steering Committee, these responsible agencies/organizations will assess the effectiveness of the mitigation actions and modify the mitigation actions as appropriate. A MJHMP Mitigation Action Progress Report worksheet, provided in Appendix E, has been 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 annual meeting to monitor mitigation actions can be used for the annual evaluation of the MJHMP. The following questions will be considered as criteria for evaluating the effectiveness 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, also provided in Appendix E, has been developed as part of this MJHMP to provide guidance to the MJHMP Steering 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 Glenn County MJHMP in 2021. The questions identified above would remain valid during the preparation of the 2021 updated MJHMP. The responsible agency, schedule, and process are summarized in Table 6-1.

Table 6-1:

| | Monitoring | Evaluating | Updating |
|-------------|---|---|---|
| WHO | Steering Committee, with Glenn County PPWA Planner as Lead | Steering Committee, with Glenn County PPWA Planner as Lead | Steering Committee, with Glenn County PPWA Planner as Lead |
| WHEN | Annually | <ul style="list-style-type: none"> Annually After a disaster event | <ul style="list-style-type: none"> Every 5 years Update process to start at least one year prior to plan expiration After a disaster event |
| HOW | <ul style="list-style-type: none"> Responsible agencies/ organizations to monitor/ evaluate progress of mitigation actions Report to Steering Committee using Mitigation Action Progress Report worksheet Report out to elected officials (i.e., Planning Commission and City Councils) as appropriate once per year | <ul style="list-style-type: none"> Use information culled from annual meetings to monitor mitigation actions Evaluate process and implementation Identify lessons learned Annual Plan Review Questionnaire worksheet Report to elected officials | <ul style="list-style-type: none"> Develop scope of work Coordinate participating jurisdictions Apply for funding/budget cost Review/revise Plan accounting for <ul style="list-style-type: none"> new hazard vulnerabilities special circumstances new information new priorities issues from monitoring/ evaluation progress in mitigation efforts |

6.4 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism is to incorporate the recommendation and underlying principles of the MJHMP into other community plans and mechanisms, such as comprehensive planning, capital improvement budgeting, economic goals and incentives, and regional plans. Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of government and development. Thus, the integration of a variety of County and City administrative departments on the MJHMP Steering Committee provides an opportunity for constant and pervasive efforts to network, identify, and highlight mitigation activities and opportunities at all levels of government, through the monitoring of agendas, attendance at meetings, and distribution of memos. This collaborative effort is also important in the monitoring of funding opportunities that can be leveraged to implement the mitigation actions.

Based on the comprehensive nature of the MJHMP, the MJHMP Steering Committee believes that this document will be highly useful when updating existing and developing new planning mechanisms in the

County and Cities. Specific documents that the MJHMP Update Steering Committee will actively incorporate information from the MJHMP include:

- **Glenn County and Cities of Orland and Willows Building/Development Codes and Ordinances:** The 2016 MJHMP will provide information to enable the County and the Cities to make decisions on appropriate building/development codes and ordinances. Appropriate building codes and ordinances can increase the County and the Cities' resilience following natural disasters.
- **Glenn County EOP:** The 2016 MJHMP will provide information on risk and vulnerability that will be extremely important to consider and incorporate into the County's EOP. Probability and vulnerability can direct emergency management and response efforts.
- **Glenn County and Cities' GP:** The 2016 MJHMP will provide information that can be incorporated into the Land Use and Public Safety Elements during the next GP update. Specific risk and vulnerability information from the MJHMP can help to identify areas where development should not take place.
- **Glenn County Community Wildfire Protection Plan (CWPP):** The 2016 MJHMP highlights wildfire areas of concerns in Glenn County. Suitable mitigation actions contained in the MJHMP can be included in the CWPP.
- **Glenn County and Cities' Capital Improvement Plan (CIP):** Projects identified in the MJHMP can be included in the annual Capital Improvement Plan.
- **Glenn County Regional Transportation Plan (RTP):** The RTP emphasizes linkages with the Regional Transportation Improvement Program (RTIP) and the Interregional Transportation Improvement Program (ITIP), the land-use transportation connection, and the public participation activities include outreach to Native Tribal Governments within the County.
- **Glenn County Storm Water Pollution Prevention Plan (SWPPP):** The 2004 SWPPP describes significant materials commonly stored on-site at various gas stations, repair shops, etc. as well as locations of landfills and other solid waste disposal sites and precautions for management of these sites.
- **Glenn County Groundwater Coordinated Resource Management Plan:** The Groundwater Coordinated Resource Management Plan details precautions taken for the protection of groundwater, as a resource, for its use within the County as necessary for the protection of health, welfare, and safety of the residents of the County.

6.5 Continued Public Involvement

As was completed during the development of the MJHMP, the MJHMP Steering Committee will involve the public during the monitoring, evaluating and updating process of the MJHMP through various public workshops and meetings. Information on upcoming public events related to the MJHMP or solicitation for comments will be announced via newsletters, newspapers, mailings, and on the County website (<http://www.countyofglenn.net>). An electronic copy of the current MJHMP document will be accessible through the Glenn County website, with a hard copy available for review at the Glenn County Department of Planning and Public Works' office. The MJHMP Steering Committee will incorporate all relevant comments during the next update of the MJHMP.

Glenn County Multi-Jurisdiction Hazard Mitigation Plan
February 2016

During the development of this MJHMP, there was very little public involvement despite the efforts to engage the public. At the Public Workshop in July 2015, the MJHMP Project Team asked meeting attendees to provide feedback and ideas to improve public involvement during the MJHMP maintenance and update process. The MJHMP Steering Committee will, as much as practicable, incorporate the following feedback and ideas into its public outreach strategy to ensure continued public involvement in the MJHMP planning process.

- Collaborate with Glenn County Disaster Council
- Collaborate with public service clubs, i.e., Lions, Rotary, Moose, etc. and other NGOs, such as Chambers of Commerce, etc., to get information to participants/members
- Collaborate with County and Cities' places of worship to get information to congregants
- Create story ideas for media outlets, such as newspapers, local radio, and TV, that tell the message in an interesting way and disseminate information
- Use the Reverse 9-1-1
- Post meeting announcements at libraries, shopping centers, and other places frequented by the public
- Involve citizen groups
- Educate and collaborate with homeowners associations and Board of Realtors
- Leverage other existing local community meetings
- Distribute information to K-12 school administrators

This page is intentionally left blank.