TUOLUMNE COUNTY

MULTI-JURISDICTION HAZARD MITIGATION PLAN

Adopted by the
Tuolumne County Board of Supervisors
October 19, 2004

I. INTRODUCTION

This chapter provides a general introduction to the Tuolumne County Multi-Jurisdiction Hazard Mitigation Plan. It is broken down into the following six sections:

A. Background

B. Purpose

C. Scope

D. Authority

E. Participants in the Planning Process

F. Description of the Planning Process

A. BACKGROUND

Natural hazards, such as floods, tornadoes and hurricanes, are a part of the world around us. Their occurrence is natural and inevitable, and there is little we can do to control their force and intensity. However, through *hazard mitigation planning*, we can control what comes afterward. By minimizing the impact of natural hazards upon our built environment, we can prevent such events from resulting in disasters.

"**Hazard mitigation**" is simply a technical term for reducing risks to people and property from natural hazards. It includes both structural measures, such as protecting buildings and infrastructure from the forces of wind and water, and non-structural measures, such as natural resource protection and wise floodplain management. These activities can target existing development or seek to protect future development by avoiding any new hazardous construction. It is widely accepted that the most effective mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are ultimately made.

The easiest way a community can get serious about hazard mitigation is through the development and adoption of a local **hazard mitigation plan**. A mitigation plan will ensure that measures to reduce the present and future vulnerability of a community are thoroughly considered before, during, and after the next disaster strikes.

Mitigation planning offers many benefits that include:

- saving lives and property;
- saving money;
- speeding recovery following disasters;
- reducing future vulnerability through wise development / redevelopment;
- expediting both pre-disaster and post-disaster grant funding; and
- demonstrating a firm commitment to improving community health and safety.

Recently, both the State of California and the U.S. Congress made the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for mitigation grant funding. Communities with an adopted plan will therefore become "pre-positioned" and more apt to receive any available mitigation funds. This requirement also applies to all forms of "local government" which has been defined by the Federal Emergency

Management Administration (FEMA) to include counties, cities, school districts, special districts, Indian tribes, and other small and large governmental entities. Based on that broad requirement, the State Office of Emergency Services (OES) and FEMA have encouraged multi-jurisdictional hazard mitigation plans, and this plan has bee designed to serve a multi-jurisdictional function. Besides the County of Tuolumne, this plan serves the jurisdictions of the City of Sonora, the Tuolumne Utilities District (TUD), the Sonora Union High School District, the Groveland Community Services District, Columbia College and the Jamestown Sanitary District. Later versions of this plan may also include other jurisdictions, because broadening the multi-jurisdictional function is the intention of Tuolumne County.

Mitigation planning has the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of mitigation is that current dollars invested in mitigation practices will significantly reduce the demand for future dollars by lessening the amount needed for emergency recovery, repair and reconstruction. Further, these mitigation practices will enable local residents, businesses and industries to re-establish themselves in the wake of a disaster, getting the community economy back on track sooner and with less interruption.

Mitigation planning will also lead to benefits that go beyond solely reducing hazard vulnerability. Measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community goals, such as preserving open space, maintaining environmental health and natural features, and enhancing recreational opportunities.

Tuolumne County, with a population of 54,501[1] persons, is located in a region of California that is particularly vulnerable to the effects of a range of natural hazards. These hazards threaten the life and safety of County residents, and have the potential to damage or destroy both public and private property and disrupt the local economy and overall quality of life. The County government, its residents and businesses have in fact suffered disaster losses in years past that resulted in significant property damage and the loss of life.

Tuolumne County has an established commitment to reducing the potential for future disaster losses. With the majority of the County land area owned or controlled by Federal agencies, there is a large amount of development within or proximate to the public forests. Development in proximity to the higher elevations, steeper slopes, and within the wildland/urban interface places structures and residents close to fire prone lands, and far from fire protection units, water supplies and other services. There are numerous successful efforts to work with private land owners and public agencies to reduce the potential for catastrophic fires and aid evacuation planning. There are also a significant number of policies and programs identified in the Tuolumne County General Plan to carefully plan development projects in light of the hazards, and promote safe, thoughtful growth.

In an effort to sustain this local commitment to hazard mitigation, Tuolumne County has prepared this first version of a Hazard Mitigation Plan (2004). At its most inner core, the Plan recommends specific actions to combat or accommodate the forces of nature and protect its residents from hazard losses. These actions go beyond simply recommending localized solutions to reduce existing vulnerability, such as promoting projects like fuel reduction and fire breaks. Local policies on community growth and development, goals to

[1] According to the 2000 Census

improve or protect important infrastructure, and public awareness and outreach activities are examples of other actions considered to reduce Tuolumne County's future vulnerability to natural hazards. The Plan has been designed to be a living document with implementation and evaluation procedures included to help achieve meaningful objectives and successful outcomes.

B. PURPOSE

The purpose of this Hazard Mitigation Plan is:

- To protect life, safety and property by reducing the potential for future damages and economic losses that result from natural hazards;
- To qualify for additional grant funding, in both the pre-disaster and post-disaster environment;
- To speed recovery and redevelopment following future disaster events;
- To demonstrate a firm local commitment to hazard mitigation principles; and
- To comply with both state and federal legislative requirements for local hazard mitigation plans.

C. SCOPE

This Hazard Mitigation Plan will be maintained to address the hazards determined to be "high risk" and "moderate risk". Other hazards may be considered, but those are not required to be as fully addressed within this Plan as will those hazards of high or moderate risk.

The geographic scope for the Hazard Mitigation Plan includes all unincorporated areas of Tuolumne County, and the incorporated area of the City of Sonora. Most of the other participating jurisdictions are sub-areas of the County and/or City; and exist as districts or special districts that provide services such as education, utilities, fire protection or similar community services. There are two exceptions among the participating jurisdictions: Columbia College and Tuolumne Band of Me-Wuk. The Columbia College campus is found within Tuolumne County, but it is part of the larger Yosemite Community College District that serves Tuolumne County and other counties. The Tuolumne Band of Me-Wuk Indians govern the Tuolumne Rancheria which is held in trust by the federal government. Although located entirely within the overall geographic boundary of the County, the trust status gives the Rancheria and Tuolumne Band a special standing as a sovereign governmental entity.

The organization of this Plan was intended to serve two purposes: as the Hazard Mitigation Plan for the County of Tuolumne, while at the same time functioning as a multi-jurisdictional plan. Therefore, the main body of the Plan serves the purpose of fulfilling the hazard

mitigation plan requirements for the County of Tuolumne. The main body of the Plan plus the appropriate appendix serves the hazard mitigation plan requirements for each of the participating jurisdictions. Chapter II, Hazard Identification and Analysis, and Chapter III, Community Vulnerability Assessment address the broad scope of hazard risks for the County, as well as for most of the participating jurisdictions. Any additional hazards or vulnerabilities or any unique characteristics of any of the participating jurisdictions are addressed within their appendix. Chapter IV, Mitigation Considerations, has two main parts: Mitigation Capabilities and Strategy. The Mitigation Capabilities section focuses on the County of Tuolumne, and each of the participating jurisdictions has a comparable section in their appendix. The Strategy section gives the details of the Mitigation Actions proposed for the overall Plan, and focuses on not only those Actions appropriate for just the County of Tuolumne, but also on any Mitigation Action that involves more than one of the participating jurisdictions. For example, an Action that requires review and updating of the County's fire codes would be found in Chapter IV, as would an Action that involves participation of two different water purveying districts. However, an Action that involves only one district would be found within the appendix written by that District.

E. PARTICIPANTS IN THE PLANNING PROCESS

The following table lists those jurisdictions that have been a part of multi-jurisdictional process, and therefore, are considered to have fulfilled their obligations towards the preparation of a hazard mitigation plan with the adoption of this Plan.

Participating Jurisdictions
County of Tuolumne
Sonora Union High School District
Tuolumne Band of Me-Wuk
City of Sonora
Tuolumne Fire Protection District
Mi-Wuk Sugar Pine Fire Protection District
Tuolumne Utilities District
Twain Harte Community Services District
Columbia College
Columbia Fire Protection District
Groveland Community Services District
Jamestown Sanitary District
Jamestown Fire Protection District

The participants in the development of this Hazard Mitigation Plan included the persons listed in the following table, who have participated in or attended meetings of the *Tuolumne County Mitigation Plan Advisory Committee:*

Participants in Meetings	
Name	**Agency /Community**
Greg Applegate	City of Sonora City Manager
Mike Barrows	City of Sonora Fire Department
Ed Wyllie	City of Sonora Community Development / Public Works
Lynn Martin	Columbia College
Preston Birdwell	Columbia College Fire Department
Randy Nickley	Columbia Fire Protection District
Glen Nunnelley	Condor Earth Technologies
Bret Beaudreau	Groveland Community Services District
V. J. DeBouver	Groveland Community Services District
Shane Warner	Groveland Community Services District
Steve Williamson	Groveland Community Services District
Gerardo Alvarez	Groveland Community Services District
John Hardin	Highway 108 Fire Safe Council
Rod Horne	Highway 108 Fire Safe Council
Ray Parsons	Jamestown Fire Protection District
L. S. Thomas	(interested citizen)
Jack C. Lewis	Jamestown Sanitary District
Ron Boyd-Snee	Jamestown Sanitary District
Sonny Hernandez	Mi-Wuk Sugar Pine Fire Protection District
Ivan Clay	Sierra Conservation Center
Ty Rawlingson	Sierra Conservation Center
Peggy Abrille	Sonora Union High School District
Tom James	SouthWest InterFace Team (SWIFT)
Stan Anderson	Tuolumne Band of Me-Wuk
Jim Pingree	Tuolumne Band of Me-Wuk
Maureen Frank	Tuolumne County Administration Office
Steve Boyack	Tuolumne County Administration Office
Rocky Wolf	Tuolumne County Alliance for Resources and Environment (TuCARE)
Ken Caetano	Tuolumne County Assessor/Recorder's Office
James Montgomery	Tuolumne County Community Development Dept /GIS
Larry Beil	Tuolumne County Community Development Dept /GIS
Bev Shane	Tuolumne County Community Development Dept.
Michael McGee	Tuolumne County Environmental Health Division
Mike Noonan	Tuolumne County Fire Department / CDF
Barry Bynum	Tuolumne County Public Works Dept.
Randy Murphy	Tuolumne County Public Works Dept.
Kevin Patton	Tuolumne Fire Protection District
George Hill	Tuolumne Utilities District
Leonard Mauro	Tuolumne Utilities District
Tom Scesa	Tuolumne Utilities District

Participants in Meetings	
Name	**Agency /Community**
Don Kasso	Twain Harte Community Services District
Paul Krawchuk	Twain Harte Community Services District
Bob Kempvanee	Twain Harte Community Services District – Fire/Rescue
Teri Woodward	US Bureau of Reclamation
Gary Cones	US Forest Service, Stanislaus National Forest
Jerry McGowan	US Forest Service, Stanislaus National Forest
Joanne Larsen	US Forest Service, Stanislaus National Forest
Millie Beranek	Yosemite Foothills Fire Safe Council
Nancy Longmore	Yosemite Foothills Fire Safe Council

The list of participants in the above table includes the primary representatives of the participating jurisdictions in this multi-jurisdiction plan. More details on the representatives of the jurisdictions and the overall planning process are found in Appendix B, Documentation of the Planning Process.

In addition, the status of the effort to draft this plan involved presentations and consideration by the Tuolumne County Board of Supervisors Planning Committee, an appointed advisory committee to the Board of Supervisors. Additional detail on that part of the planning process is also available in Appendix B.

D. AUTHORITY

This Multi-Jurisdiction Hazard Mitigation Plan has been adopted by the Tuolumne County Board of Supervisors, and by the approval bodies of all of the other participating jurisdictions. This Plan has been developed to be in accordance with current rules and regulations governing local hazard mitigation plans. The Plan shall be routinely monitored to maintain compliance with the Robert T. Stafford Disaster Relief and Emergency Assistance Act as amended by the Disaster Mitigation Act of 2000 (Public Law 106-390 – October 30, 2000); and all related laws and regulations.

F. DESCRIPTION OF THE PLANNING PROCESS

Tuolumne County utilized the process recommended by the California Office of Emergency Services (OES) to develop this Hazard Mitigation Plan. In short, the process included the following steps, listed in the order in which they were undertaken:

1. Hazard Identification and Analysis
2. Community Vulnerability Assessment
3. Mitigation Capabilities Assessment
4. Mitigation Strategy
5. Mitigation Action Plan and Implementation Program

Step 1, the *Hazard Identification and Analysis,* describes and analyzes the natural hazards present in Tuolumne County that can threaten human life and damage property. It includes historical data on past hazard occurrences, and establishes hazard profiles.

Step 2, the *Community Vulnerability Assessment,* was completed predominantly through investigative research along with the use of geographic information system (GIS) technology and best available data. It includes tabular and narrative descriptions on community characteristics, such as Tuolumne County's geographic, economic and demographic profiles, and discusses future development trends and implications for hazard vulnerability. To graphically depict hazard vulnerability, this chapter also includes community vulnerability assessment maps. Also included is a qualitative risk index based upon hazard frequency, magnitude and impact. Conclusions of both the quantitative and qualitative nature of risk and vulnerability form the basic foundation for concentrating and prioritizing mitigation efforts.

Step 3, the *Mitigation Capabilities Assessment,* provides a comprehensive examination of Tuolumne County's capacity to implement meaningful mitigation strategies, and identifies existing opportunities for program enhancement. Capabilities addressed in this chapter include staff and organizational capability, technical capability, policy and program capability, fiscal capability, legal authority and political willpower. The purpose of this assessment is to identify any existing gaps, weaknesses or conflicts in local programs/activities that may hinder mitigation efforts, or to identify those local activities that can be built upon in establishing a successful community hazard mitigation program.

The conclusion of these three background studies results in the formation of community goal statements (Step 4) and sets the stage for developing, adopting and implementing a meaningful Hazard Mitigation Strategy (Step 5) for Tuolumne County. These two steps help make the Plan strategic and functional for implementation purposes, and ultimately are the "action" components of the plan. Following the completion of Step 5, Tuolumne County concentrated on designing measures to ensure the Plan's ultimate implementation, and adopted evaluation and enhancement procedures to ensure the Plan is routinely updated.

Meetings - The Plan was prepared through a coordinated effort among the participating jurisdiction and other interested agencies and parties, highlighted by a series of coordination meetings and presentations. These steps are explained in detail in Appendix B, Documentation of the Planning Process.

II. Hazard Identification and Analysis

The United States and its communities are vulnerable to a wide array of natural hazards that threaten life and property. Due to the geographic characteristics of each location, not all of the typical hazards that may affect other parts of the United States, or even California, are a threat in Tuolumne County. This Chapter will address all of the typical hazards that can be encountered throughout much of the United States, but only in detail for those that truly present a threat to Tuolumne County. Each of the primary hazards will be addressed first from a general, national perspective, followed by a local perspective. Where available, historical records will be used to help identify risk. Other analytical tools will also be used, whenever those are available. This Chapter also provides maps that illustrate the location and spatial extent for those hazards within Tuolumne County that have a recognizable geographic boundary (i.e., hazards that are known to occur in particular areas such as the 100-year floodplain). For those hazards not confined to a particular geographic area (such as earthquakes and storms), general information on their applicable intensity across the entire jurisdiction is provided.

This Chapter provides a treatment for all of the typical natural hazards included on the list below. For each hazard, the general nature of the hazard will first be discussed, followed by a treatment of the local nature of that hazard. If that hazard is found in Tuolumne County, then that treatment will be extensive, and include an assessment of the location and spatial extent of the event as well as best available data regarding the impact on the County.

- **Wildfire**
- **Floods**
- **Dam/Levee Failure**
- **Earthquakes, Sinkholes and Landslides**
- **Winter Storms**
- **Volcano**
- **Drought/Extreme Heat**
- **Erosion**
- **Severe Thunderstorms and Tornadoes**
- **Hurricanes, Tropical Storms and Nor'easters**
- **Tsunami**

Wildfire

1. General Description of Wildfire Hazard from National Perspective

A wildfire is any fire occurring in a wildland area (i.e. grassland, forest, brush land) except for fire under prescription.[1] Wildfires are part of the natural management of the Earth's ecosystems, but may also be caused by natural or human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

There are three classes of wildland fires: surface fire, ground fire, and crown fire. A surface fire is the most common of these three classes and burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. Wildland fires are usually signaled by dense smoke that fills the area for miles around.

On Sunday, August 6, 2000, several forest fires converged near Sula, Montana, forming a firestorm that overran 100,000 acres and destroyed 10 homes.(Photo by John McColgan/U.S. Forest Service Firefighter)

State and local governments can impose fire safety regulations on home sites and developments to help curb wildfire. Land treatment measures such as fire access roads, water storage, helipads, safety zones, buffers, firebreaks, fuel breaks, and fuel management can be designed as part of an overall fire defense system to aid in fire control. Fuel management, prescribed burning, and cooperative land management planning can also be encouraged to reduce fire hazards.

Fire probability depends on local weather conditions, outdoor activities such as camping, debris burning, and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural disasters (tornadoes, hurricanes, etc.) increase the probability of wildfires in both urban and rural settings. Drought can increase fuel while forest damage from severe storms may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities.

Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses, and industries are located within high fire hazard areas. The increasing demand for outdoor recreation places more people in wildlands during holidays, weekends, and vacation periods. Unfortunately, wildland residents and visitors are sometimes not educated or prepared for the inferno that can sweep through the brush and timber and destroy property in minutes.

[1] Prescription burning, or a "controlled burn," undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

2. Wildfire Hazard in Tuolumne County

Of the over 2,216 square miles that make up Tuolumne County, approximately 70% are federally owned or controlled. The majority of the federal land is either part of Yosemite National Park, or the Stanislaus National Forest, which own or administer most of the eastern portion of the County in the higher elevations of the Sierra. Nearly all of this land is forested to some extent, as is much of the remaining sections of the County. Even the lower elevations of the County in the western extreme, which include blue oak and grass savannah are subject to wildfires.

Photo of Creek Fire, Southern Tuolumne County, 2001
(Tuolumne County Fire Prevention Bureau)

In California, the occurrence of large, damaging wildfires is increasing each year. Tuolumne County has had a long history of major wildfires resulting in the loss of life and property. The fuel models, topography, weather, urban interface and urban intermix combine for extreme fire behavior problems. The long history of devastating fires has caused cohesion and good working relationship between fire agencies within the county.

Within Tuolumne County, in 2003, there were 192 fires within the State Responsibility Area (SRA). The causes of these fires vary. In 2001, a major fire in the southern Tuolumne County area, “The Creek Fire” resulted in the burning of thousands of acres of wildlands, 70 structures, watershed disruption, death of hundreds of livestock, and burning of multiple vehicles.

Multiple fires, some of which grow into the large devastating fires that cause huge loss, occur as the result of many factors. One such factor is the population increase in Tuolumne County. The urban interface within Tuolumne County is significant. Whereby, there are large populations within communities located in the grass, brush, and timber lands. Outside of these communities the County experiences rural sprawl which lends itself to having pockets of homes and/ or individual homes scattered throughout the wildlands.

There are many causes of wildland fires but it is important to understand that not only are the structures within the County a threat from wildland fires but the wildlands are threatened by the people living within the structures. The following Table II-1 depicts the causes of fires within the SRA for 2003.

Table II-1. Causes of Fires With Tuolumne County State Response Area for Fire Season 2003

Cause	Number of Events
Miscellaneous	23
Playing with fire	18
Electrical Power	3
Railroad	0
Vehicle	45
Equipment use	25
Arson	19
Debris burning	13
Smoking	9
Campfire	10
Lightning	16
Undetermined	11
Total	**192**

Not only do the fire services within the county have to be aware of the local population, but also fire prevention activities must be geared toward the high tourist activity. There are over two million visitors annually to Tuolumne County. Many of these tourists come to enjoy the wildlands in the form of camping, hunting, fishing and other outdoor activities. The high use on the lands is another catalyst for human caused fires.

Heavy fuel loading is a factor which contributes to the large wildland fires. A typical Tuolumne County fire season starts in the spring and the first wildland fires occur in the “front country”, or the lower elevations which experience less rainfall and therefore dries out more quickly. The lighter fuels typical of brush and grass have cured and are receptive to fire. The fuels within the county continue to dry throughout the summer months and the live fuel moistures become critical lending themselves to rapid fire spread. The brush lands tend to begin active sustained burning in June and July and continue until significant rainfall occurs. The timber fires typically begin sustained burning in July and will continue supporting vigorous burning conditions until significant storms saturate the forests. All of these generalities will be affected by unusual droughts, bug kills, or other factors increasing the dead to live fuel ratios within the fuel models.

Tuolumne County has topography which draws millions of visitors because of its splendor. This splendor equated into the fire environment means steep terrain which helps spread wildland fires. The complexity of these fires is well documented and can largely be tied to the significant changes in elevation, substantial river drainages and confluences within these drainages systems.

It is a well known fact that increases in elevation will enhance the rate of spread of a wildland fire. Because Tuolumne County is a mountainous county it has many of its communities located within prominent topographic features. At many different elevations of the topography are found structures and consequently a contributing factor for constant structural threat by wildland fire.

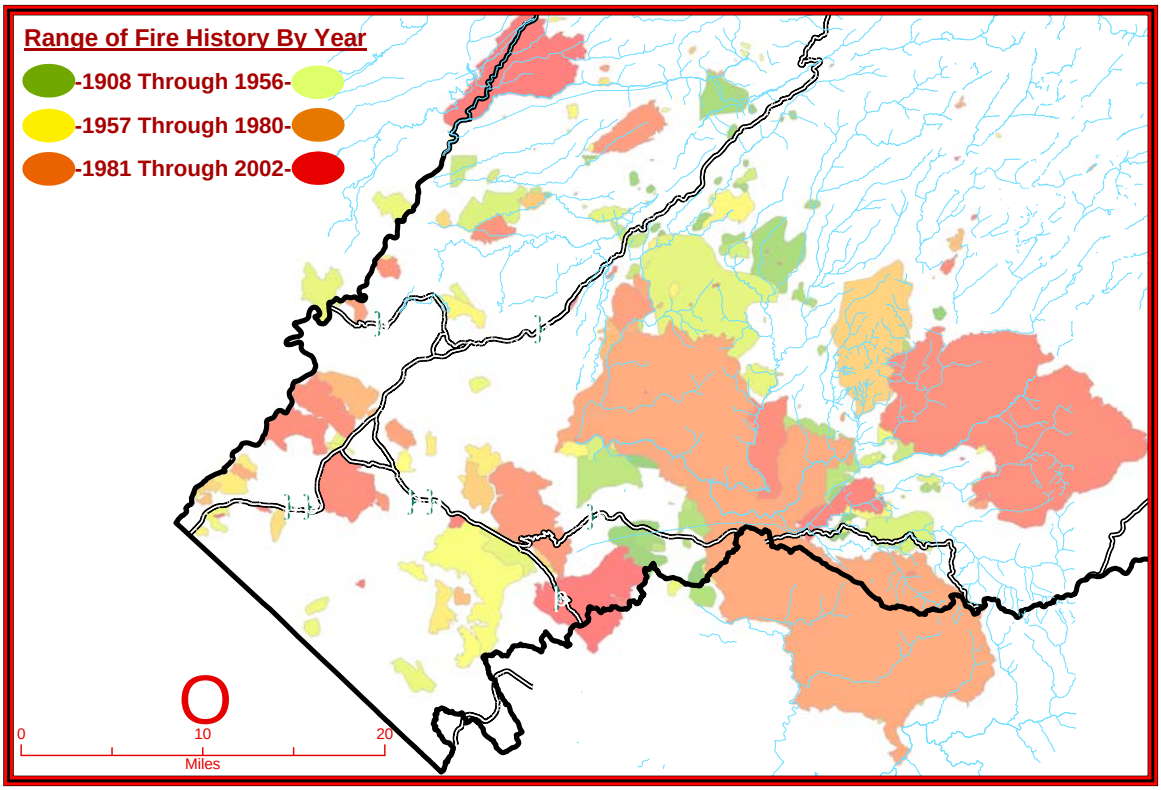
Energy on a wildland fire is significantly charged when the fires reach drainages. The vast watershed system found in the county often experiences these conditions during wildland fires. The adverse fire behavior can become deadly when these elements align within drainages, not only to the fire fighters but to the residents whom live in such areas.

The number one factor influencing wildland fires is the weather. The primary weather element increasing the spread of a wildland fire is the wind. In Tuolumne County, the general local wind pattern in the summer during a high pressure system is that known as upslope/up canyon during the day and down slope/down canyon during the late evening/ early morning. This is caused by topographic heating and cooling whereby air rises when heated and sinks when cooled. There are many weather phenomena which can increase and change the wind. When there are alterations in the weather pattern, such as a front, the winds often increase and can override the local wind patterns. When there is such an increase in winds, wildland fires can become dangerous and erratic.

The elements and factors found within Tuolumne County have lead to a well documented occurrence of large devastating wildland fires, evidence that these fires will occur in the future. Fire agencies within Tuolumne County and surrounding areas have become interdependent to combat and prevent such fires. These relationships must be fostered and maintained at the highest level to help prevent future catastrophes.

The history of burning is documented by the following graphic, Figure II-1, which shows a historical look at some of the areas in the Stanislaus National Forest which have burned during the period 1908 to 2002, and some of the private lands of Tuolumne County which have burned between 1950 and 2002.

Figure II-1
Fire History Map of Tuolumne County

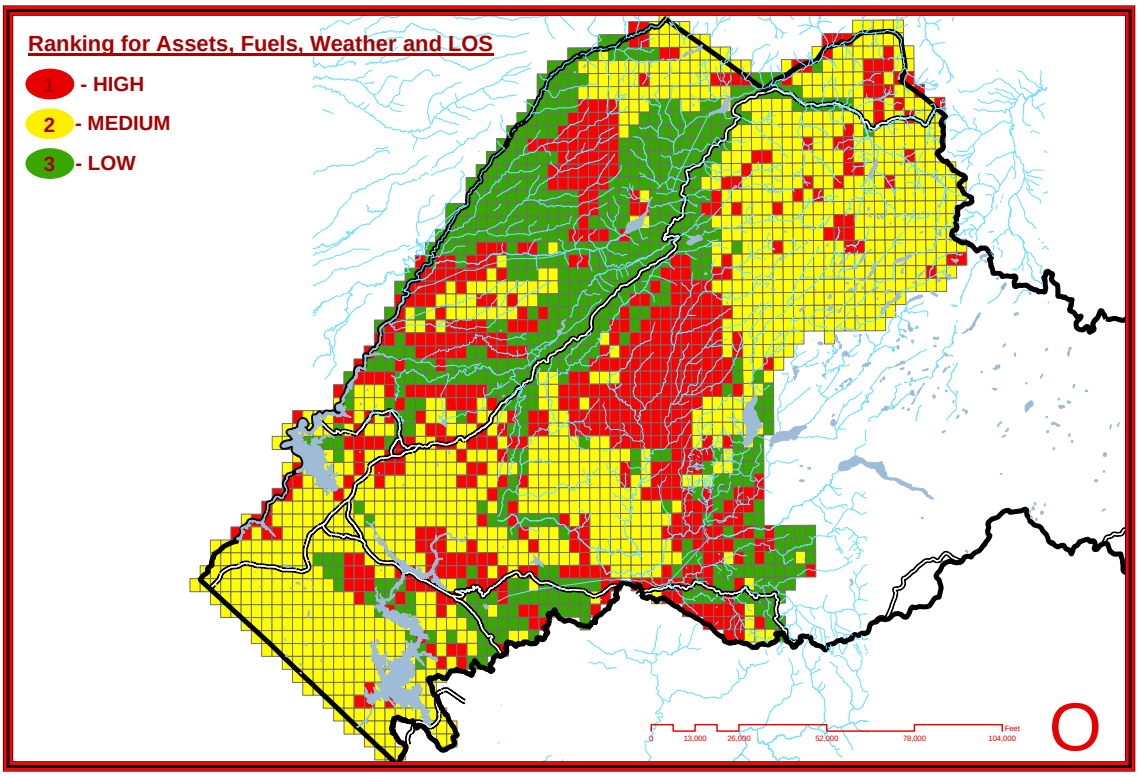


The preceding graphic demonstrates that even during the era of wildfire suppression, wildfires have affected significant portions of Tuolumne County, and can happen almost anywhere. The records used to create the graphic show that there have been 1,524 fire events recorded, plus more that were smaller than the criteria used to assemble this graphic (the minimum fire size used to make this graphic has varied from agency to agency and over the period). Of course, fire hazards vary not only seasonally, but year to year dependent on winter rainfall/snow levels, summer temperature variations, etc. However, a simple mean calculation shows that during the "average" year, Tuolumne County experienced 29 wildfire events that got recorded. During this typical year, over 43,000 acres were burned. Once again, the actual area burned each season varied widely from year to year, but is an indication that the historical record shows wildfire to be a significant hazard in Tuolumne County.

It is also valuable to attempt to quantify or categorize the existing risk levels for wildfire in the County. In an effort to map wildfire potential in Tuolumne County, GIS-based data was obtained from the California Division of Forestry and Fire Protection (CDF) that breaks the majority (not including Yosemite National Park) of the County down into rectangular shaped polygons. Each polygon represents 1/9 of the area included within a USGS 7.5 minute quadrangle map. A large number of attributes have been assembled for each

polygon that in some way address fire potential and risk. These attributes include factors for slope, vegetation type, aspect, accessibility and other factors related to the potential for burning or for suppressing fires. Other factors such as housing density, water supply, and value of assets such as structures and wildlife habitat are included as attributes to give value to what can be lost if the polygon burns. There are grouping of various attributes to arrive at ranking criteria, and the most illustrative is the combined ranking for assets, fuels, weather, and LOS which stands for level of service (greater distance from firefighting stations and lesser accessibility via road networks creates a lower level of service). This combined ranking divides the polygons into low, medium, and high ranks, the highest having the worst fuels, weather, and level of service, and the greatest number of assets at risk. The following graphic, Figure II-2, shows the combined ranking for the majority of Tuolumne County.

Figure II-2. Wildfire Potential in Tuolumne County



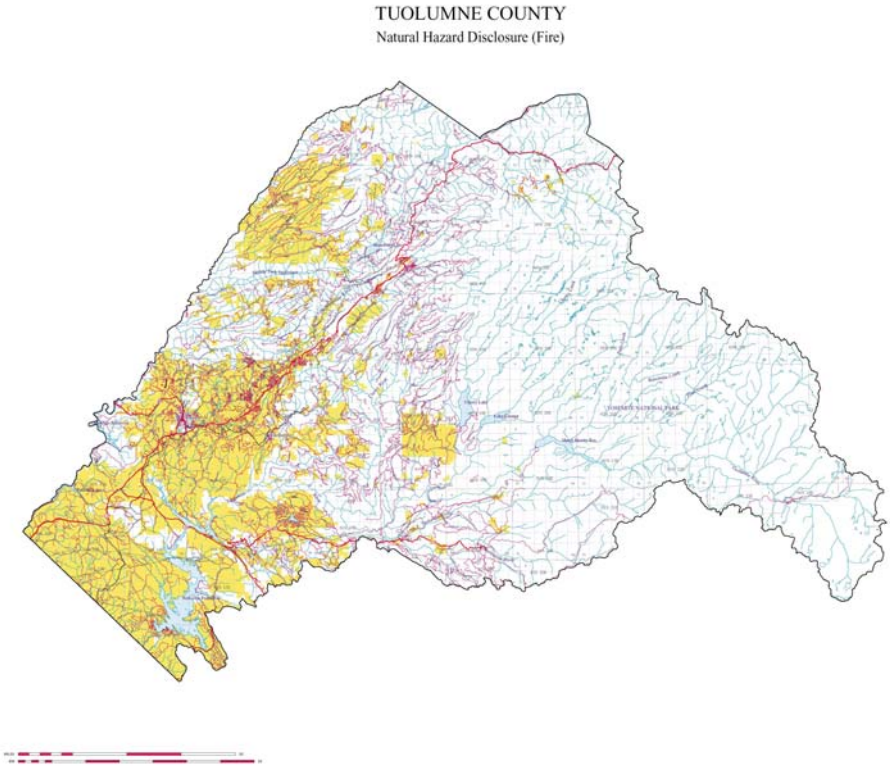
Source: California Division of Forestry and Fire Protection, Tuolumne-Calaveras Ranger District.

The above graphic demonstrates the generally high level of wildfire potential in Tuolumne County, using the available datasets obtained from the California Division of Forestry and Fire Protection. Use of level of service in the production of this rating system could be misleading, as some areas along the highways (highways are marked with lines without a ranking color) in the middle area of the County appear to have a low ranking. The adjoining polygons are rated green (low) based on the presence of the highway and

therefore a high level of accessibility, or level of service. This could be misleading as the fuel values in these forested areas are quite high, as are the numbers of developed properties. In general, the wildfire risks are very high there as well, although that is unable to be demonstrated using these available data. Despite that misgiving, Figure II-2 is included for purposes of discussion, and to show the overall high to extremely high potential for wildfire in Tuolumne County.

The State of California requires real estate sellers to disclose certain information about properties as disclosure items. The California Division of Forestry and Fire Protection (CDF) maintains Natural Hazard Disclosure (Fire) maps which show the two types of fire hazard areas referred to in legislation as disclosure items in real estate transactions. These areas are: (1) wildland areas that may contain substantial forest fire risks and hazards, and (2) very high fire hazard severity zones. According to the legislation that initiated this requirement, the primary distinction is that the wildland zones are those that are State Responsibility Areas (SRA), while, at least for Tuolumne County, the very high fire hazard severity zones, are those private lands that are not part of the SRA. The SRA in Tuolumne County are the privately owned properties where CDF is the primary agency responsible for wildfire suppression. The non-SRA areas are either property owned or controlled by the Federal Government, or another governmental entity such as an irrigation district, or the City of Sonora or the community of Tuolumne, where their fire districts are the first responder to fire calls. The private-owned lands of those communities are then considered within a very high fire hazard severity zone. The following graphic, Figure II-3, from CDF shows that the wildland areas clearly make up the vast majority of the County subject to typical growth and development.

FIGURE II-3. Natural Hazard Disclosure Areas for Fire



Outside of City of Sonora and townsite of Tuolumne, all private land is considered within a wildland fire area that may contain substantial forest fire risks and hazards.

FLOODS

1. General Description of Flooding Hazard from National Perspective

Flooding is the most frequent and costly natural hazard in the United States, a hazard that has caused more than 10,000 deaths since 1900. Approximately 90 percent of presidentially declared disasters result from natural hazard events with flooding as a major component.

Floods are generally the result of excessive precipitation, and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time; and flash floods, the product of heavy localized precipitation in a short time period over a given location. The severity of a flooding event is determined by the following: a combination of stream and river basin topography and physical geography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing.

General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters, and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Entire communities lie underwater for days—and in some cases weeks—as a result of Hurricane Floyd, which impacted the East Coast in September 1999. (Photo courtesy of North Carolina Division of Emergency Management)

Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. However, flash flooding events can also occur from accelerated snow melt due to heavy rains, a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by an ice jam. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces. Flash flood waters move at very high speeds—"walls" of water can reach heights of 10 to 20 feet. Flash flood waters and the accompanying debris can uproot trees, roll boulders, destroy buildings, and obliterate bridges and roads.

The periodic flooding of lands adjacent to rivers, streams, and shorelines (land known as floodplain) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude

and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood and the 100-year floodplain by the 100-year flood. Flood frequencies such as the 100-year flood are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1 percent chance of occurring in any given year. Table II-2 shows flood damage values by fiscal year from a national perspective.

Table II-2. National Flood Damage by Fiscal Year (October-September)

Fiscal Year	Damage (Thousands of Current Dollars)	Implicit Price Deflator	Damage (Millions Of 1995 Dollars)	U.S. Population (Millions)	Damage Per Capita (1995 Dollars)
1960	111,168	0.22620	491	180.671	2.72
1961	147,680	0.22875	646	183.691	3.51
1962	86,574	0.23180	373	186.538	2.00
1963	179,496	0.23445	766	189.242	4.05
1964	194,512	0.23792	818	191.889	4.26
1965	1,221,903	0.24241	5041	194.303	25.94
1966	116,645	0.24934	468	196.560	2.38
1967	291,823	0.25698	1136	198.712	5.71
1968	443,251	0.26809	1653	200.706	8.24
1969	889,135	0.28124	3161	202.677	15.60
1970	173,803	0.29623	587	205.052	2.86
1971	323,427	0.31111	1040	207.661	5.01
1972	4,442,992	0.32436	13698	209.896	65.26
1973	1,805,284	0.34251	5271	211.909	24.87
1974	692,832	0.37329	1856	213.854	8.68
1975	1,348,834	0.40805	3306	215.973	15.31
1976	1,054,790	0.43119	2446	218.035	11.22
1977	988,350	0.45892	2154	220.239	9.78
1978	1,028,970	0.49164	2093	222.585	9.40
1979	3,626,030	0.53262	6808	225.055	30.25
1980	No data	0.58145	0	227.225	0.00
1981	No data	0.63578	0	229.466	0.00
1982	No data	0.67533	0	231.664	0.00
1983	3,693,572	0.70214	5260	233.792	22.50
1984	3,540,770	0.72824	4862	235.825	20.62
1985	379,303	0.75117	505	237.924	2.12
1986	5,939,994	0.76769	7737	240.133	32.22
1987	1,442,349	0.79083	1824	242.289	7.53
1988	214,297	0.81764	262	244.499	1.07
1989	1,080,814	0.84883	1273	246.819	5.16
1990	1,636,366	0.88186	1856	249.464	7.44
1991	1,698,765	0.91397	1859	252.153	7.37
1992	672,635	0.93619	718	255.030	2.82
1993	16,364,710	0.95872	17069	257.783	66.22
1994	1,120,149	0.97870	1145	260.327	4.40
1995	5,110,714	1.00000	5111	262.803	19.45

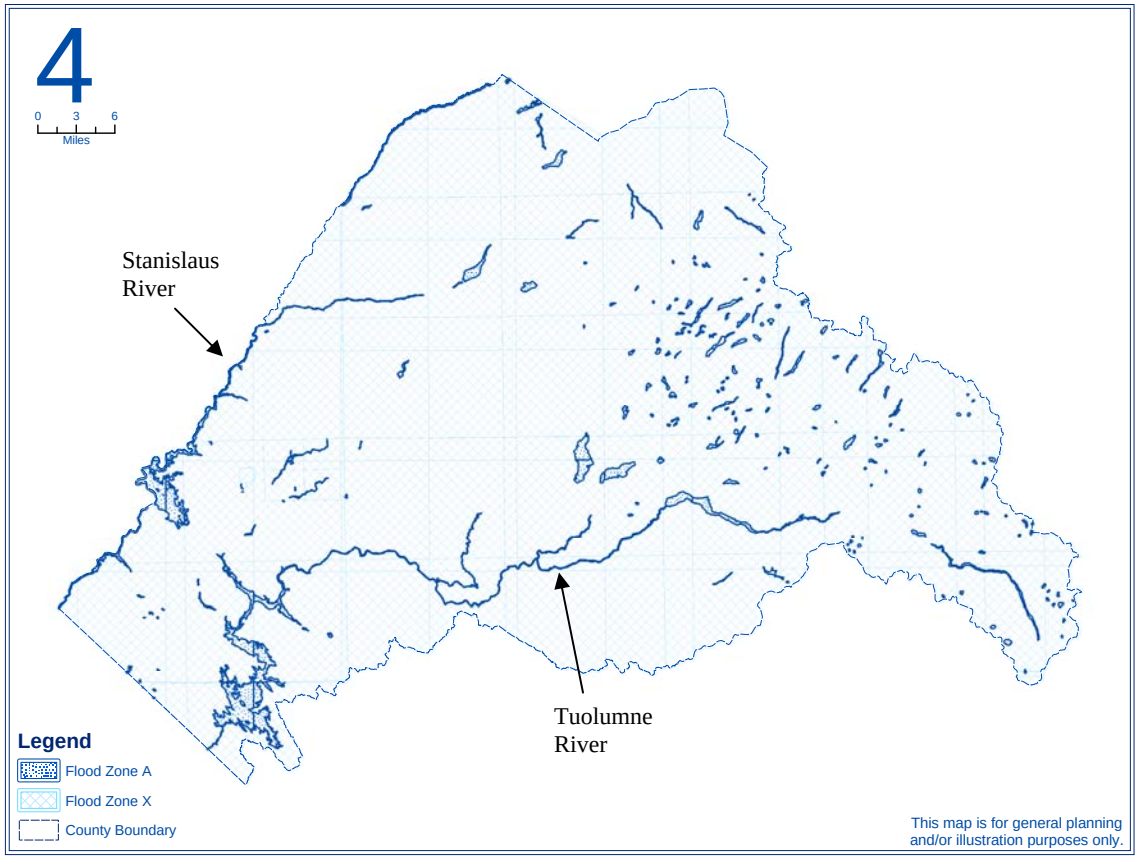
1996	6,121,753	1.01937	6005	265.229	22.64
1997	8,934,923	1.03925	8597	267.784	32.11
1998	2,465,048	1.05199	2343	270.248	8.67
1999	5,450,375	1.06718	5107	272.691	18.73
2000	1,336,744	1.08960	1227	282.125	4.35
2001	7,158,700	1.11539	6418	284.797	22.54

Source: National Weather Service

2. Flood Hazard in Tuolumne County

Tuolumne County's flood potential is strongly affected by the physical geography of the County. Located on the western slope of the Sierra Nevada and in an area of moderate seasonal rainfall, the runoff characteristics of the watersheds strongly determine the possibility of flooding. Due to the elevation of much of the watersheds of Tuolumne County, much of the precipitation is in the form of snowfall, which melts over a long duration with snow prevailing at the higher elevations long into the summer. The overall slope of the watersheds is relatively steep, and most of the higher elevations of Tuolumne County is owned or controlled by Federal agencies, and therefore not subject to private ownership or development. The two main watersheds that form the County are all of the upper Tuolumne River, and a significant portion of the upper Stanislaus River. Both are dammed in the lower elevations along much of the streamcourses, and are mostly contained within government or special district ownership. Therefore, except for a few tributaries, the larger rivers and the immediate environs are not in areas where much private development can occur. In addition, due to the overall gradient of the streams and rivers, they reside within relatively steep canyons or valleys, with very little floodplain has been formed. FEMA has published Flood Information Rate Maps, which are available to local jurisdictions to show where modeling has shown the 100 year floodplains to be. The following graphic, Figure II-4 shows where the FIRM indicate floodways to exist in Tuolumne County.

Figure II-4. Potential Flood Hazard Areas Countywide



There have been examples of localized flash flooding, particularly where development has occurred in the watersheds without adequate improvement of drainage systems to accommodate the reduced infiltration and increased runoff that usually results. This typically occurs in the urbanized areas where there has been minor floodplain formation, or where natural runoff is blocked by inadequate culverts or other obstacles. These flash flooding events are directly related to significant rainfall events, usually during the winter or spring rainy season. Therefore, all further discussion of localized or flash flooding will be addressed under the heading of “storms” rather than floods.

Dam/Levee Failure

1. General Description of Dam/Levee Hazard from National Perspective

Worldwide interest in dam and levee safety has risen significantly in recent years. Aging infrastructure, new hydrologic information, and population growth in floodplain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation and maintenance.

There are about 80,000 dams in the United States today, the majority of which are privately owned. Other owners include state and local authorities, public utilities, and federal agencies. The benefits of dams are numerous: they provide water for drinking, navigation, and agricultural irrigation. Dams also provide hydroelectric power, create lakes for fishing and recreation, and save lives by preventing or reducing floods.

Dam failure can result from natural events, human-induced events, or a combination of the two. Failures due to natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. The most common cause of dam failure is prolonged rainfall that produces flooding. (Photo: Michael Baker Corporation)

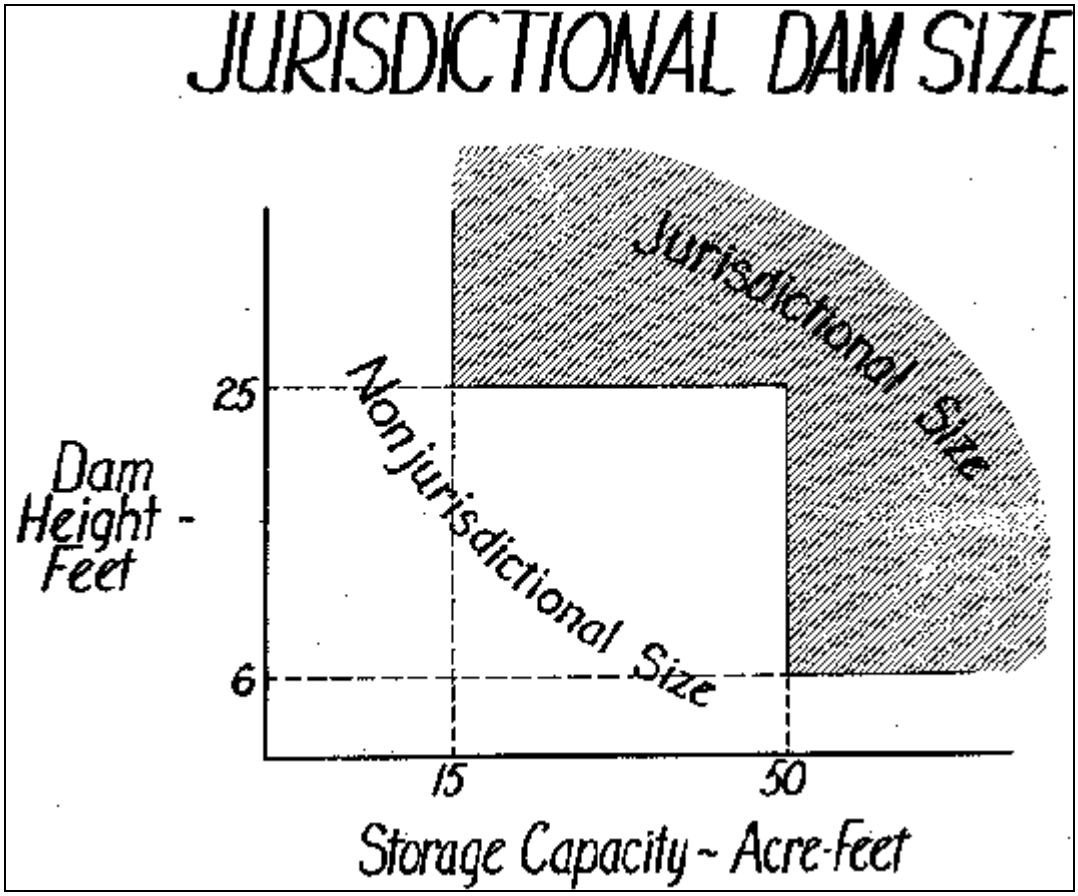
Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream of the dam. If a levee breaks, scores of properties are quickly submerged in floodwaters and residents may become trapped by this rapidly rising water. The failure of dams and levees has the potential to place large numbers of people and great amounts of property in harm's way.

2. Dam/Levee Failure Hazard in Tuolumne County

Tuolumne County has a significant number of large and small dam structures with impoundments, but no levees. Therefore, only the potential for dam failure will be considered further.

There is an historical record since the Gold Rush days of the mid 19th Century of the construction and use of dams as water reservoirs. During the Gold Rush, the water was used primary to wash placer gold deposits from the stream sediments, particularly during the summer months in the lower elevations when surface water is not normally available. Many of the dams were constructed of logs and other primitive construction, and there were failures of some of the impoundments with castastrophic results including loss of lives and property. Although remnants of the miners' water delivery system of canals and reservoirs are still in service, all of the impoundments have been subjected to modern engineering and regulation, and are no more prone to failure than any other dam and impoundment. The State Division of Safety of Dams regulates the construction, maintenance, and overall safety of all substantial impoundments that meet the minimum jurisdictional size threshold. The following graphic, Figure II-5 shows the jurisdictional size:

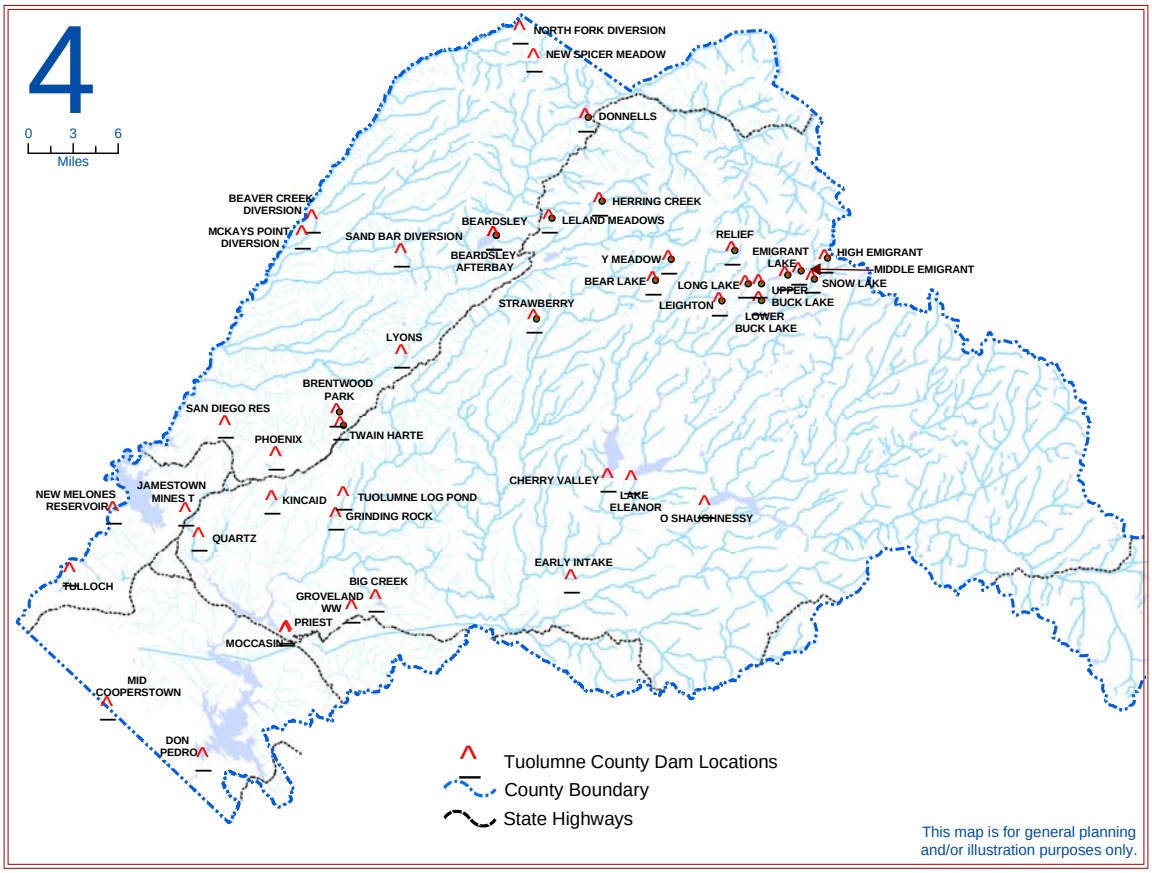
Figure II-5. Chart Indicating Jurisdictional Dam Size for California Division of Safety of Dams



Source: The California Division of Safety of Dams web page.

There are a significant number of dams in Tuolumne County. These range from dams creating large reservoirs intended to provide sources for irrigation, water supply, or power generation, to smaller impoundments which are part of water distribution or treatment systems or intended to provide a recreational amenity for visitors or residents. The following Figure II-6 shows the distribution of all of the larger impoundments found in Tuolumne County and many of the smaller dams as well.

Figure II-6. Location of Dams of Significant Size in Tuolumne County



The modern design standards for dams include significant safety factors that make dam failure a very low risk.

Earthquakes, Sinkholes and Landslides

Earthquake

1. General Description of Earthquake Hazard from National Perspective

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quick sand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth's outer crust. These fault planes are typically found along borders of the Earth's ten tectonic plates. These plate borders generally follow the outlines of the continents, with the North American plate following the continental border with the Pacific Ocean in the west, but following the mid-Atlantic trench in the east. As earthquakes occurring in the mid-Atlantic trench usually pose little danger to humans, the greatest earthquake threat in North America is along the Pacific Coast.

The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength, a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (see Table II-3 below). Each unit increase in magnitude on the Richter Scale corresponds to a ten-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in Table II-4.

Table II-3. Richter Scale

Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0-7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

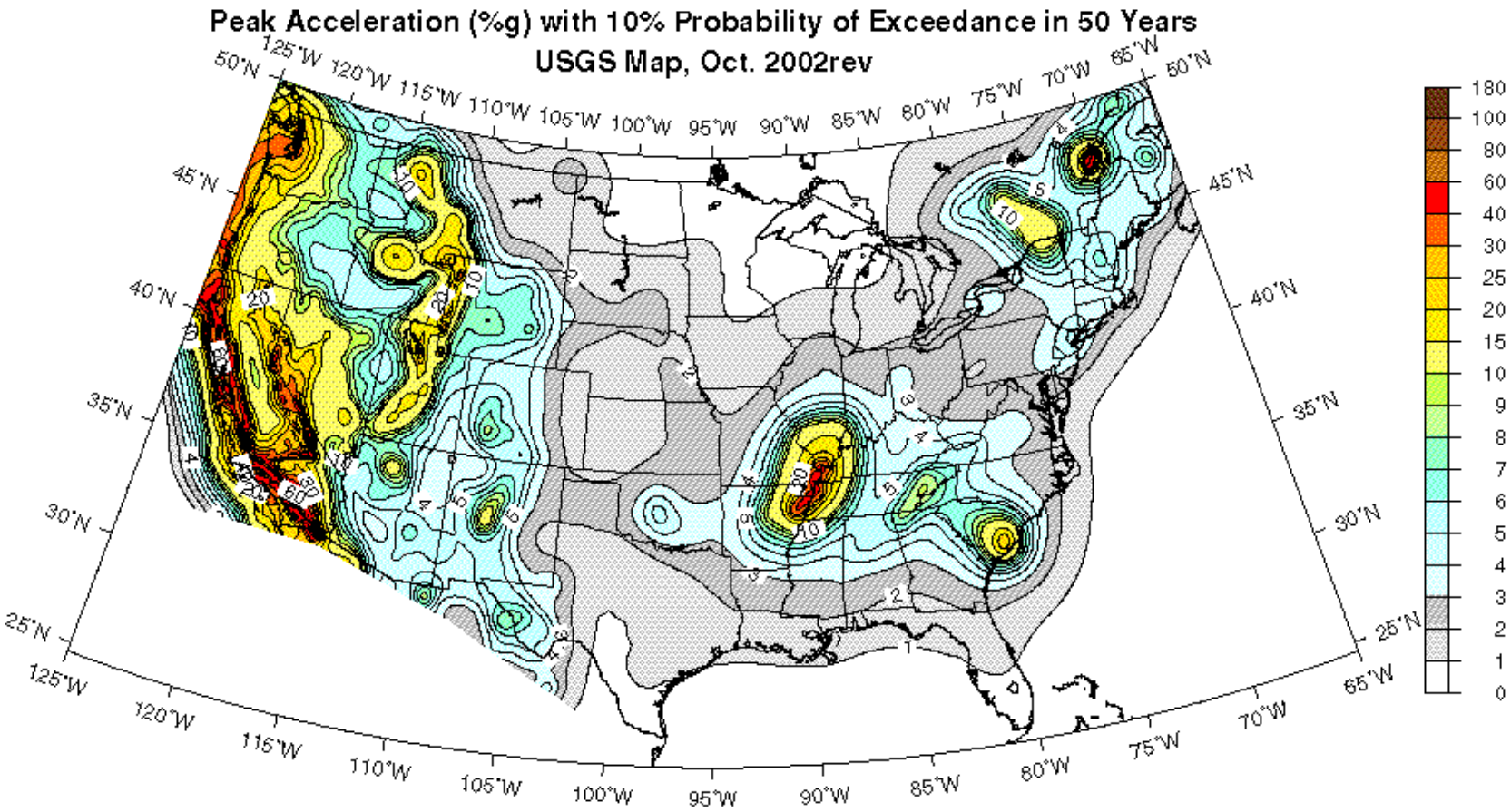
Table II-4. Modified Mercalli Intensity Scale for Earthquakes

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	<5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

Source: North Carolina Division of Emergency Management

Figure II-7 shows the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards.

Figure II-7. Peak Acceleration with 10 Percent Probability of Exceedance in 50 Years (Nationwide)



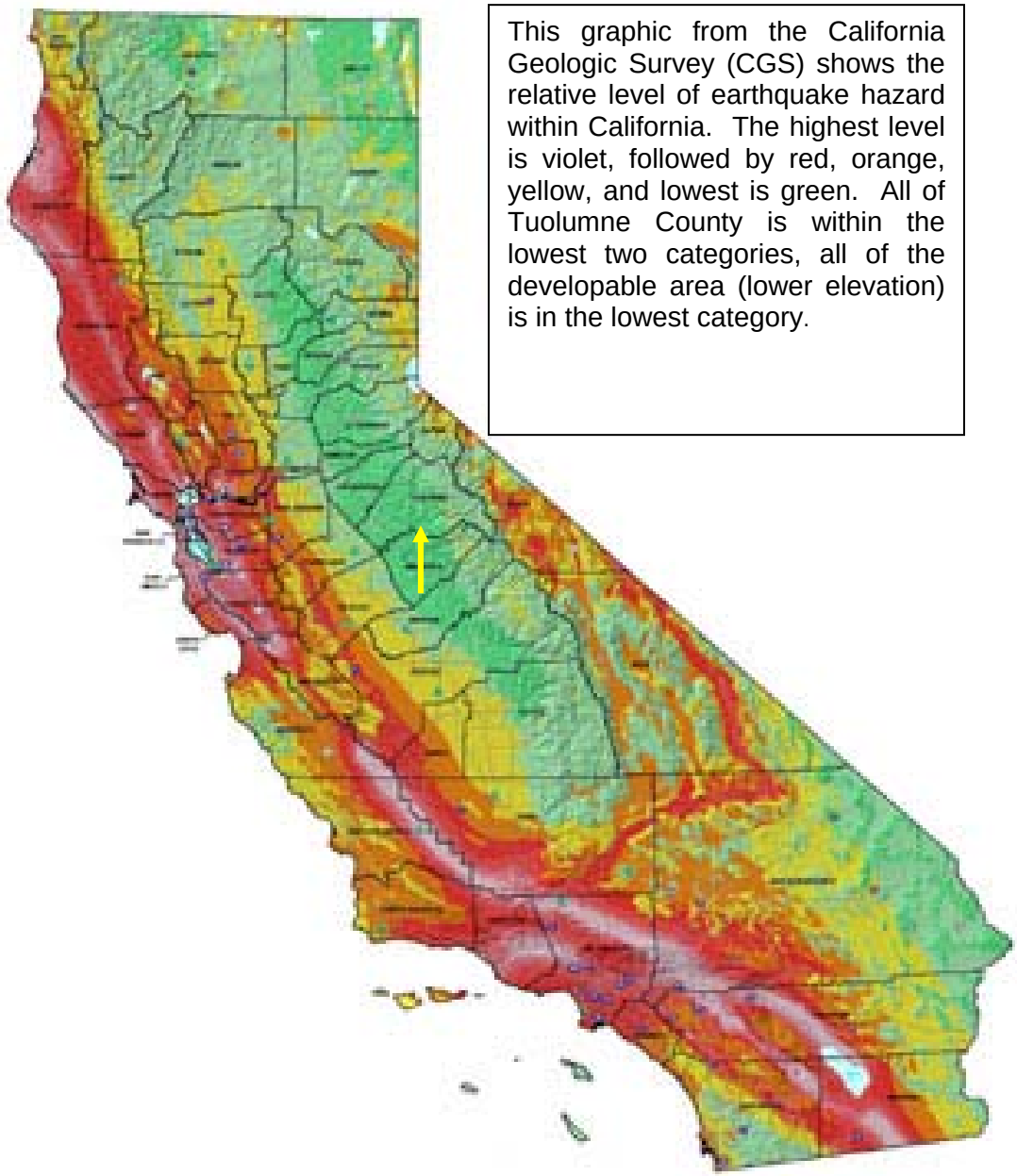
Source: USGS

II. Hazard Identification and Analysis

2. Earthquake Hazard in Tuolumne County

The above graphic from the USGS shows that the west coast in general, and California in particular, has an elevated level of risk from earthquake. As demonstrated by the following graphic, Figure II-8, Tuolumne County is one of the lowest risk areas in the State.

Figure II-8. Level of Earthquake Hazard (California)[2]

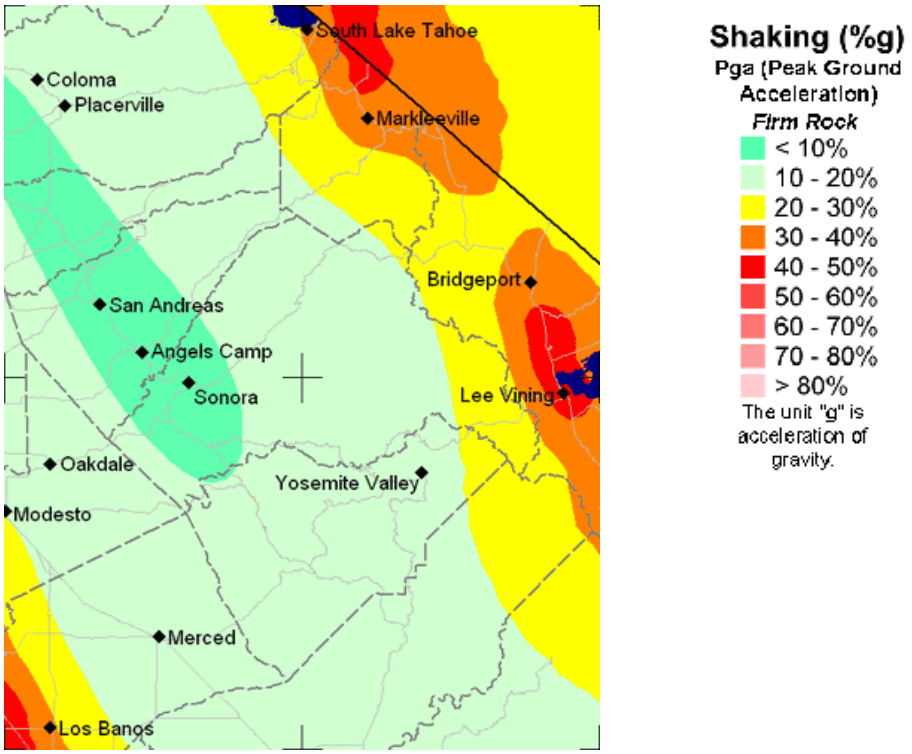


This graphic from the California Geologic Survey (CGS) shows the relative level of earthquake hazard within California. The highest level is violet, followed by red, orange, yellow, and lowest is green. All of Tuolumne County is within the lowest two categories, all of the developable area (lower elevation) is in the lowest category.

[2] Source: California Geological Survey Webpage

The following graphic, Figure II-9, gives a closer look at the Tuolumne County area, and shows that the predicted peak acceleration for the developable portion of the County does not exceed 20% of gravity, which puts the County in the lowest potential for the State.

Figure II-9. Peak Acceleration with 10 Percent Probability of Exceedance in 50 Years (Tuolumne County and Vicinity)[3]



The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This state law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. Surface rupture is the most easily avoided seismic hazard.

The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides.

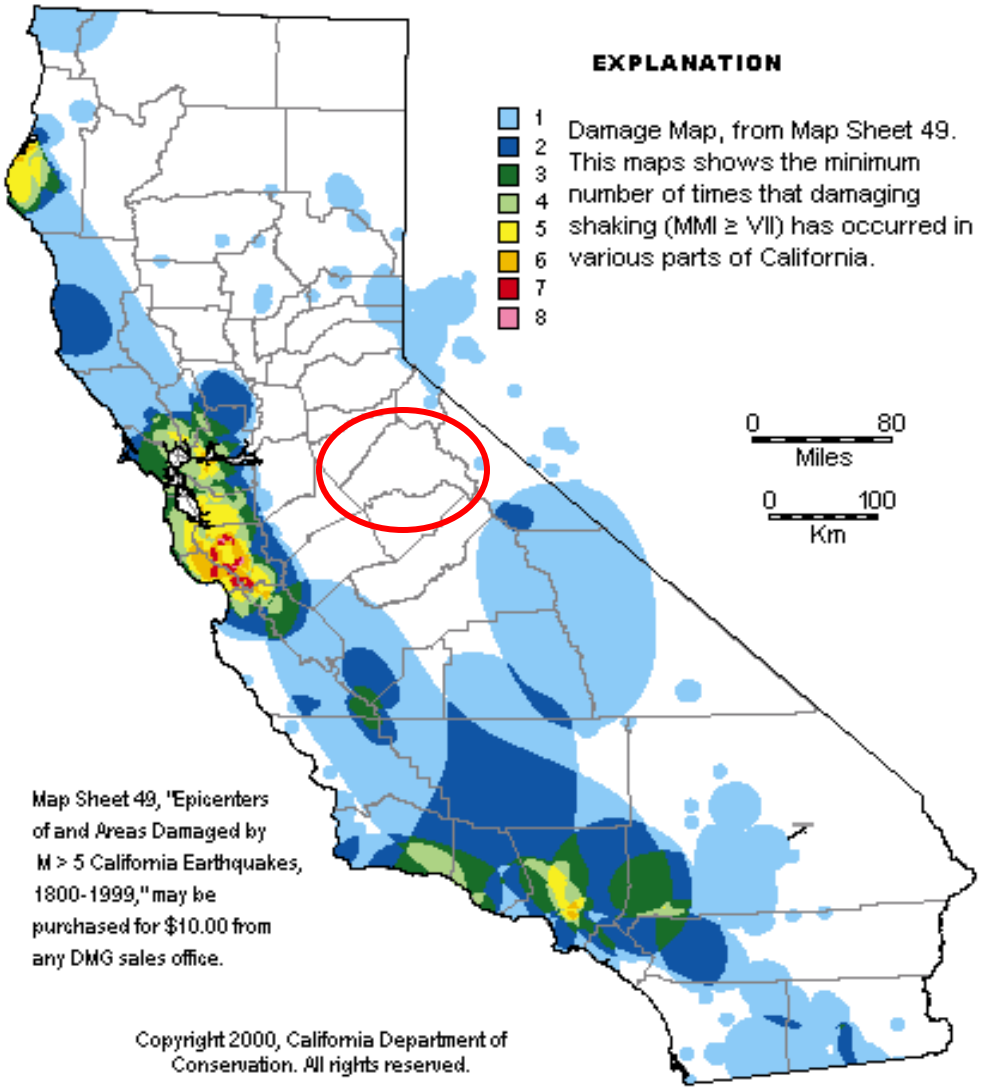
The law requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones) around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. That list does not include Tuolumne

[3] Source: California Geological Survey Webpage

County, due to its location along with the neighboring counties of Calaveras and Mariposa, as being relatively distant from any known faults that meet the criteria of the mapping program.

The following graphic (Figure II-10) demonstrates the minimum number of times during the period 1800 to 1999 that various areas of the state have been subject to damaging shaking from earthquakes. Tuolumne County lies within the portion of the State that has no record of damaging shaking events during that period.

Figure II-10. Number of Times Areas of the State have Experienced Significantly Damaging Earthquakes



Sinkholes

1. General Description of Sinkhole Hazard from National Perspective

Sinkholes are a natural and common geologic feature in areas with underlying limestone and other rock types that are soluble in natural water. Most limestone is porous, allowing the acidic water of rain to percolate through their strata, dissolving some limestone and carrying it away in solution. Over time, this persistent erosional process can create extensive underground voids and drainage systems in much of the carbonate rocks. Collapse of overlying sediments into the underground cavities produces sinkholes.

The three general types of sinkholes are: subsidence, solution, and collapse. Collapse sinkholes are most common in areas where the overburden (the sediments and water contained in the unsaturated zone, surficial aquifer system, and the confining layer above an aquifer) is thick, but the confining layer is breached or absent. Collapse sinkholes can form with little warning and leave behind a deep, steep sided hole. Subsidence sinkholes form gradually where the overburden is thin and only a veneer of sediments is overlying the limestone. Solution sinkholes form where no overburden is present and the limestone is exposed at land surface.

Sinkholes occur in many shapes, from steep-walled holes to bowl or cone shaped depressions. Sinkholes are dramatic because the land generally stays intact for a while until the underground spaces get too big. If there is not enough support for the land above the spaces, then a sudden collapse of the land surface can occur. Under natural conditions, sinkholes form slowly and expand gradually. However, human activities such as dredging, constructing reservoirs, diverting surface water, and pumping groundwater can accelerate the rate of sinkhole expansions, resulting in the abrupt formation of collapse sinkholes.

Although a sinkhole can form without warning, specific signs can signal potential development:

- Slumping or falling fence posts, trees, or foundations;
- Sudden formation of small ponds;
- Wilting vegetation;
- Discolored well water; and/or
- Structural cracks in walls or floors.

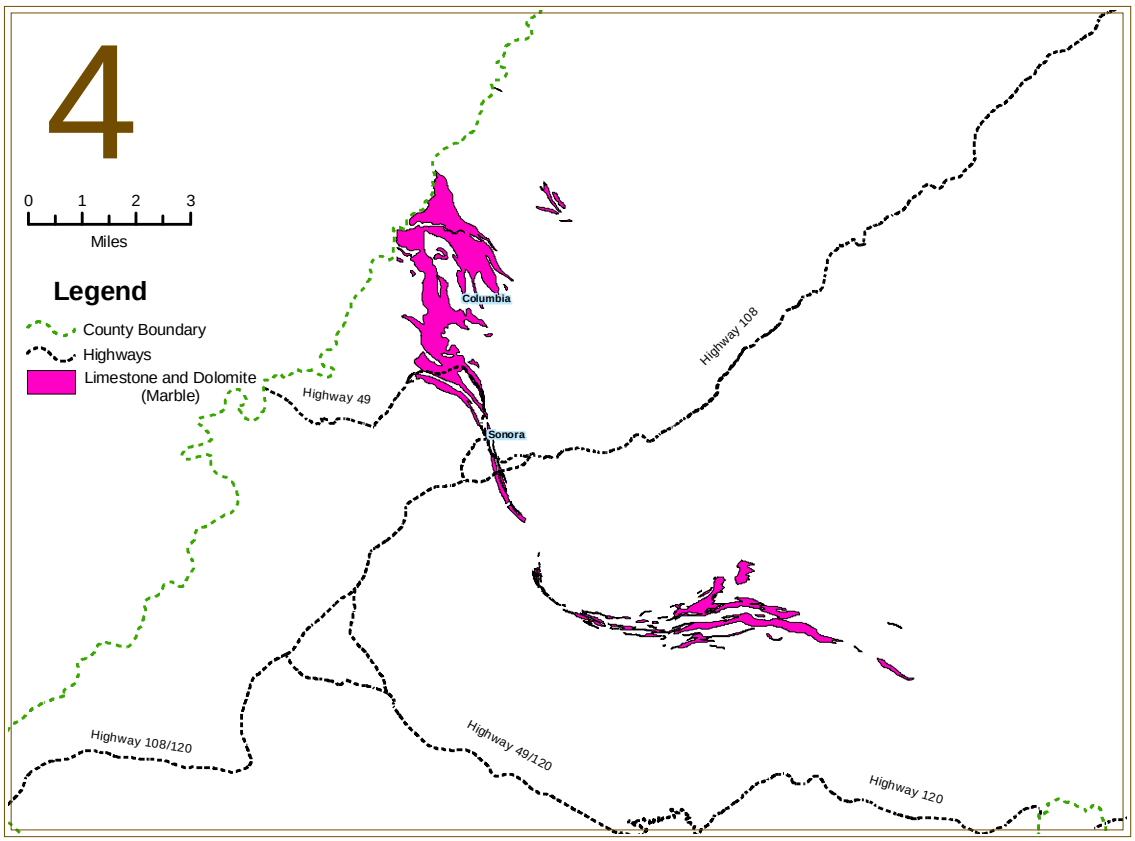
Collapses, such as the sudden formation of sinkholes, may destroy buildings, roads, and utilities. (Photo: Bettmann)

Sinkhole formation is aggravated and accelerated by urbanization. Development increases water usage, alters drainage pathways, overloads the ground surface, and redistributes soil. According to the Federal Emergency Management Agency (FEMA), the number of human-induced sinkholes has doubled since 1930, insurance claims for damages as a result of sinkholes has increased 1,200 percent from 1987 to 1991, costing nearly $100 million.

2. Sinkhole Hazard in Tuolumne County

Sinkholes in Tuolumne County could be of natural or man-made origin. The naturally occurring sinkholes could be a result of solution of limestone or related carbonate bedrock, resulting in the formation of sinkholes. The following graphic (Figure II-11) shows the extent of carbonate bedrock areas in the County, limited primarily to the Columbia and Sonora areas.

Figure II-11. Carbonate Rock Areas of Tuolumne County



Source: Tuolumne County GIS, using data obtained from California Geological Survey

The above graphic identifies the areas where carbonate bedrock is found in Tuolumne County. There is some geologic expression of "Karst" type solution of the bedrock and formation of solution holes or caverns in this area. A large amount of the area was subject to hydraulic mining techniques of the 19th Century, which blasted the soil from the bedrock in a attempt to extract placer gold. Much of the area was affected by the hydraulic mining, resulting in a difficult landscape of large boulders or outcrops surrounded by depressions. The elevation of the remaining surface can vary as much as 20 feet over a few feet of horizontal distance. Development has been difficult in these areas, as initial land leveling can be expensive to create a buildable area. Although development has occurred in Sonora and around Columbia, there have not been any documented instances of sinkholes or other karst features developing or causing any significant damage.

Man-made “sinkholes” can be from subsidence due to previous deep mining activity. Gold mining in the past has resulted in tunnels, stopes (large underground rooms excavated to extract the gold ore, usually backfilled with waste as other areas of the same underground complex are excavated), and shafts which can cause depressions or holes to develop on the ground surface. The primary areas affected by underground mining are the Mother Lode area west of Jamestown and smaller gold ore deposits that have been mined in several other smaller areas of the County. Portions of the City of Sonora are underlain by gold mining tunnels, and some areas of subsidence have occurred with structural damages to buildings.

Landslides

1. General Description of Landslide Hazard from National Perspective

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation, which is driven by gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, volcanic eruptions, and changes in groundwater levels.

There are several types of landslides: rock falls, rock topple, slides, and flows. Rock falls are rapid movements of bedrock, which result in bouncing or rolling. A topple is a section or block of rock that rotates or tilts before falling to the slope below. Slides are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material. Mudflows, sometimes referred to as mudslides, mudflows, lahars or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry." Slurry can flow rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

Landslides can damage or destroy roads, railroads, pipelines, electrical and telephone lines, mines, oil wells, buildings, canals, sewers, bridges, dams, seaports, airports, forests, parks, and farms. (Photo by Lynn Forman)

Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow

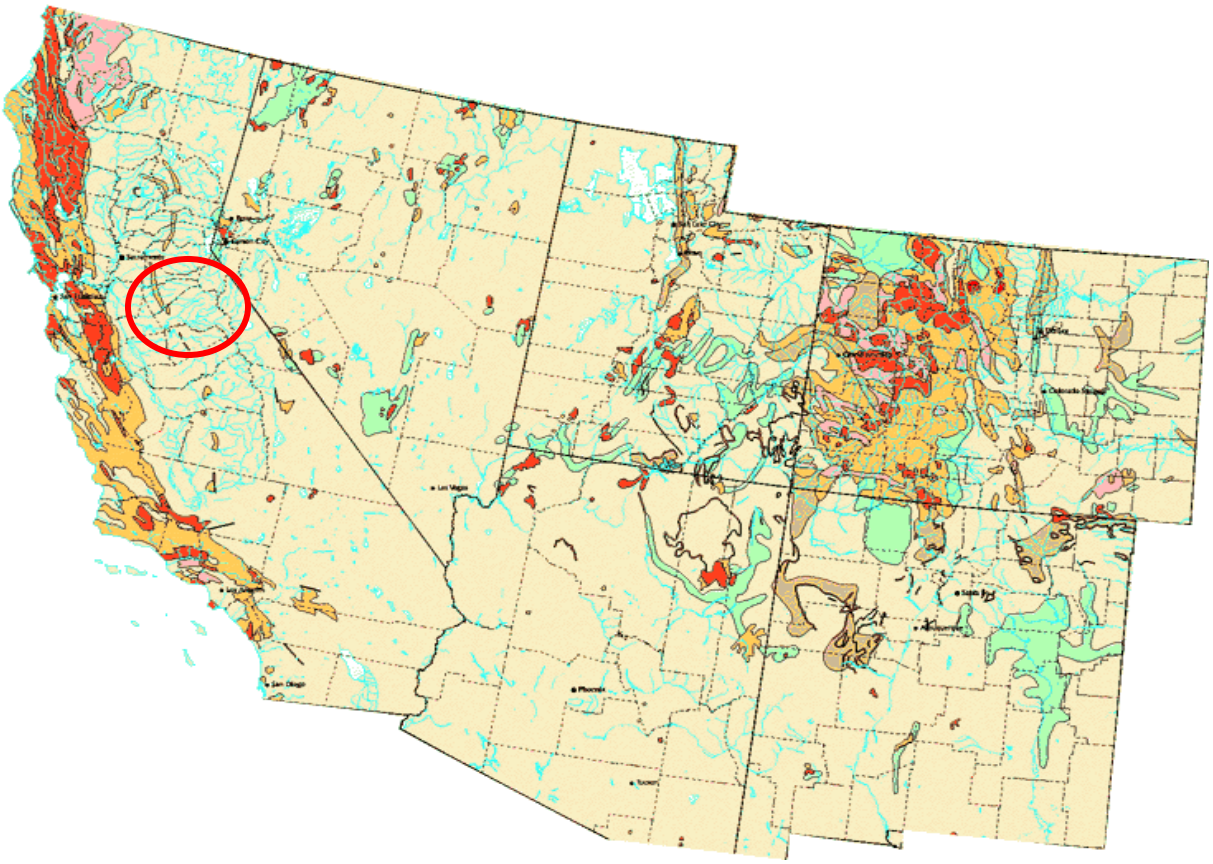
resulting from the 1980 eruptions of Mount St. Helens, Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of California, Oregon and Washington are at risk from the same types of flows during future volcanic eruptions.

Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges which are set back from the tops of slopes.

In the United States, it is estimated that landslides cause up to $2 billion in damages and from 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.

Figure II-12 delineates areas where large numbers of landslides have occurred and areas which are susceptible to landsliding in the southwestern United States. This map layer is provided in the U.S. Geological Survey Professional Paper 1183, Landslide Overview Map of the Conterminous United States., and is also available on the USGS's webpages on the Internet at http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html. The red circle on the image was added to help in identifying the location of Tuolumne County on the relatively small scale map.

Figure II-12. Landslide Overview Map of the Southwestern United States



EXPLANATION

LANDSLIDE INCIDENCE

- Low (less than 1.5% of area involved)
- Moderate (1.5%-15% of area involved)
- High (greater than 15% of area involved)

LANDSLIDE SUSCEPTIBILITY/INCIDENCE

- Moderate susceptibility/low incidence
- High susceptibility/low incidence
- High susceptibility/moderate incidence

Susceptibility not indicated where same or lower than incidence. Susceptibility to landsliding was defined as the probable degree of response of [the areal] rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated.

2. Landslide Hazard in Tuolumne County

The topography of Tuolumne County displays a wide range of landforms ranging from vertical cliffs to gently undulating plains. Combined with often times complex underlying geology that gives rise to a wide range of surficial soil types, native topography can provide a challenging environment for safe development.

In general, the greater the existing slope the greater the overall threat of landslide. The Tuolumne County Geohazards Maps indicate general areas of the developable properties that have slopes in excess of 30%. It is to be expected that areas of greater than 30% slope will exist outside the delineated areas as will areas of less than 30% slope exist inside the delineated areas due to constraints imposed by the general nature of the USGS. topographic maps that were used in the compilation of slopes. Local mapping of project areas is recommended in conjunction with geologic interpretation prior to the development of slopes in excess of 30%.

The diverse geology of western Tuolumne County includes areas underlain by serpentine. This generic rock type is particularly prone to slope failure as evidenced by native slope failures and failure of man-made slopes such as those experienced on the roadways in the vicinity of Don Pedro Reservoir. Slope failure of the steep slopes on Table Mountain have littered the adjacent slopes with boulders and other debris. In places, the layering of relatively soft volcanic mudflows beneath more dense volcanic rocks has resulted in erosion removing portions of the softer materials with the overlying harder volcanic rock being left to hang in clear air. Typically limited to the Table Mountain landforms, development on the top of Table Mountain should be done only after carefully considering appropriate setbacks from the break point where the topography dramatically changes.

Downslope development on relatively flat land at the base of steep cliffs should occur only after the potential for rockfall is evaluated. The steep cliffs, for example as found along the edge of Table Mountain (but not limited to Table Mountain) have the potential for depositing landslide debris over a large area which may exceed, in a horizontal plane measured from the foot of the cliff face, several times the height of the cliff. Surface mapping of rock exposures along with observation of conditions in the local area of a project will assist in the determination of site specific areas subject to rockfall damage.

The above discussion concerning areas with potential landslide hazard is limited to certain areas near cliff-like structure or on very steep slopes, none of which are often subject to development. There have been reported incidents of landslides and general slope failure in isolated portions of the County, but this is a very uncommon occurrence with no defined history of significant damages. Although the above discussion shows that portions of the privately-owned and potentially developable land of Tuolumne County can include areas where landslide could occur, it is not common to most areas. Overall, the hazard is much less than can be expected to occur in much of the more densely developed portions of the State (see above Figure II-12), where the geologic conditions are much more prone to landslide and general instability.

Winter Storms

1. General Description of Winter Storm Hazard from National Perspective

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility.

Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Sleet – raindrops that freeze into ice pellets before reaching the ground – usually bounce when hitting a surface and do not stick to objects; however, sleet can accumulate like snow and cause a hazard to motorists. Freezing rain is rain that falls onto a surface with a temperature below freezing, forming a glaze of ice. Even small accumulations of freezing rain can cause a significant hazard, especially on power lines and trees. An ice storm occurs when freezing rain falls and freezes immediately upon impact. Communications and power can be disrupted for days, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

A heavy layer of ice was more weight than this tree in Kansas City, Missouri could withstand during a January 2002 ice storm that swept through the region, bringing down trees, power lines and telephone lines. (Photo by Heather Oliver/ FEMA News Photo)

A freeze is weather marked by long periods of sustained low temperatures, especially when below the freezing point (zero degrees Celsius or thirty-two degrees Fahrenheit). Agricultural production is seriously affected when temperatures remain below the freezing point.

2. Winter Storm Hazard in Tuolumne County

Tuolumne County is subject to a variety of winter or seasonal storm hazards due to the elevation changes in different parts of the County. Typical storms associated with the rainy season (late fall, winter, early spring) cause different problems depending on elevation. A warm storm with relatively mild temperatures usually brings rain to the lower elevations, and snow to the higher elevations. Often the “snow line” is above 3,000 feet above sea level, and a smaller percentage of the County population is directly affected by the snow and freezing conditions. However, meteorological conditions can be different, and can change radically during an actual storm event, resulting in snowfall down to 1,000 foot elevation, affecting a much greater range of the County’s population. As a tourist destination, low snowfall events also greatly affect the transitory tourist population or day visitors to the County, many of whom are ill-prepared for winter weather. Cold storms can also be accompanied by freezing rain and wet heavy snow, making driving treacherous and causing more infrastructure damage with felled trees and powerlines. Some storms

deposit significant amounts of rainfall in a small geographic area where the ditches, creeks and bridges are overwhelmed by the runoff. Storms can also be associated with strong pressure changes with resultant winds that bring down trees unable to support themselves in saturated soils.

Damage-causing storms can occur during any time of year, but usually occur during the rainy season, which generally runs from mid-fall through spring. Snow at the lower elevations can occur during the entire rainy season, but more frequently happen in winter and early spring. A summertime monsoon flow of tropical moisture can bring thunderstorms to the high elevations in the extreme east and southeast of the County, but seldom brings any significant rainfall to the lower elevations. However, higher elevation fires as a result of lightning strikes during these summer events can cause significant wildfire events to the Stanislaus National Forest and Yosemite National Park.

Storm-related damage to properties and infrastructure varies depending on the nature of the storm. Intense localized rainfall causes washouts of roadways and bridge damage, or localized flooding of structures that lack the storm-drain capacity to remove the water. Snowfall and freezing rain can temporarily paralyze transportation, but also result in power distribution damage and power outages that can take extended periods to restore. Heavy snow and ice can also collapse buildings, or fell trees that damage buildings, block roadways, or damage powerlines. Strong winds have also damaged building roofs or caused other structural problems, as well as brought down trees through buildings, powerlines, or otherwise caused significant property damage. Snowfall and felled trees are more likely to cause significant damage in the higher elevations of Tuolumne County, but localized flooding from intense rainfall can occur anywhere.

Volcano

1. General Description of Volcano Hazard from National Perspective

Over 75 percent of the Earth's surface above and below sea level, including the seafloors and some mountains, originated from volcanic eruption. Emissions from these volcanoes formed the Earth's oceans and atmosphere. Volcanoes can also cause tsunamis, earthquakes, and dangerous flooding.

The May 18, 1980 eruption of Mount Saint Helens created an eruptive cloud that rose to an altitude of more than 12 miles in 10 minutes. Nearly 550 million tons of ash fell over a 22,000 square mile area. (Photo courtesy of Department of Natural Resources, State of Washington)

Volcanoes are vents in the Earth’s crust that emit molten rock and steam. They are evidence that the physical makeup of our planet is ever-changing. Volcanoes are relatively site specific, but the molten rock, steam, and other gases they release can have an impact on much larger areas.

Lahar is the mudflow of debris and water caused by a volcano. It is also known as debris flow or volcanic mudflow. Lahar is most often triggered by rainfall washing down the debris from the slopes of volcanoes. However, lahar flows can also be

triggered by rapidly melting snow and ice, debris avalanches and breakouts of lakes that were dammed by volcanic debris.

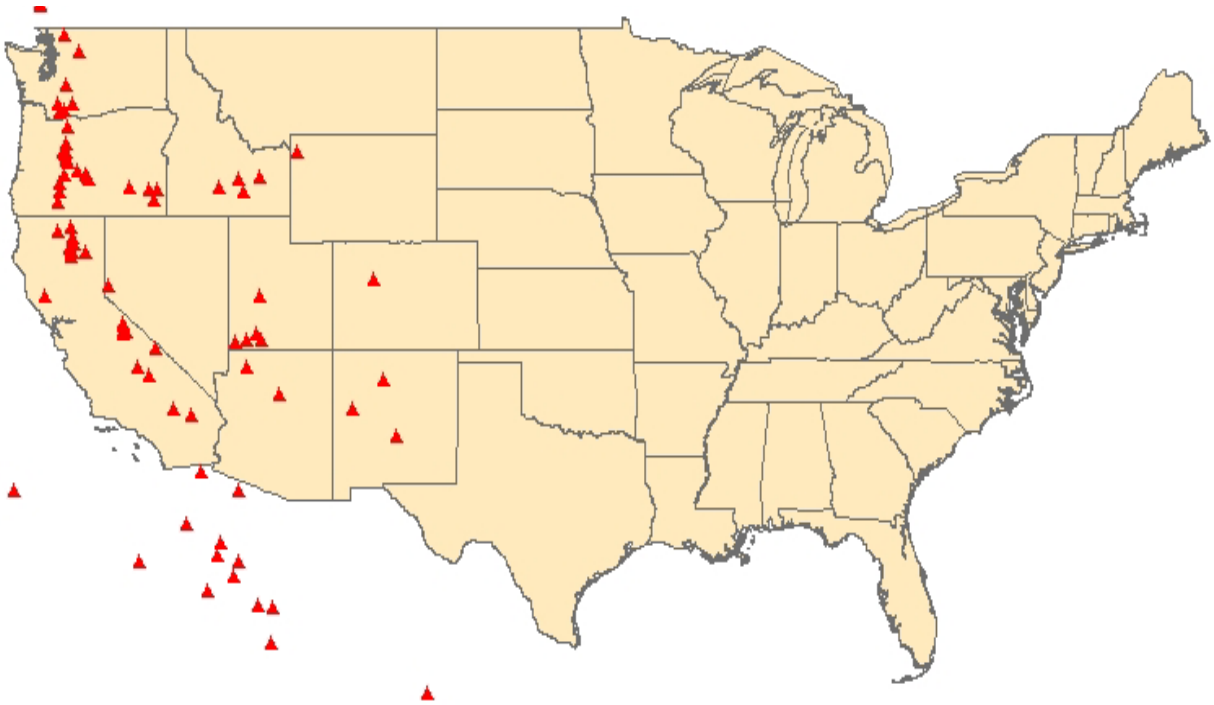
Tephra is the general term used to describe the ash and other materials that are released into the air after a volcanic eruption. Tephra ranges in size from fine powder to larger rock-sized particles. Volcanic ash can contaminate water supplies, cause electrical storms, and collapse roofs, and can affect people hundreds of miles away.

Volcanic explosions which are directed sideways are called lateral blasts. Lateral blasts can throw large pieces of rock at very high speeds for several miles. These explosions can kill by impact, burial, or heat and may have enough force to knock down entire forests of trees. The majority of deaths attributed to the Mount St. Helens volcano were a result of lateral blast and tree blow-down.

There are more than 500 active volcanoes in the world. More than half of these volcanoes are part of the "Ring of Fire," a region that encircles the Pacific Ocean. More than 50 volcanoes in the United States have erupted one or more times in the past 200 years. The most volcanically active regions of the nation are in Alaska, Hawaii, California, Oregon, and Washington (Figure II-13). The danger area around a volcano covers approximately a 20-mile radius. Some danger may exist 100 miles or more from a volcano.

Figure II-13. Known Volcano Locations in the United States

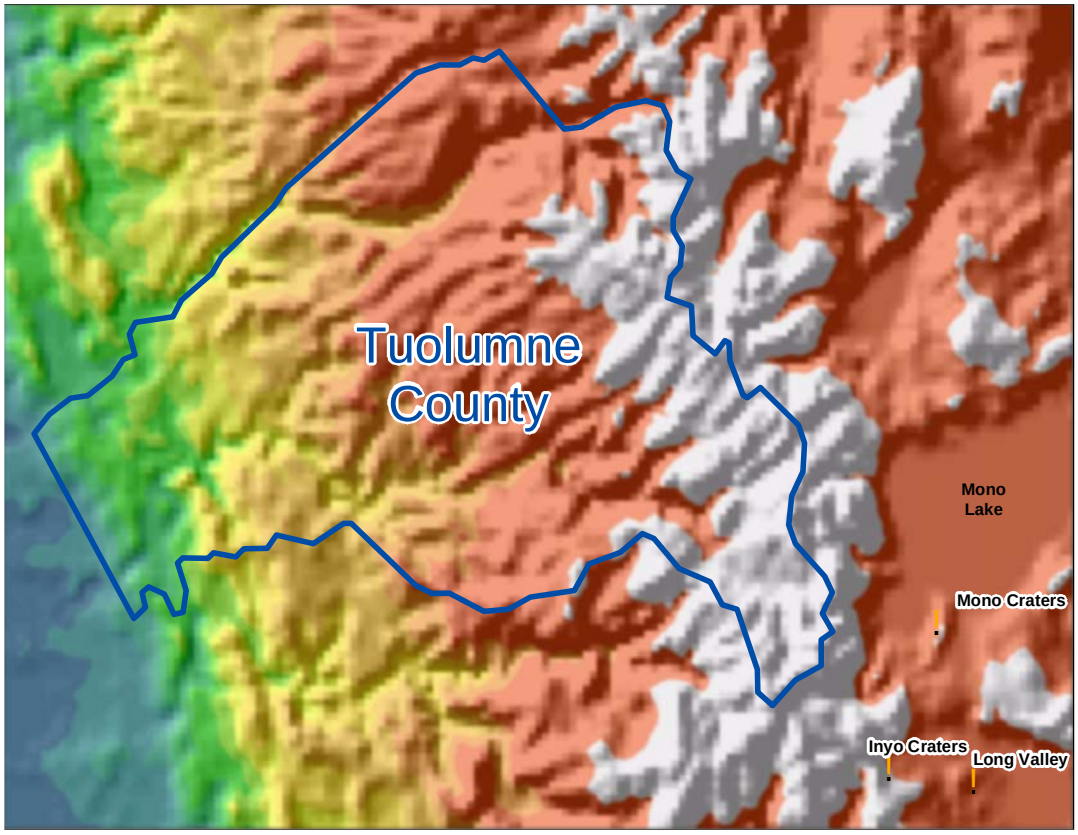
Source: Global Volcanism Program



2. Volcano Hazard in Tuolumne County

The volcano hazard of Tuolumne County is presented by the relative proximity to the Long Valley Caldera and Mono-Inyo Craters Volcanic Field. This Long Valley area is located on the east side of the crest of the Sierra Nevada, east of the most extreme southeastern portion of the County.

Figure II-14. Location of Long Valley Area Relative to Tuolumne County



The Long Valley Caldera was formed by a catastrophic eruption about 730,000 years ago. Most of the major landforms of the complex were created then or soon thereafter, associated with a major eruption of ash and subsequently lava flows. Other features like Mammoth Mountain, a major ski resort area, were created between 200,000 to 50,000 years ago. Most of the more recent events were of a smaller scale, and some did result in ash events that affected areas to the east of the complex. Tephra, or ash falling from the sky after volcanic events, can cause impacts ranging from inconvenience to equipment failure and large-scale property and agricultural losses, depending on the amount of ash being deposited and the duration of the event. The movement of ash is subject to the normal jet stream effects of air masses moving in general from west to east.[4] This reduces the risk of a significant ash event from affecting Tuolumne County.

[4] Miller, C. D., Mullineaux, D.R., Crandell, D.R., and Bailey, R.C., 1982, Potential Hazards of Future Volcanic Eruptions in the Long Valley – Mono Lake Area, East-Central California and Southwest Nevada; US Geological Survey Circular 877.

Drought/Extreme Heat

1. General Description of Drought/Extreme Heat Hazard from National Perspective

Drought is a natural climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area. High temperatures, high winds, and low humidity can worsen drought conditions, and can make areas more susceptible to wildfire. Human demands and actions can also hasten drought-related impacts.

Droughts are frequently classified as one of following four types:

- Meteorological,
- Agricultural,
- Hydrological, and
- Socio-economic.

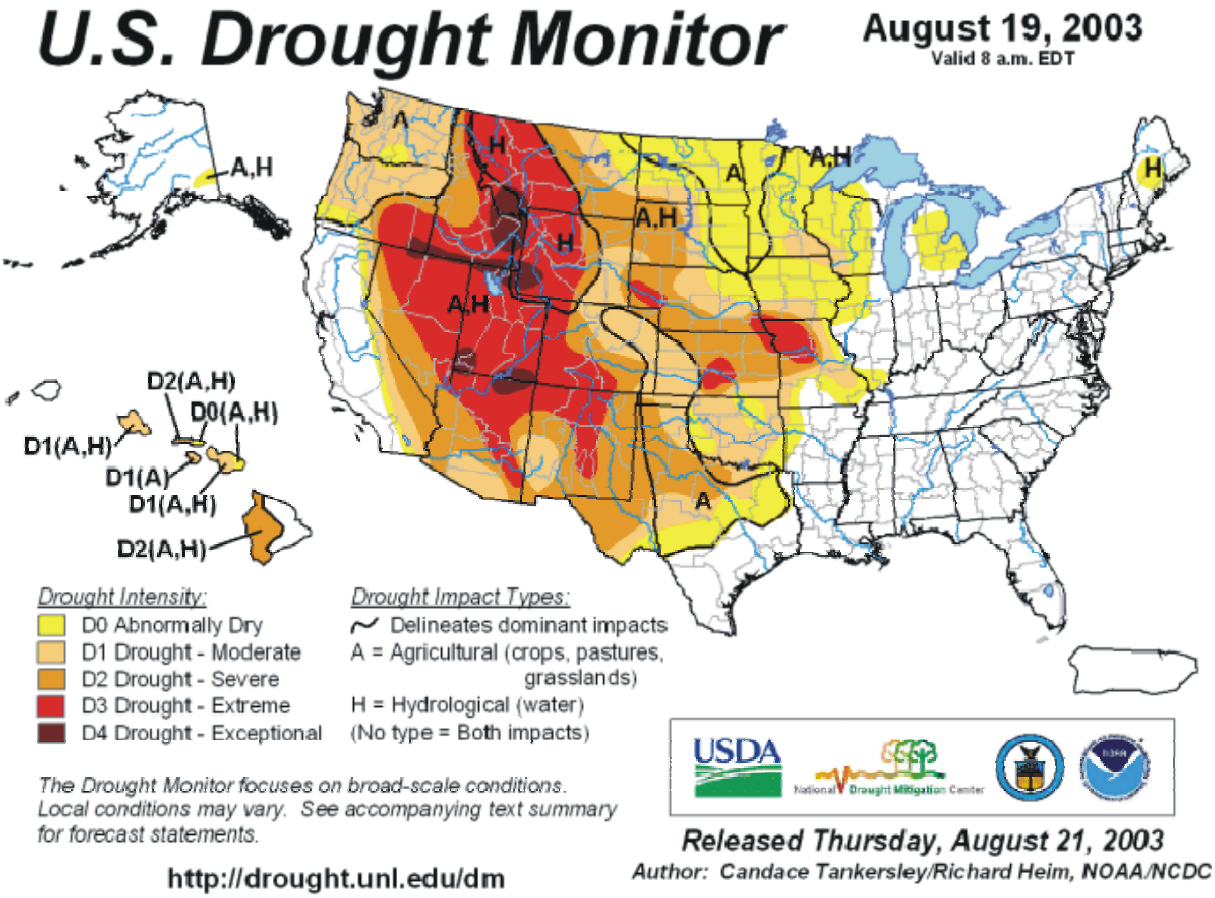
Meteorological droughts are typically defined by the level of "dryness" when compared to an average, or normal amount of precipitation over a given period of time. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts. Emphasis tends to be placed on factors such as soil water deficits, water needs based on differing stages of crop development, and water reservoir levels. Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socio-economic drought is the result of water shortages that limit the ability to supply water-dependent products in the marketplace.

While drought mostly impacts land and water resources, extreme heat can pose a significant risk to humans. Extreme heat can be defined as temperatures that hover 10 degrees or more above the average high temperature for the region, last for prolonged periods of time, and are often accompanied by high humidity. Under normal conditions, the human body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work much harder to maintain a normal temperature. Elderly persons, young children, persons with respiratory difficulties, and those who are sick or overweight are more likely to become victims of extreme heat. Because men sweat more than women, they are more susceptible to heat-related illness because they become more quickly dehydrated. Studies have shown that a significant rise in heat-related illness occurs when excessive heat persists for more than two days. Spending at least two hours per day in air conditioning can significantly reduce the number of heat-related illnesses.

Long periods of extreme heat in urban areas can create health concerns when stagnant atmospheric conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, the "urban heat island effect" can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer) gradually release heat at night.

Figure II-15 shows a U.S. Drought Monitor summary map from the United States Department of Agriculture for August 19, 2003. Drought Monitor summary maps identify general drought areas and label droughts by intensity, with D1 being the least intense and D4 being the most intense.

Figure II-15. U.S. Drought Monitor Summary Map



Weekly-updated maps may be obtained online from The Drought Monitor Web site, maintained by the National Drought Mitigation Center, located at the following Web address: http://drought.unl.edu/dm.

2. Drought/Extreme Heat Hazard in Tuolumne County

Tuolumne County has a Mediterranean-style climate based on cool wet winters and hot dry summers. The following graphics illustrate seasonal changes in temperature and rainfall.

Figure II-16. Average and Extreme Temperatures for Sonora

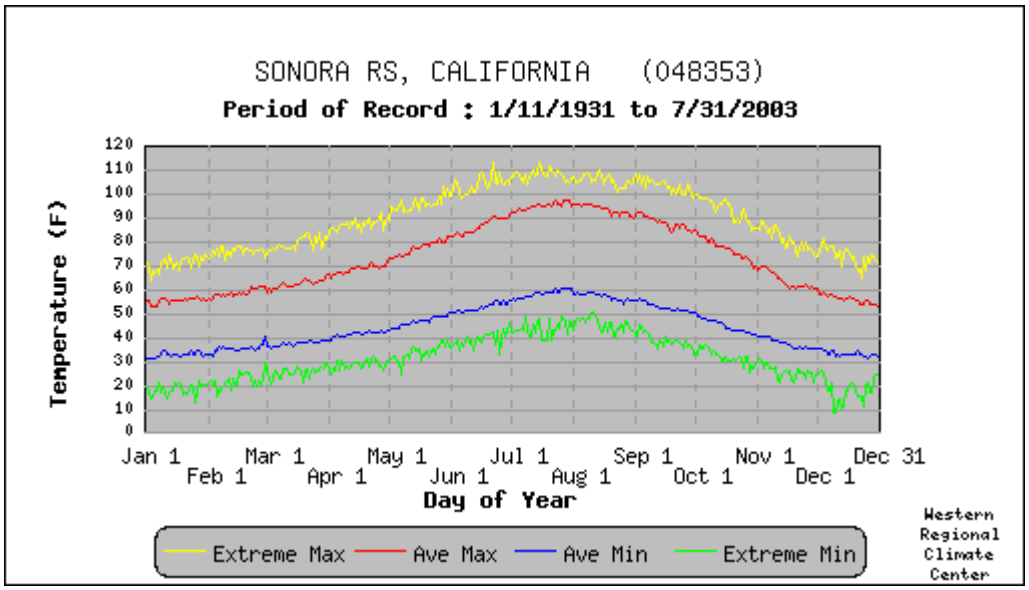
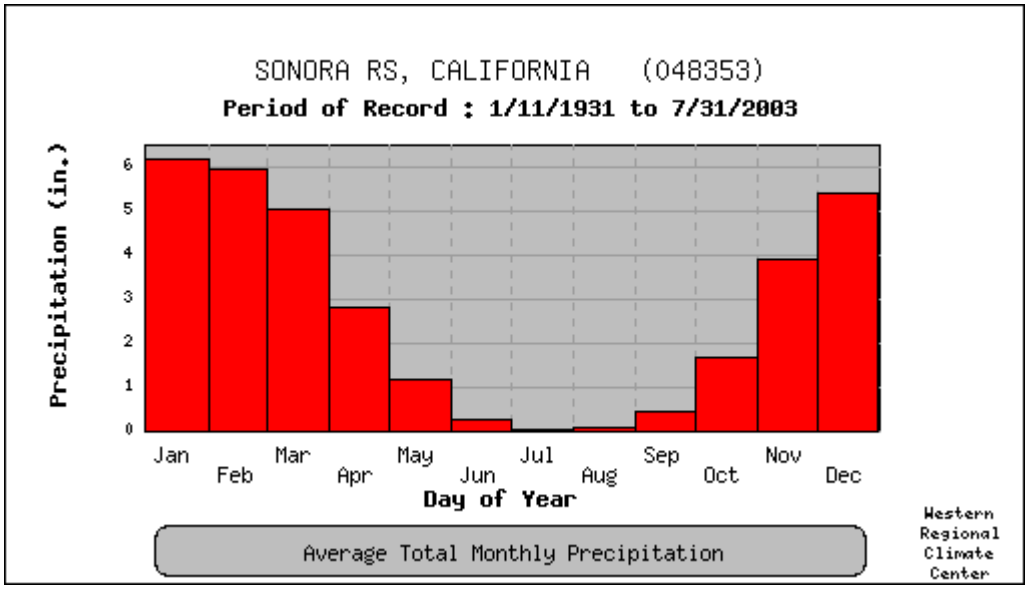


Figure II-17. Average Monthly Precipitation for Sonora



The amount of rainfall and temperature regimes experienced by portions of the County differ widely dependent on the elevation and aspect of each portion. Typically, the lower

elevations to the west are hotter and drier than the higher elevations to the east. Much of the precipitation at the higher elevation is in the form of snow, with little snow falling at the lower elevations. The City of Sonora is the County seat, and at 1,800 feet above mean sea level is the location most described in historical records concerning rainfall and temperature.

Rainfall records are maintained for each rain season, which lasts from the beginning of July to the end of June the following year. The Union Democrat newspaper has kept records beginning with the rain year 1887-88. For an "average" rain year, Sonora has received 29 inches of rain. The Tuolumne Utilities District (TUD), the largest public water purveyor in Tuolumne County, considers a drought year as having less than 16 inches of rainfall. According to newspaper records, this has happened 3 times: 1923-24 (13.57 inches), 1975-76 (15.37 inches) and 1976-77 (15.78 inches).

TUD had to implement water conservation measures during the above multiple drought years in the mid-1970's, and during a five year period from 1986-87 to 1990-91 due to a sustained period of less-than-normal rainfall. In both instances, the water supply was conserved by retaining (purchasing) more than the normal allotment from the Stanislaus River watershed, and through conservation of water being distributed.

Erosion

1. General Description of Erosion Hazard from National Perspective

Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth's formation and continues at a very slow and uniform rate each year.

There are two types of soil erosion: wind erosion and water erosion. Wind erosion can cause significant soil loss. Winds blowing across sparsely vegetated or disturbed land can pick up soil particles and carry them through the air, thus displacing them. Water erosion can occur over land or in streams and channels. Water erosion that takes place over land may result from raindrops, shallow sheets of water flowing off the land, or shallow surface flow, which is concentrated in low spots. Stream channel erosion may occur as the volume and velocity of water flow increases enough to cause movement of the streambed and bank soils. Major storms such as hurricanes may cause significant erosion by combining high winds with heavy surf and storm surge to significantly impact the shoreline.

An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, climate or rainfall, and topography. Soils composed of a large percentage of silt and fine sand are most susceptible to erosion. As the content of these soils increases in the level of clay and organic material, the potential for erosion decreases. Well-drained and well-graded gravels and gravel-sand mixtures are the least likely to erode. Coarse gravel soils are highly permeable and have a good capacity for absorption, which can prevent or delay the amount of surface runoff. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from falling rain, absorbing water from the soil, and slowing the velocity of runoff. Runoff is also affected by the topography of the area including size, shape and slope. The greater the slope length and gradient, the more

potential an area has for erosion. Climate can affect the amount of runoff, especially the frequency, intensity and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

During the past 20 years, the importance of erosion control has gained the increased attention of the public. Implementation of erosion control measures consistent with sound agricultural and construction operations is needed to minimize the adverse effects associated with increasing settling out of the soil particles due to water or wind. The increase in government regulatory programs and public concern has resulted in a wide range of erosion control products, techniques, and analytical methodologies in the United States. The preferred method of erosion control in recent years has been the restoration of vegetation.

3. Erosion Hazard in Tuolumne County

The soils in Tuolumne County can be generally considered to be shallow. The diverse underlying geology along with agents of weathering such as erosion, soil chemistry, and cultural activities all play a part in the soil type. Clays exist both as a weathering product and as native sediments. Clays have the potential for expansion and contraction when they go through wet/dry cycles. Foundations based on clay soils have the potential for being affected by the associated changes in soil volumes over time. This phenomena can be most directly observed by areas of roadway failure that are commonly evidenced by repeated patching over the years (although patching is often due not only to clay soils but also to the presence of inadequate drainage of the subbase beneath the pavement).

When clay soils are noted as present in a development, the clays in areas of proposed cultural improvements should be tested for shrink/swell potential and the test results considered in the improvements structural design.

Grading, either by natural agents such as erosion or the activities of man, has the potential for creating unstable slopes. Erosion control can be accomplished on critical slopes being affected by natural agents. Proper investigation of the soils underlying proposed areas of grading in conformance with the mandates of the Uniform Building Code can assist in delineating potential areas of concern and provide information to the project engineer which will allow for the design of remedial measures. Grading, with concurrent testing, again in conformance with the recommendations of the Uniform Building Code, and the project engineer can ensure a project that has the highest possible potential for avoiding future problems with stability or erosion.

Erosion is a natural process where soil is removed by water, wind or gravity from one location to another. The process of removal and deposition changes the topography toward a condition of equilibrium. It is a natural process that when aided by man can result in undesirable consequences. Grading activities remove the natural vegetative cover that protects the soil from erosion agents. Grading plans should be accompanied by erosion control plans that have a specific time line for implementation.

The potential for erosion of soils increases as a function of the steepness of the slope. The areas delineated on the Tuolumne County General Plan Geotechnical Maps as being in excess of 30% should be considered as having a high potential for erosion.

The vast majority of development in Tuolumne County is not in proximity to cliff-like areas such as Table Mountain, nor has it often occurred on steep slopes in excess of 30%. Erosion problems are generally limited to restricted areas where grading has oversteepened slopes, or deposited fill in areas where it has not stabilized, or where improper grading practices have not included provisions to seed or otherwise protect fresh slopes from eroding. There have also been other examples of burned areas being eroded prior to reestablishment of vegetation to protect the slopes from degrading. Otherwise, compared to many areas of the State such as the coastal mountains, erosion has proven to be a modest hazard in Tuolumne County.

Severe Thunderstorms and Tornadoes

1. General Description of Thunderstorm/Tornado Hazard from National Perspective

According to the National Weather Service, more than 100,000 thunderstorms occur each year, though only about 10 percent of these storms are classified as "severe." Although thunderstorms generally affect a small area when they occur, they are very dangerous because of their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those regions are most ideal for generating these powerful storms.

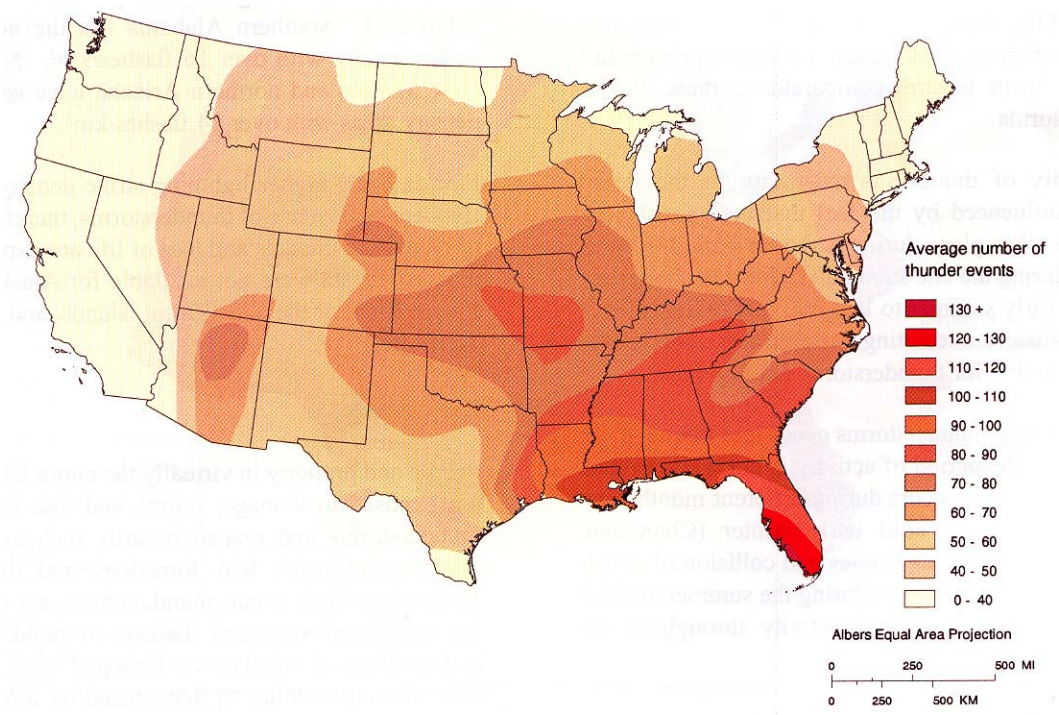
Multiple cloud-to-ground and cloud-to-cloud lightning strokes observed during a nighttime thunderstorm. (Photo courtesy of NOAA Photo Library, NOAA Central Library; OAR/ERL/ National Severe Storms Laboratory)

Thunderstorms are caused when air masses of varying temperatures meet. Rapidly rising warm moist air serves as the "engine" for thunderstorms. These storms can occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours.

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 89 people are killed each year by lightning strikes in the United States.

The National Weather Service collected data on the number days with thunderstorms, number and duration of thunder events, and density of lightening strikes, all for the 30-year period from 1948 to 1977. The most significant of these data sets was the annual average number of thunder events, or storms that resulted in thunder, and it was used to create a map that follows as Figure II-18.

Figure II-18. Annual Average Number of Thunder Events



A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other coastal storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 to more than 300 miles per hour. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles.

The most comprehensively observed tornado in history, this tornado south of Dimmitt, Texas developed June 2, 1995 curving northward across Texas Highway 86 where it entirely removed 300 feet of asphalt from the road, tossing it more than 600 feet into an adjacent field. (NOAA Photo Library)

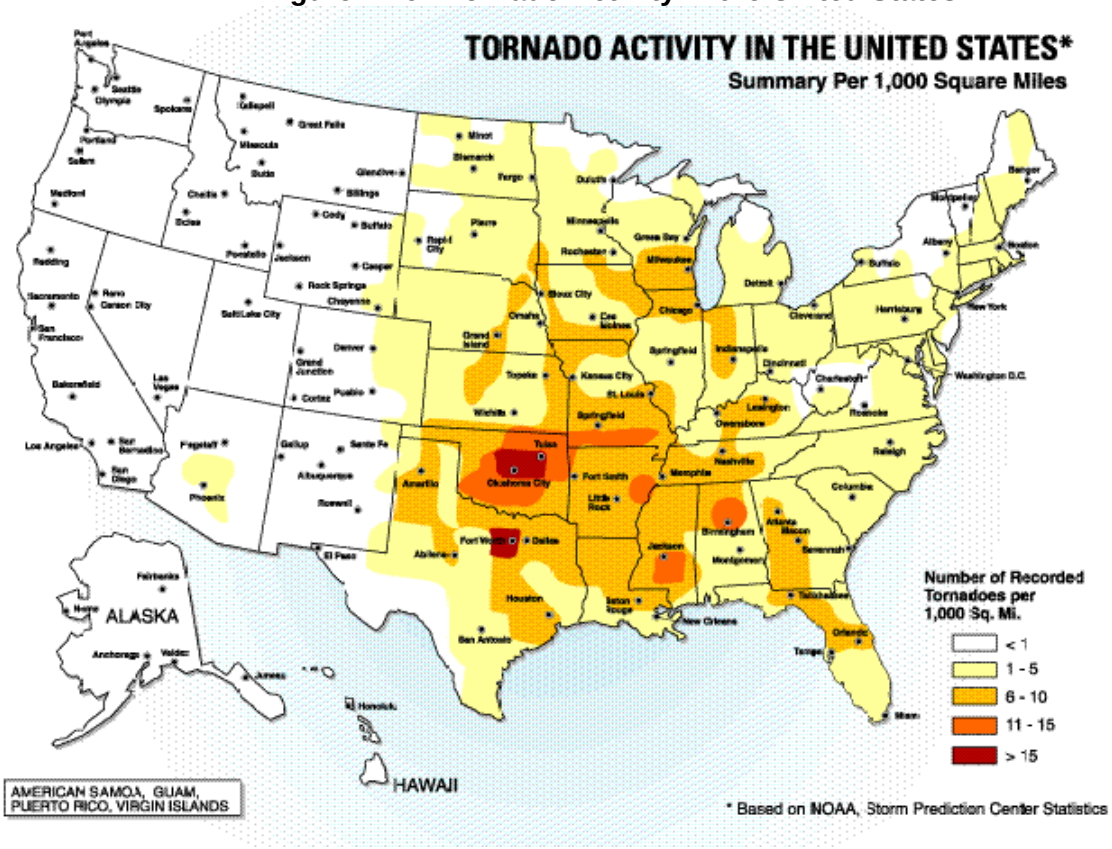
Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (National Oceanographic and Atmospheric Administration, 2002). They are more likely to occur during the spring and early summer months of March through June and can occur at any time of day, but are likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

Waterspouts are weak tornadoes that form over warm water and are most common along the Gulf Coast and Southeastern states. Waterspouts occasionally move inland, becoming tornadoes that cause damage and injury. However, most waterspouts dissipate over the open water, causing threats only to marine and boating interests. Typically a waterspout is weak and short-lived and, because they are so common, most go unreported unless they cause damage.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction such as residential homes (particularly mobile homes), and tend to remain localized in impact.

According to the National Oceanographic and Atmospheric Administration (NOAA) Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of “tornado alley”), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). Figure II-19 shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

Figure II-19. Tornado Activity in the United States



Source: American Society of Civil Engineers

The tornadoes associated with tropical cyclones are most frequent in September and October when the incidence of tropical storm systems is greatest. This type of tornado usually occurs around the perimeter of the storm, and most often to the right and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

Figure II-20 shows how the frequency and strength of extreme windstorms vary across the United States. The map was produced by the Federal Emergency Management Agency and is based on 40 years of tornado history and over 100 years of hurricane history. Zone IV, the darkest area on the map, has experienced both the greatest number of tornadoes and the strongest tornadoes. As shown by the map key, wind speeds in Zone IV can be as high as 250 miles per hour.

Figure II-20. Wind Zones in the United States

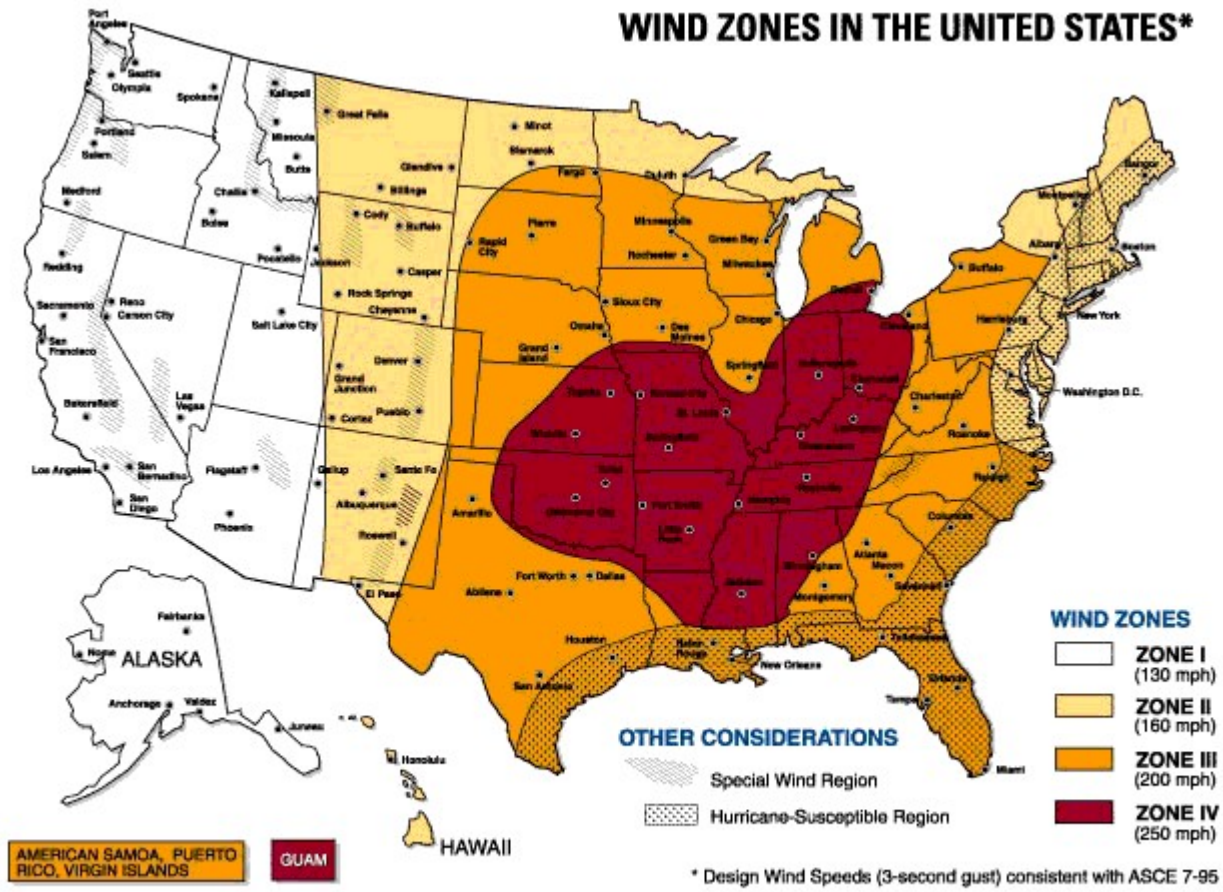


Figure I.2 Wind zones in the United States

Source: Federal Emergency Management Agency

2. Thunderstorm/Tornado Hazard in Tuolumne County

As shown by the graphics in the leading section above, Tuolumne County is not located in an area of these types of extreme meteorological events. Particularly, with these types of wind and storm events associated with summer or fall warm air masses, Tuolumne County and the surrounding regions have no history of hazards from these types of events. Strong winds, snow and ice associated with winter or winter season storms are considered in the "winter/seasonal storm" section, as will localized flooding as a result of thunderstorms or similar intense rainfall events. Thunderstorms in summer can be sources of wildfire in the higher elevations, and wildfire from any source will be addressed in the overall "wildfire" sections of this document. Because there is otherwise no history of significant damage from thunderstorms or tornadoes in the County, there will be no further discussions related to these in this document.

Hurricanes and Tropical Storms

1. General Description of Hurricane / Tropical Storm Hazard from National Perspective

Hurricanes, tropical storms, nor'easters and typhoons, also classified as cyclones, are any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a "safety-valve," limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation, and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves, and tidal flooding which can be more destructive than cyclone wind.

Wind and rain from Hurricane Lili damage road signs along I-10 in Louisiana on October 3, 2002. (Photo by Lauren Hobart/FEMA News Photo)

The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force from the spinning of the earth, and the absence of wind shear in the lowest 50,000 feet of the atmosphere. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico during the official Atlantic hurricane season, which encompasses the months of June through November. The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in that basin is about six (6).

A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to 20 feet in a Category 5 storm. The

storm surge arrives ahead of the storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Water rise can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas. A storm surge is a wave that has outrun its generating source and become a long period swell. The surge is always highest in the right-front quadrant of the direction in which the hurricane is moving. As the storm approaches shore, the greatest storm surge will be to the north of the hurricane eye. Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast.

Storm surge heights, and associated waves, are dependent upon the shape of the continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves.

Damage during hurricanes may also result from spawned tornadoes and inland flooding associated with heavy rainfall that usually accompanies these storms.

The National Oceanic and Atmospheric Administration's Hurricane Research Division has accumulated data from 1944 to 1999 that counts hits when a tropical storm or hurricane was within approximately 100 miles (165 km) of each location. That data show that all of the "named storms" make landfall in the southeastern or eastern United States, with none having significant effects on this part of the Country.

Hurricane Floyd brought a devastating 15 feet of storm surge that damaged or destroyed hundreds of houses along the ocean front of Long Beach on Oak Island, North Carolina in September 1999. A prime example of successful hazard mitigation, the elevated home (right) survived while the older, ground-level block foundation of the home on the left was crushed. (Photo by Dave Gatley/FEMA)

2. Hurricane/Tropical Storm Hazard in Tuolumne County

Due to the nature of most hurricanes and tropical storms being a phenomenon of the southeastern/southern area of the United States, Tuolumne County has never experienced major problems related to these hazards nor will it ever. There have been conditions related to tropical moisture originating from the more southerly parts of Pacific Ocean, known as "monsoons" or similar storms that bring humid air into the Sierra that can result in thunderstorms and intense rainfall. This could result in localized floods and those related hazards are discussed in the "Winter or Seasonal Storms" section of this document.

Tsunami

1. General Tsunami Hazard from National Perspective

The word tsunami is Japanese and means "harbor wave." A tsunami is a series of great waves that are created by undersea disturbances such as earthquakes or volcanic eruptions. From the area of disturbance, tsunami waves will travel outward in all directions. Tsunamis can originate hundreds or even thousands of miles away from coastal areas.

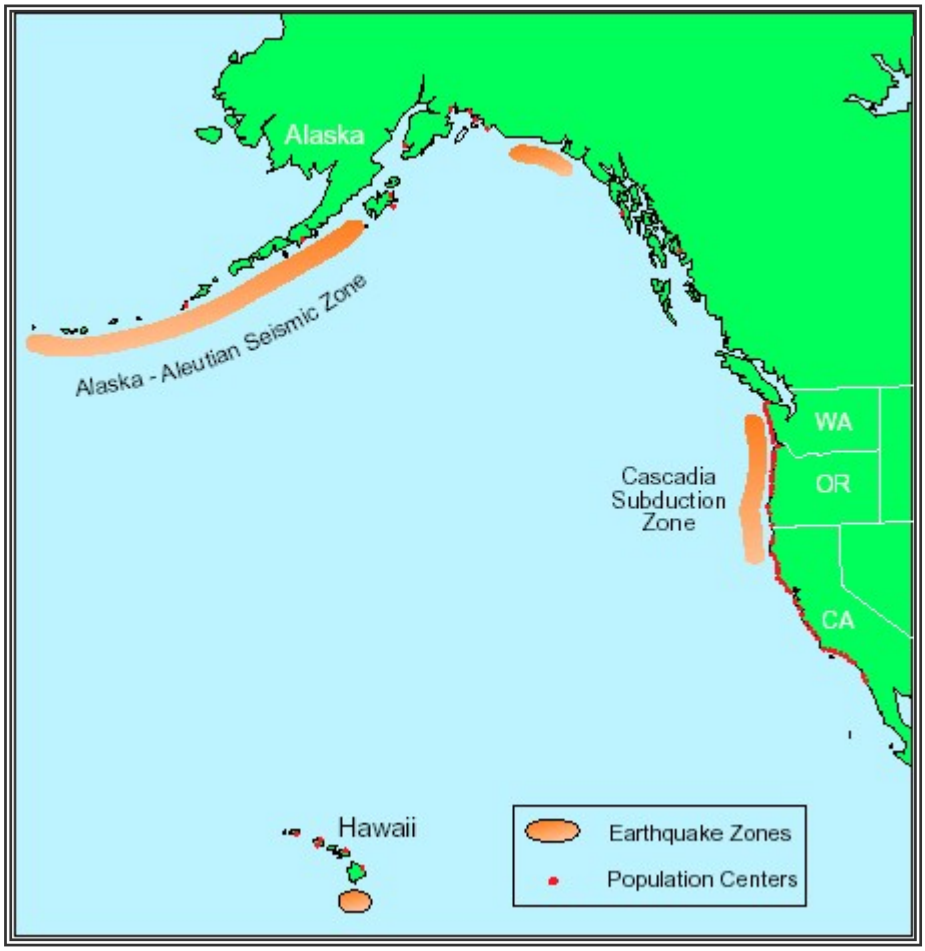
The time between wave crests may be five to 90 minutes and the open ocean wave speed may average 450 miles per hour. As tsunami waves approach shallow coastal waters, they appear normal size and the speed decreases until the waves near the shoreline, where it may grow to great height and crash into the shore. Areas at greatest risk are less than 50 feet above sea level and within one mile of the shoreline. Rapid changes in the ocean water level may indicate that a tsunami is approaching. Most deaths during a tsunami are the result of drowning. Associated risks include flooding, polluted water supplies, and damaged gas lines.

Tsunami Hazard Zone *signs are posted at coastal access points or other low-lying areas that would clearly be vulnerable to a large, locally generated tsunami. . (Photos courtesy of Washington State Department of Transportation)*

In the United States, tsunamis have historically affected the West Coast (Figure II-21), but the threat of tsunami inundation is also possible on the Atlantic Coast. Pacific Ocean tsunamis are classified as local, regional, or Pacific-wide. Regional tsunamis are most common. Pacific-wide tsunamis are much less common, with the last one being recorded in 1964, but are larger waves, which have high potential to cause destruction. Figure II-21 identifies known off-shore earthquake zones, which are known to potential tsunami generators. Proximity to the earthquake zones would appreciably increase the potential for the hazards from tsunamis.

The Pacific Tsunami Warning Center was established in 1949 at Ewa Beach, Hawaii to monitor conditions in the Pacific Ocean and to provide warnings in case of tsunamis. According to the Pacific Tsunami Warning Center Laboratory in Novosiirsk, 796 tsunamis were observed or recorded in the Pacific Ocean between 1900 and 2001. Approximately 117 caused casualties and damage and at least nine caused widespread destruction throughout the Pacific. The greatest number of tsunamis during any one-year was 19 in 1938, but all were minor and caused no damage. There was no single year of the period that was free of tsunamis.

Figure II-21. Primary Tsunami Hazard Areas



Source: National Oceanic and Atmospheric Administration (NOAA)

2. Tsunami Hazard in Tuolumne County

The distance from any portion of Tuolumne County to the open ocean is at least 50 miles. Additionally, the absolute lowest elevation in Tuolumne County is at least 200 feet above sea level, and there are no structures below 400 feet above sea level. Based on these aspects of geography, there is no threat of tsunami hazard for Tuolumne County.

III. Community Vulnerability Assessment

Based on the *Hazard Identification and Analysis* conducted for Tuolumne County, the hazards listed below have been chosen for inclusion in a vulnerability assessment.

- **Wildfire**
- **Floods**
- **Dam Failure**
- **Earthquakes, Sinkholes and Landslides**
- **Winter/Seasonal Storms**
- **Volcano**
- **Drought/Extreme Heat**
- **Erosion**

These hazards were chosen from the previous sections due to the higher level of risk for these hazards compared to others. It is important to note that this risk assessment is based on best available data and represents a base-level assessment for the planning area. Additional work will be done on an on-going basis to enhance, expand and further improve the accuracy of the baseline established here.

Methodologies Used

To drive the risk assessment effort, two distinct methodologies were applied. The first methodology consists of utilizing HAZUS® (GIS-based loss estimation software available from the Federal Emergency Management Agency) as well as a GIS-based approach independent of the HAZUS software. These two GIS-based studies, which together form a quantitative assessment, were then combined with a qualitative element to create a hybrid approach. The quantitative assessment focuses on potential loss estimates, while the qualitative assessment is comprised of a scoring system built around values assigned by the Hazard Mitigation Advisory Committee to the likelihood of occurrence, spatial extent and potential impact of each hazard studied.

It is important to note that the determinations presented in this section with regard to vulnerability were developed using best available data, and the methodologies applied have resulted in an approximation of risk. These estimates should be used to understand relative risk from hazards and the potential losses that may be incurred; however, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment and also from approximations and simplifications that are necessary in order to provide a comprehensive analysis.

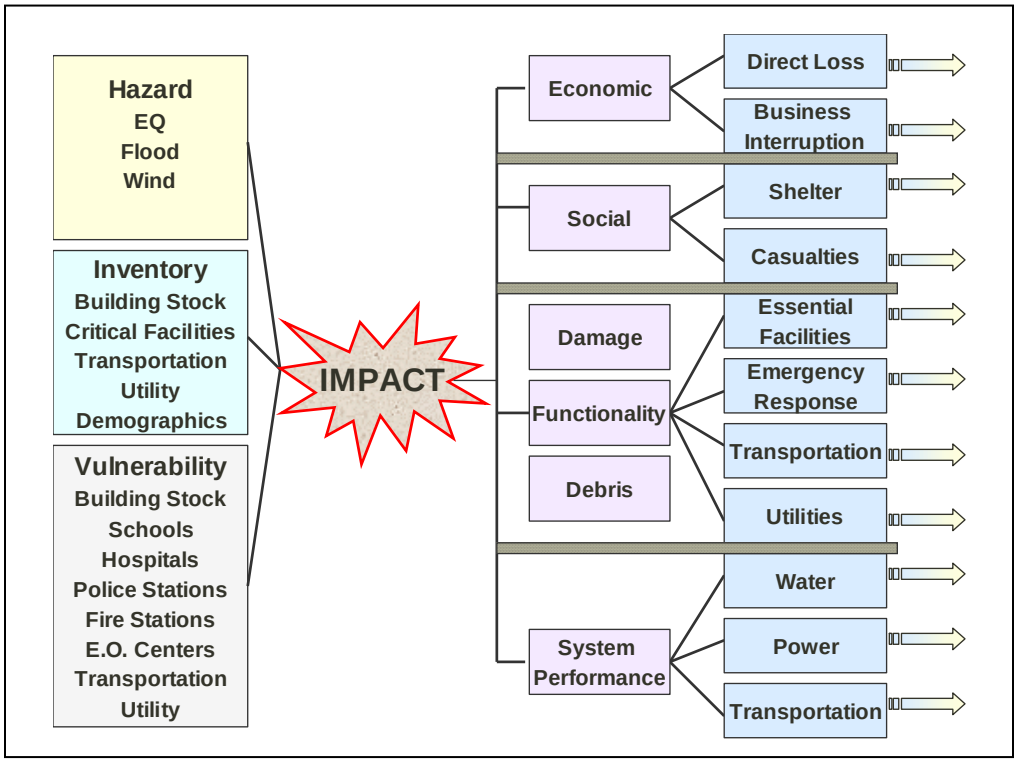
Explanation of HAZUS Risk Assessment Methodology

HAZUS is FEMA's nationwide standardized loss estimation software package, built upon an integrated geographic information system (GIS) platform. This risk assessment utilized HAZUS to produce regional profiles and estimated losses for one of the hazards addressed in this section: earthquake. At the time this assessment was completed, a newer version of HAZUS, was under development to better address potential losses from

flood, wind and earthquake hazards to incorporate updated baseline data. It is anticipated that when the newer version of HAZUS is available, the hazards addressed by the newer version will be used to create an updated vulnerability assessment in the future. At this time, since only the earthquake hazard is accommodated, that is the hazard analysis that uses the HAZUS software.

The HAZUS risk assessment uses distinct hazard and inventory parameters — such as peak ground velocity and building type, for example — modeled using the HAZUS software to determine the impact (damages and losses) on the built environment. Figure III-1 shows a conceptual model of HAZUS methodology.

Figure III-1. Conceptual Model of HAZUS Methodology



It is important to note that for those hazards where HAZUS was used, "worst case scenario" results were produced to show the maximum potential extent of damages for those hazards. It is understood that any smaller events which could occur would likely create fewer losses than those calculated here.

Explanation of GIS-based (non-HAZUS) Risk Assessment Methodology

The general steps used in the GIS-based assessment conducted independently of the HAZUS software are summarized below:

- The first step in conducting this facet of the risk assessment consisted of GIS data collection from local, state and national sources.

- For the flood hazard, ESRI® ArcGIS™ 8 was used to assess risk utilizing digital flood hazard data (based on FEMA Flood Insurance Rate Maps) in combination with locally-available GIS data layers. Primary data layers used include local tax records for individual parcels, assessor's parcel files, digital orthophotographic layers, and various geo-referenced point locations and line files. Using these data layers, flood risk was assessed by calculating the total structural and contents value of all of the structures estimated to be at risk. The structural values was estimated for a typical residence in Tuolumne County from a combination of Assessors files and current construction cost tables regionally adjusted. The mean square footage of a residence in the County was multiplied by the adjusted construction per square foot. A factor was added to account for the garage values, resulting in an estimate that the typical residential development could be replaced for $180,000. Adding a typical contents value of 50 percent then resulted in an assumption that the loss of a typical dwelling plus contents is estimated at $270,000. The flood losses were determined by applying that to the estimated numbers of dwellings lost during a 100 year flood, and then annualized.

- A similar process to that described above for flooding was followed to address the hazard of dam failure and subsequent inundation. The area of potential inundation was determined using the inundation maps the State of California requires owners or operators of larger dams to prepare. Submitted to the Office of Emergency Services (OES) and forwarded to the County Emergency Services Coordinator, these paper maps were scanned and converted to a useful GIS file. The risk of inundation damages was then calculated similarly the process outlined above for flooding.

- For the hazards of wildfire, GIS mapping files were acquired from the California Department of Forestry and Fire Protection (CDF) and processed with County GIS data. The primary datasets were a fire history map of Tuolumne County locating the area and year of both CDF and Stanislaus National Forest wildfires, a fire risk map produced by CDF, and the primary parcel layer for Tuolumne County based on Assessor's parcel maps. The risk data was based on numerous attributes such as slope, vegetation, aspect, accessibility, and assets to be protected. From the fire history files, the average number of acres burned of "developable" parcels was determined for the last 52 years (limit of full data history). Those burned areas were compared using GIS to find out the average acres of each of the three fire risk types (high, medium, and low) that burned. By comparing the existing parcel data against the risk areas, the mean density of the structures within each risk area was estimated. The estimated densities were then multiplied by the mean number of acres burned of each risk type, and the risk of lost structures was estimated on an annual basis. The typical replacement cost of rebuilding those structures (homes) was multiplied by the estimated risk per year to produce an annualized loss estimate of potential damages in Tuolumne County.

- For the winter storms, volcano, drought, and erosion hazards, meaningful historical data (meaning data which would have included property damages and other essential indicators) was virtually non-existent, and therefore annualized potential losses for these hazards is assumed to be negligible.

Explanation of Hybrid Approach

As described in the preceding commentary, the quantitative assessment focuses on potential loss estimates, while the qualitative assessment is comprised of a scoring system built around values assigned by the Hazard Mitigation Advisory Committee to the likelihood of occurrence, spatial extent and potential impact of each hazard presented. For likelihood of occurrence, the following four options were available to members of the Mitigation Advisory Committee: Highly Likely, Likely, Possible or Unlikely. For spatial extent, three options were offered to describe the area which might be expected to be affected: Large, Moderate or Small. For potential impact, the choices consisted of: Catastrophic, Critical, Limited or Minor. Table III-1 provides the criteria associated with each label.

Table III-1. Criteria for Qualitative Assessment

	Assigned Value	Definition
Likelihood of Occurrence		
Highly Likely	3	Near 100% annual probability
Likely	2	Between 10 and 100% annual probability
Possible	1	Between 1 and 10% annual probability
Unlikely	0	Less than 1% annual probability
Spatial Extent		
Large	3	More than 50% of area affected
Moderate	2	Between 10 and 50% of area affected
Small	1	Less than 10% of area affected
Potential Impact		
Catastrophic	4	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	3	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than one week.
Limited	2	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than one day.
Minor	1	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

The values assigned for each option chosen are added together for each hazard to arrive at a total score. All conclusions are presented in “Conclusions on Hazard Risk,” found at the end of this section. Findings for each hazard are detailed in the hazard-by-hazard vulnerability assessment which follows, beginning with an overview of the planning area.

Overview of Tuolumne County Vulnerability

GEOGRAPHIC SETTING

Figure III-2. Location Map

Tuolumne County is a political subdivision of the State of California established in 1850. The County is one of California's original 27 counties and it continues to have its County seat in its first and only location, the City of Sonora.

The County is located in the Central Sierra portion of California and is bordered to the north by Calaveras and Alpine Counties, to the south by Mariposa and Madera Counties, to the east by Mono County and to the west by Stanislaus County. Portions of the Stanislaus National Forest and Yosemite National Park cover the easterly section of Tuolumne County.

Access to and through the County is provided by State Highways 108 and 120 which serve as east-west arterials and Highway 49 which runs through the County from Mariposa County in the south to Calaveras County in the north. Highway 132 traverses the southerly portion of the County linking the Lake Don Pedro area to Mariposa and Stanislaus Counties.

Figure III-2 above illustrates the geographic relationship of Tuolumne County within the State of California.

TOPOGRAPHY AND LAND FORMS

Land forms within the County range from gently rolling grasslands in the west to steep, jagged mountainous terrain in the east and along the canyons of the Tuolumne, Stanislaus and Clavey Rivers which flow through the County. These land forms were derived from the uplifting of the Sierra Nevada Range from the Pacific Ocean which once covered Tuolumne County and most of California. Over millions of years, the water receded as the Sierra Nevada Range was uplifted from below. The original smooth, rolling mountains were transformed by volcanic action, glaciers and tumbling rivers into a series of broad sloping benches separated and deeply cut by river canyons and numerous tributary drainages. Tuolumne County is within the Sierra Nevada Geomorphic Province. Elevations range from 400 feet in the western grasslands to 13,050 feet at Mt. Dana along the Sierra Crest.

The County's two major rivers, the Stanislaus and Tuolumne, occupy deep canyons that drain west into the Central Valley. Slopes along these river canyons are extremely steep with gradients of 60% to 100% with banks soaring as much as 1,000 to 2,000 feet above the riverbeds. Slopes on the broad areas between the major river canyons are moderately steep with gradients of 30% to 60%.

Five major kinds of geologic formations make up the County. Along the western part is a series of steeply tilted, metamorphic rocks trending northwest to southwest. Slates, phyllites and schists dominate with small localized areas of limestone and dolomite. Underlying the central and easterly sections of the County are the typical granitic rocks of the Sierras. Overlying these granitic rocks along the major ridges are volcanic breccias and flows. The volcanic rocks once covered most of the eastern portions of the County but have been mostly removed by subsequent erosion exposing the underlying granitic rocks. The existing volcanic ridges, such as Table Mountain, feature flat tops and moderately steep sides.

Glacial deposits occur primarily above the 6,500 foot elevation but locally extend to as low as 4,000 feet occurring as veneers along the canyon walls of the rivers. Much of the glacial material has been reworked by rainfall flowing down the canyon walls.

Recent alluvial fill material occurs in basins in the glaciated areas and a few larger basin fill areas along the rivers. Many of the large river basin areas have been flooded by manmade reservoirs, such as Beardsley and Cherry Lakes. Many small terraces and benches are found along minor stream courses; however, because the rivers occupy the entire stream course area in the canyon bottoms, few stable terraces are found there. There are also remnants of older Tertiary terraces, some of which were hydraulically mined for gold. From the Sierra crest down to the 7,000 foot elevation, the mountains have been glaciated with significant amounts of granitic and volcanic rock outcrops interspersed with areas of glacial deposits left on ridges and canyon walls. Glaciation extended down the river canyons leaving the steep-sided, barren rocky gorges that are in evidence today.

The area from the 7,000 foot elevation down to 3,500 feet, is dominated by coniferous forest of varied composition. There are also many narrow barren volcanic ridges, some isolated meadows and large areas of hardwood forests and shrub vegetation types.

Most of the area below 3,500 feet is rolling to hilly with numerous small drainages, many of them steep-sided. Vegetation in this area is a mixture of shrub types with scattered coniferous forest on the north and east slopes at the higher elevations and oak woodlands predominating at the lower elevations.

There are two fault zones on land under the County's jurisdiction, both located within the Foothill Fault System. The Bear Mountain fault zone extends from Sugarloaf Mountain southerly through Lake Don Pedro while the Melones Fault Zone extends from Jackass Hill southerly through Moccasin. Both zones trend north-south and continue beyond the County's boundaries. The gold bearing Mother Lode belt follows the Melones Fault zone through the west central portion of Tuolumne County.

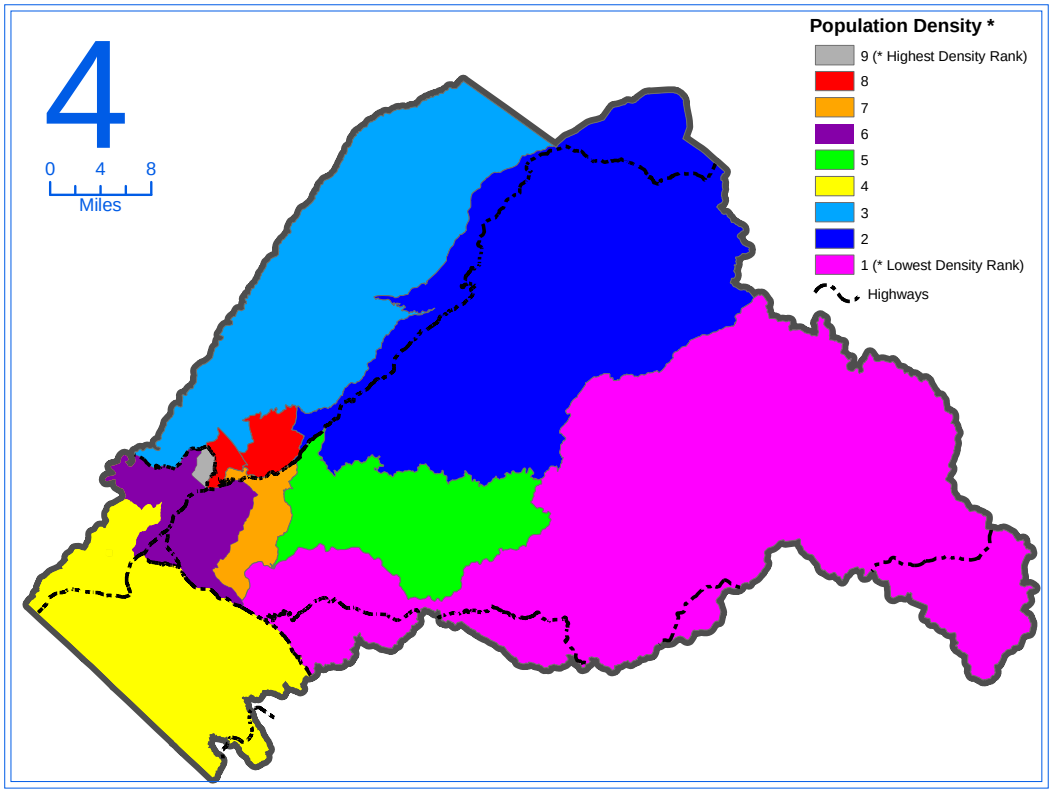
The mountainous topography of the County affects water table levels so that, unlike the Central Valley, there is no uniform depth of water. The hard rock wells in Tuolumne County are unpredictable and often unreliable. Surface water has been developed for use by many of the County's residents through a series of reservoirs, ditches and pipelines as a reliable source of water.

The development capacity of Tuolumne County is constrained by its geology, landform, soils and water supply. These factors are used to determine the existence of steep slopes, fault zones, inadequate supplies of water and soils unsuitable for sewage disposal or building foundations.

DEMOGRAPHICS

According to the U.S. Census Bureau, the total population of Tuolumne County in 2000 was 54,501. Figure III-3 shows the distribution of this population across the county's geographic area.

Figure III-3. Population Density by Census Tract (U.S. Census 2000)



ECONOMIC EXPOSURE

The total dollar exposure of buildings within Tuolumne County is estimated to be approximately $3,400,916,000. This is based on a study of 23,804 residential, commercial and industrial buildings located throughout the County, derived from HAZUS data.[1] Total dollar exposure accounts for both the building and building contents, which is based on a percentage of each building's value.

Of the approximately $3.4 billion in total building exposure, the general classification by use is shown the following Table III-2.

Table III-2. Building Exposure by Use (from HAZUS)

Use Type	Estimated Value (in millions)
Commercial	$38
Educational	$30
Government	$9
Industrial	$92
Religious	$28
Residential	$2,900

[1] HAZUS uses Census 1990 and Dunn and Bradstreet data for its default inventories. Any values unavailable in the current version of the HAZUS software are not reflected.

Figures III-4 through III-6 show the distribution of residential, commercial and industrial property exposure throughout the county by census tract.

Figure III-4a. Residential Dollar Exposure – Relative Numbers of Residences per Census Tract*

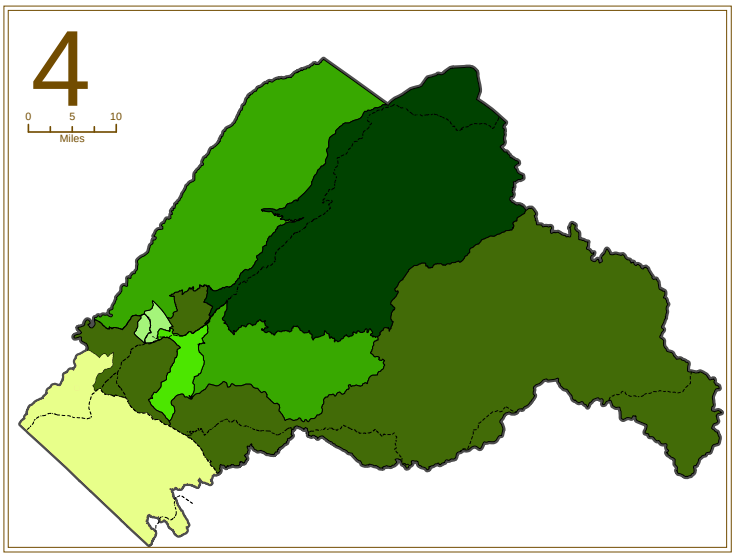
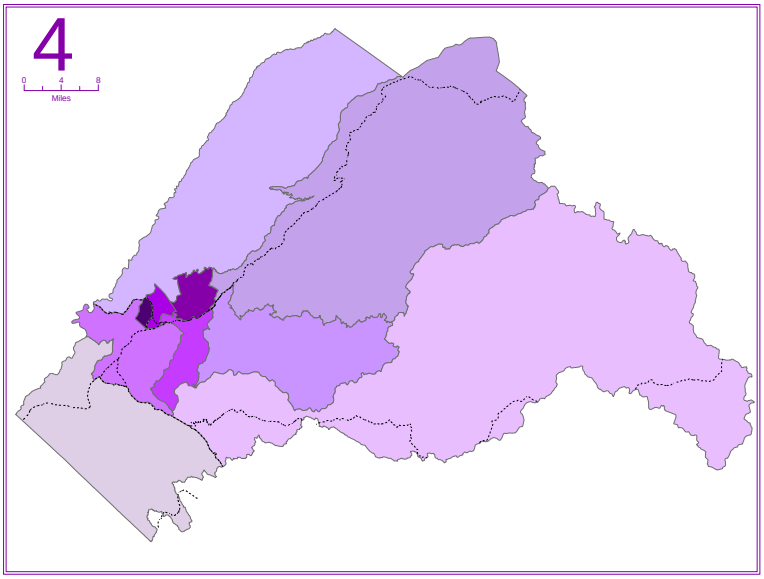
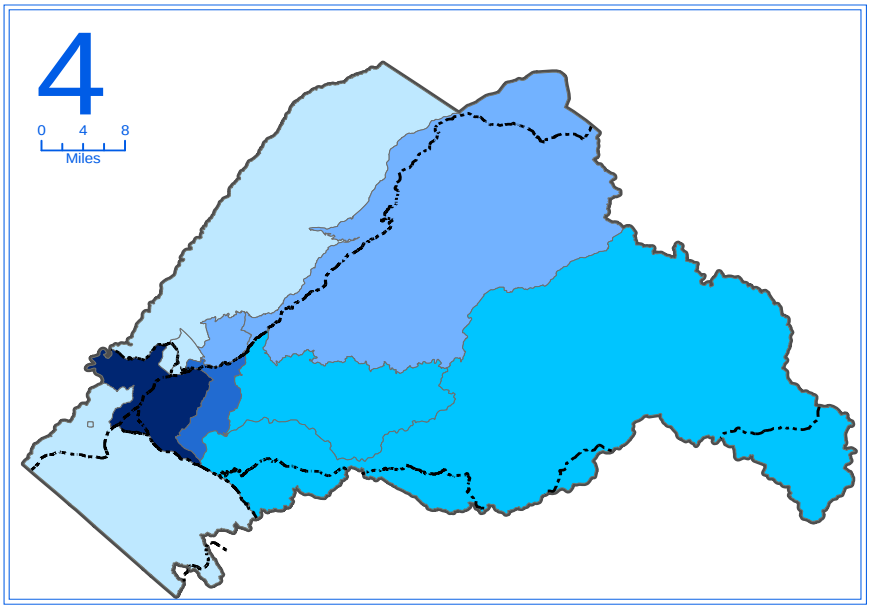


Figure III-4b. Residential Dollar Exposure – Relative Density of Residences per Census Tract*



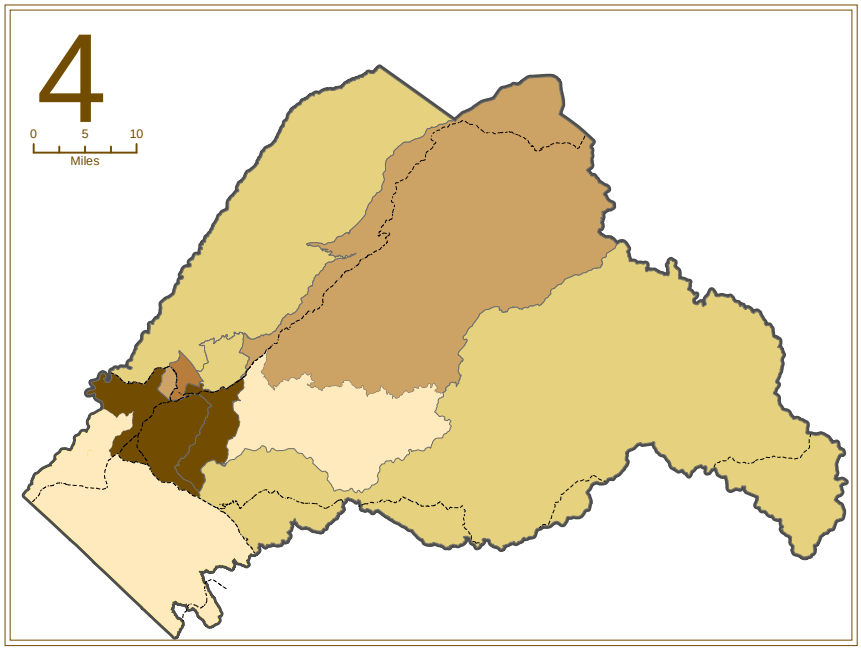
** Explanation: For both graphics, the darker the shading, the greater the concentration of residential dollar exposure. However, the two graphics differ in approach. Figure III-4a shows only the relative total numbers of residences per census tract, while Figure III-4b shows density by dividing the number of residences by the area of the tract. For example, the northeastern tract in 4a is darkest green, because that tract has the highest number of residences. However, most are concentrated in the southwestern part of that tract, and the eastern extreme is wilderness. That overall lower density is demonstrated in 4b, where the northeastern tract is relatively less dense than the more densely developed tracts in proximity to Sonora.*

Figure III-5. Industrial Dollar Exposure*



Explanation: The darker the shading, the greater the concentration of industrial dollar exposure.

Figure III-6. Commercial Dollar Exposure*



** Explanation: The darker the shading, the greater the concentration of commercial dollar exposure.*

DEVELOPMENT TRENDS

Prior to 1900, the County's population varied from 16,229 in 1860 to 6,082 in 1890 in response to the decades marked by California's Gold Rush. Only since 1930 has Tuolumne County experienced a steady growth rate. From the 1950's to the 1960's, the growth rate of the unincorporated area of Tuolumne County increased from 1.5% to 6.3% per year and remained at a high level through 1990. The population of the unincorporated area of Tuolumne County grew by 44.4% during the 1980's and slowed to 13.0% during the 1990's. Table III-3 shows the population growth of the unincorporated area of the County over the last 100 years.

Table III-3. Historical Population Growth 1900-2000

Year	Population	Change from Preceding Year/Census		
		No. of Persons	Percentage (10 yr.)	% Average Annual Change
1900	9,244			
1910	7,950	-1,294	-14.0%	-1.4
1920	6,084	-1,866	-23.5%	-2.3
1930	6,993	909	14.9%	1.5
1940	8,630	1,637	23.4%	2.3
1950	10,136	1,506	17.5%	1.7
1960	11,679	1,543	15.2%	1.5
1970	19,069	7,390	63.3%	6.3
1980	30,681	11,612	60.9%	6.1
1990	44,303	13,622	44.4%	4.4
2000	54,501	10,198	23.0%	2.3

Source: U.S. Census

Of the County's total population of 54,501 persons, 4,423 reside within the City of Sonora and 50,078 reside within the unincorporated area of Tuolumne County. The population within the unincorporated area includes 4,246 incarcerated persons, mostly within the Sierra Conservation Center (State prison). The rest are located either within the smaller unincorporated communities of Jamestown, Tuolumne, Columbia or Twain Harte, or within numerous subdivisions spread throughout the County, or in some form of rural housing. The Tuolumne County General Plan attempts to control continued sprawl by directing future growth in areas contiguous to existing communities or development, or within logical in-fill areas. None of the future new growth areas are directly affected by the known hazards of flooding or dam inundation. The more generally distributed hazards such as wildfire, storms, or earthquakes cannot be avoided totally with planning growth in specific areas, due to the pervasive nature of those hazards within Tuolumne County. Wildfire in particular is considered by the General Plan, which for the most part directs significant dense growth to areas of the County in lower elevations, where the vegetation density and relative wildfire hazards are somewhat reduced.

LAND USE

Tuolumne County features a large geographic area consisting of approximately 1.4 million acres, or 2,200± square miles, stretching from the San Joaquin Valley and west 70 miles to the crest of the Sierra Nevada which forms the County's easterly boundary. Of these 1.4 million acres, approximately 1.1 million acres are under Federal jurisdiction, nearly 3,300 acres are under State jurisdiction, and local governments and utility agencies, excluding Tuolumne County, have jurisdiction over more than 14,000± acres within Tuolumne County's boundaries. Approximately 333,000 acres are privately owned, and subject to typical residential, commercial or industrial development. For purposes of this plan, those are the properties that are considered "developable".

Table III-4. Distribution Of Land Ownership in Tuolumne County - 1995 Estimates

OWNERSHIP/JURISDICTION	ACREAGE
FEDERAL OWNERSHIP[2]	
Stanislaus National Forest	605,803
Yosemite National Park	435,847
Bureau of Land Management	47,352
Bureau of Reclamation (New Melones Reservoir, Two-mile Bar)	9,906
SUBTOTAL FEDERAL OWNERSHIP	1,098,908
STATE OWNERSHIP[3]	
Big Trees State Park	3,000
Columbia and Railtown State Historic Parks	270
SUBTOTAL STATE GOVERNMENT	3,270

[2] Source: 1994-95 Tuolumne County Assessor's records. All acreages are approximate. NOTE: This total acreage includes lands under the jurisdiction of the Bureau of Indian Affairs: Tuolumne Rancheria and Chicken Ranch Rancheria.

[3] Source: 1994-95 Tuolumne County Assessor's records. All acreages are approximate. Acreages do not include property owned by Caltrans.

LOCAL GOVERNMENT OWNERSHIP AND DISTRICTS[4]	
TriDam's Oakdale and Southern San Joaquin Irrigation Districts (Tulloch Lake), Turlock and Modesto Irrigation Districts (Lake Don Pedro), Tuolumne Utilities District (Phoenix Lake)[5]	8,460
City and County of San Francisco (Hetch Hetchy, Moccasin)	4,051
City of Sonora[6]	1,920
Tuolumne County	676
SUBTOTAL LOCAL GOVERNMENTS AND DISTRICTS	15,107

PRIVATE OWNERSHIP	
Agricultural Land[7]	171,841
Timber Production[8]	87,662
Other Private Land[9]	73,825
SUBTOTAL PRIVATE OWNERSHIP	333,328
GRAND TOTAL (all lands within Tuolumne County)	1,450,613

[4] Source: 1994-95 Tuolumne County Assessor's records. All acreages are approximate. Acreages do not include property owned by Caltrans.

[5] Not included in this total are numerous reservoirs included in totals for State and Federal ownership: Tridam's Goodwin, Beardsley and Donnell Lake Reservoirs; Pacific Gas and Electric Company's Pinecrest and Lyons Lakes; Utica and McKays Reservoirs, Phoenix hydroelectric powerhouse; and the Northern Power Consortium's Spicer Reservoir and Camp Nine hydroelectric powerhouse on the Stanislaus River.

[6] Acreage within the City of Sonora's jurisdictional boundaries and not of parcels owned by the City.

[7] Source: 1996 Tuolumne County Geographic Information System database. The California Department of Conservation reports that as of March 1, 1995, 123,738 acres of the 171,841 acres of agricultural lands were under Williamson Act contract. However, because many large acreage parcels under the Williamson Act have never been thoroughly surveyed, the 123,738 acres figure is approximate only.

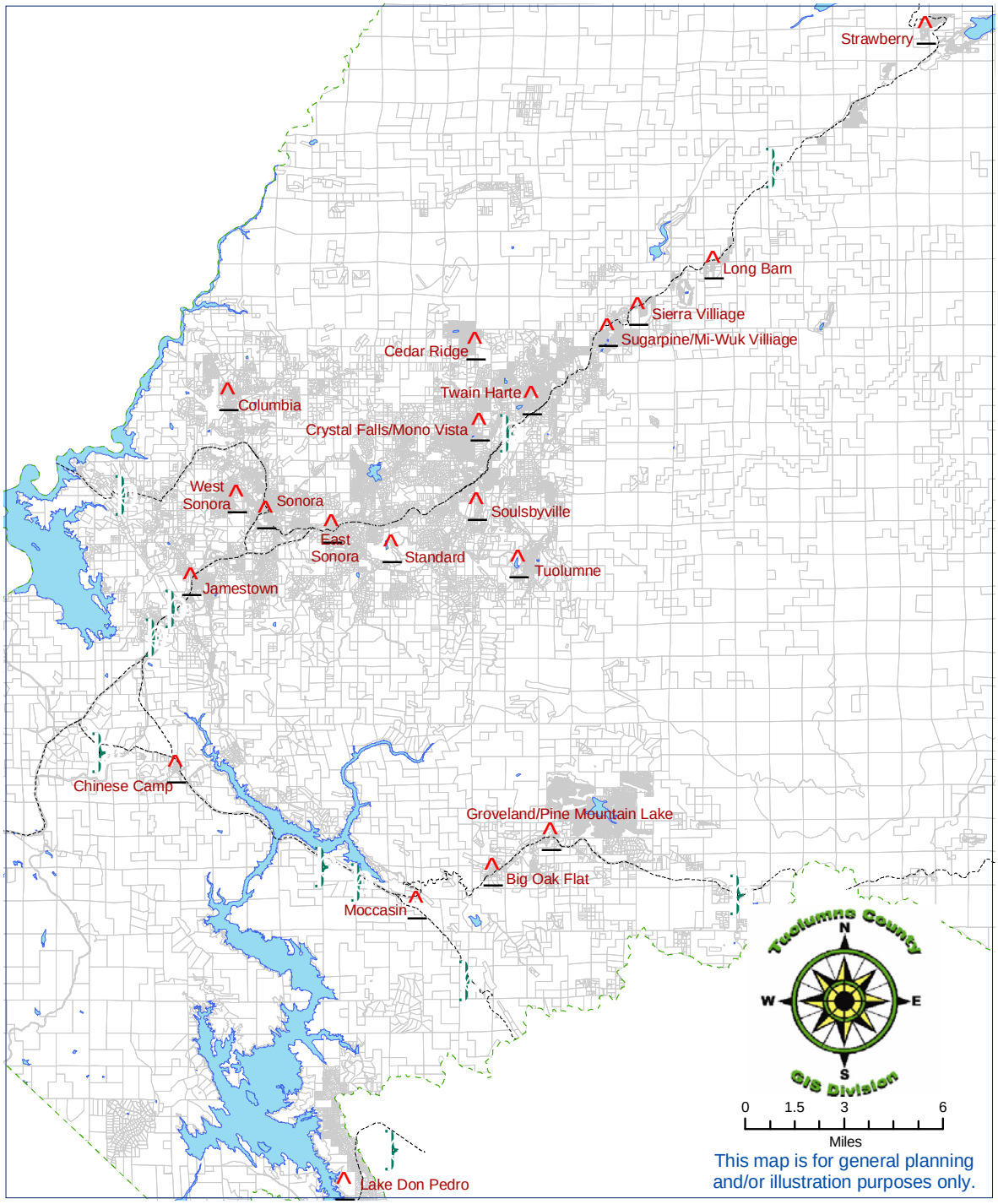
[8] Source: 1996 Tuolumne County Geographic Information System database.

[9] Source: 1996 Tuolumne County Geographic Information System (GIS) database for all commercial, industrial, urban, rural, agricultural and timber production acres. Acreages for parks and recreation, open space and mineral preserve lands for 1995 are unavailable from the GIS, but are estimated at 1,684 acres.

COMMUNITY ORIENTATION

The following graphic, Figure III-7, shows the general orientation of communities within Tuolumne County. The original settlement pattern reflected the location of the sources of gold or other resources that the settlers came to exploit, and the current arrangement of communities for a large part reflects that history. A more complete discussion of the historic settlement of Tuolumne County is found in the following section “Historical Resources”.

Figure III-7. Location of Communities



Southwest. The southwest portion of the County, also known as the West County, is primarily rangeland, located below an elevation of 2,000 feet, with beef cattle representing the region's primary commercial product. Over 120,000 acres of these lands are enrolled in Williamson Act Land Conservation Contracts; consequently, development of the southwest

region has been limited. However, there is growing pressure to develop this area to provide housing for Tuolumne County residents commuting to jobs outside the County's boundaries. Currently, an estimated 4,500 residents commute to work outside the County on a daily basis. Small communities like Chinese Camp and small, scattered subdivisions are located in this region.

South. Due to its physical separation from the remainder of the County, the land use patterns and service needs of residents south of the Tuolumne River and south of Lake Don Pedro differ from those elsewhere in the County. Many of the South County's residents go to Sonora to shop or work, although limited commercial development and job opportunities exist in this region. The South County serves as an important gateway to Yosemite National Park and a large portion of the area's economy caters to park visitors.

Groveland, Big Oak Flat, the Lake Don Pedro Subdivision (excepting a small portion of Unit One located northwest of La Grange Road near the Stanislaus County Line) and Pine Mountain Lake support the majority of the South County's population. Moccasin, owned and operated by the City and County of San Francisco, is also located in the South County.

Central. The central County extends from Jamestown eastward to Twain Harte and is, and has been, home to the majority of the County's population and the bulk of the County's development since the Gold Rush. The area provides the majority of the County's shopping centers, public services, and industrial facilities. The central County is characterized by highly urbanized areas with agricultural operations and rural development at the edges of, and between, the individual communities. The central County, as in the northeast County, includes both year-round and second residences built on lots from one quarter to five acres in size.

The central County is the site of the County seat, Sonora. In addition, it includes Columbia, East Sonora, Phoenix Lake, Mono Vista, Soulsbyville, Tuolumne City, Tuttletown, Standard, Jamestown and numerous residential subdivisions located in and around these communities.

Northeast. The northeast portion of the County, extending from Twain Harte to the Sonora Pass, features concentrated tourist-oriented and residential development along the Highway 108 corridor. This area also is known as the “High Country” and is concentrated at elevations of 3,000 feet and higher. The Highway 108 corridor through the northeast County provides a primary route to some of the Stanislaus National Forest's most popular recreational destinations including Pinecrest, the Dardanelles, Kennedy Meadows, the Dodge Ridge ski area, and numerous lakes, campgrounds and miles and miles of trails. The northeast County is the site of much of the logging activity which supports the timber industry in Tuolumne County from both privately-owned and Stanislaus National Forest lands. Most of the County’s timber producing lands are found in this portion of the County.

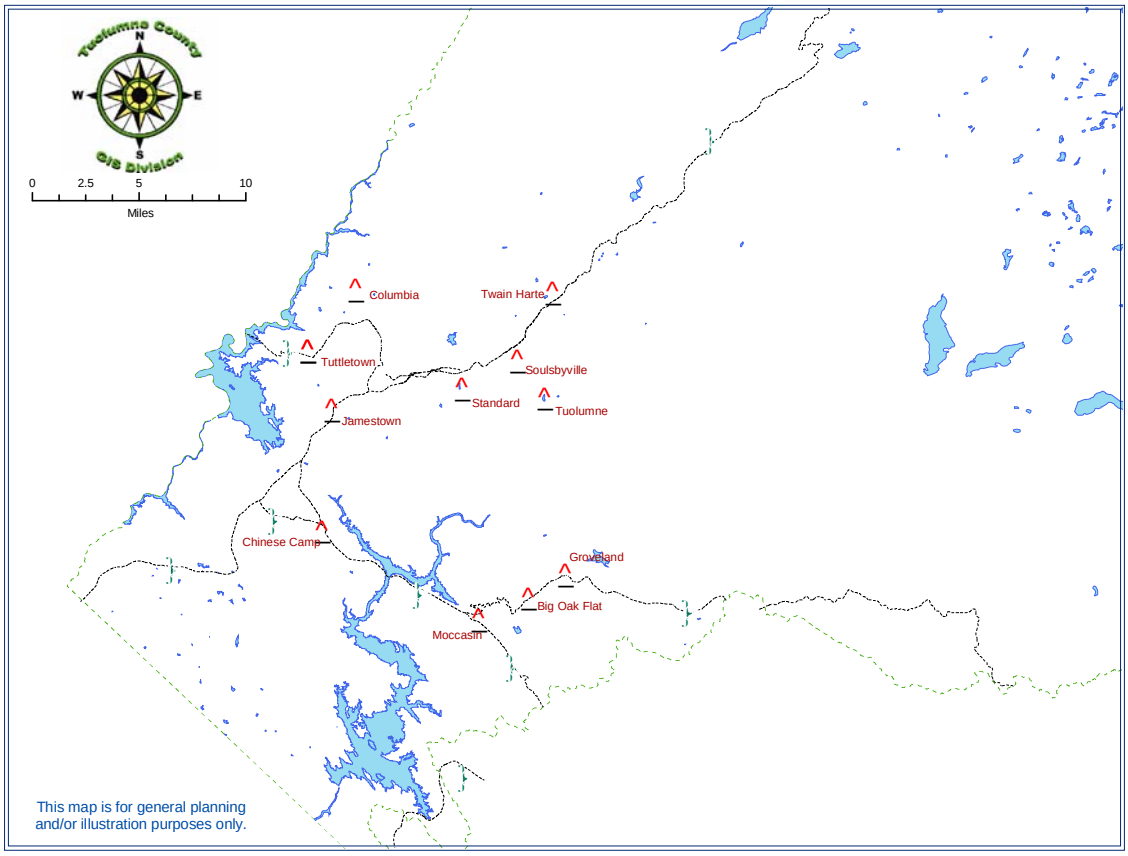
Small lot subdivisions for both year-round and seasonal residents are found in the northeast County and include Twain Harte, Cedar Ridge, Brentwood Park, Jupiter, Leland Meadows, Sugar Pine, Mi-Wuk Village, Sierra Village, Long Barn, Cold Springs, Confidence, Sherwood Forest, Lakewood Park, Leisure Pines, Peter Pam and Strawberry.

PREHISTORIC AND HISTORIC RESOURCES

Tuolumne County has a rich past beginning with prehistoric habitation which began more than 10,000 years ago and extending back conceivably more than 11,000 years. The County's indigenous peoples, the Central Sierra Me-Wuks arrived between 2000 and 600 years ago. The most visible remnants of the County's past are found in its Gold Rush Era buildings and artifacts dating from 1848, however the County's rich heritage also is well-grounded in its agricultural, lumber, railroad, water development, and transportation development past. Each of these eras has been colored by the strong influences of the various ethnic groups which have come and gone from the County. Whatever the context, Tuolumne County's history has left an indelible imprint on the County's present landscape.

With this rich heritage, the County is, like many Central Sierra counties, home to numerous resources which are both concentrated along old, historic Main Streets and scattered throughout the hills, valleys, mountains and waterways of the County's public and private lands. The following graphic shows the communities in Tuolumne County that contain a significant number of historic structures, most occupied and used for residences, businesses and offices.

Figure III-8. Historic Communities of Tuolumne County



A significant number of studies have been conducted to examine the numerous historic towns, structures, sites and other resources, and this documentation is all available for review at the County. There are also numerous sites, potential districts, and individual

structures in Tuolumne County that could be considered as important based on federal, state and local standards, but which have not been thoroughly evaluated or, in the case of prehistoric sites, have yet to be identified. A much more thorough explanation on the nature of prehistoric and historic activity, and related resources can be found in an appendix to this document, Appendix A Prehistoric and Historic Cultural Resources Summary.

Figure III-9. Streetscape of Historic Buildings in Community of Jamestown

The threat to cultural resources from hazards is difficult to define, and probably impossible to quantify. This particularly applies to historic structures, which can be damaged or destroyed by natural hazards, in particular fire and earthquakes. The historic structures were constructed long before modern codes that require seismic reinforcement of masonry buildings, or fire prevention and suppression attributes like sprinklers. Historic preservation allowances for these structures allow continued use as commercial and residential buildings, and remodeling that may not meet the same building and fire code requirements as a new structure. A major earthquake could cause substantial loss of these structures throughout the County, and the historic communities could be complete losses if a major fire was to sweep through the town. As the historic buildings are, for practical purposes, irreplaceable then rebuilding after such a disaster would result in new buildings that would not have the same character and the same value as the historic resources.

High Potential Loss Properties, Critical Facilities and HAZMAT Sites

Tuolumne County has inventoried high potential loss properties within the County (buildings with an assessed building value greater than $1 million) along with critical facilities such as fire and police stations, hospitals and schools, and hazardous materials (HAZMAT) sites. These facilities are considered to be of special value and/or significance, and are considered as a default to be generally at-risk from such hazards as earthquakes and winter storms. Table III-5 lists these facilities along with a total number in the County's inventory that are assumed to be at-risk from most general hazards.

Table III-5. High Potential Loss Properties, Critical Facilities and HAZMAT Sites

Type	Total Number in Inventory[10]
High Potential Loss Properties	83
Fire Stations/Emergency Services	8
Medical Facilities	3
Schools	34
Sewage Treatment Facilities	39
Water Treatment Facilities	38
Airports	2
Group living facilities for seniors	10
HAZMAT (TRI)[11]	3
TOTAL:	**220**

The following series of graphics show locations for many of the categories of described above. The first, Figure III-10, shows the locations of the "high potential loss properties". These properties were derived from the County Assessor's assessed values as being $1 million or greater for the improvements on the sites. The real property values without structures is not considered. What are included are many of the significant commercial and industrial complexes, as well as larger structures such as privately owned nursing homes, hospital, and a few large residences. This data source is limited due to the fact that publicly owned structures are not taxed and therefore not assessed, and would not be included.

[10] With the exception of the "High Potential Loss Properties", the inventory numbers were derived directly from the data supplied with HAZUS, and should be considered an estimate. High Potential Loss Properties were derived from a list of developed properties with improvements that have an assessed value of $1million or greater. For any of the other categories, such as schools or utility facilities, other data that may be found elsewhere in this document or in the appendices from the participating jurisdictions should be considered more representative.

[11] In order to capture a realistic number for those HAZMAT sites that (potentially) are the most significant in terms of a hazardous materials release, only those sites listed on the Toxic Release Inventory are counted here. The Toxic Release Inventory is a publicly available EPA database that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups and federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990.

Figure III-10. Location of High Value Structures

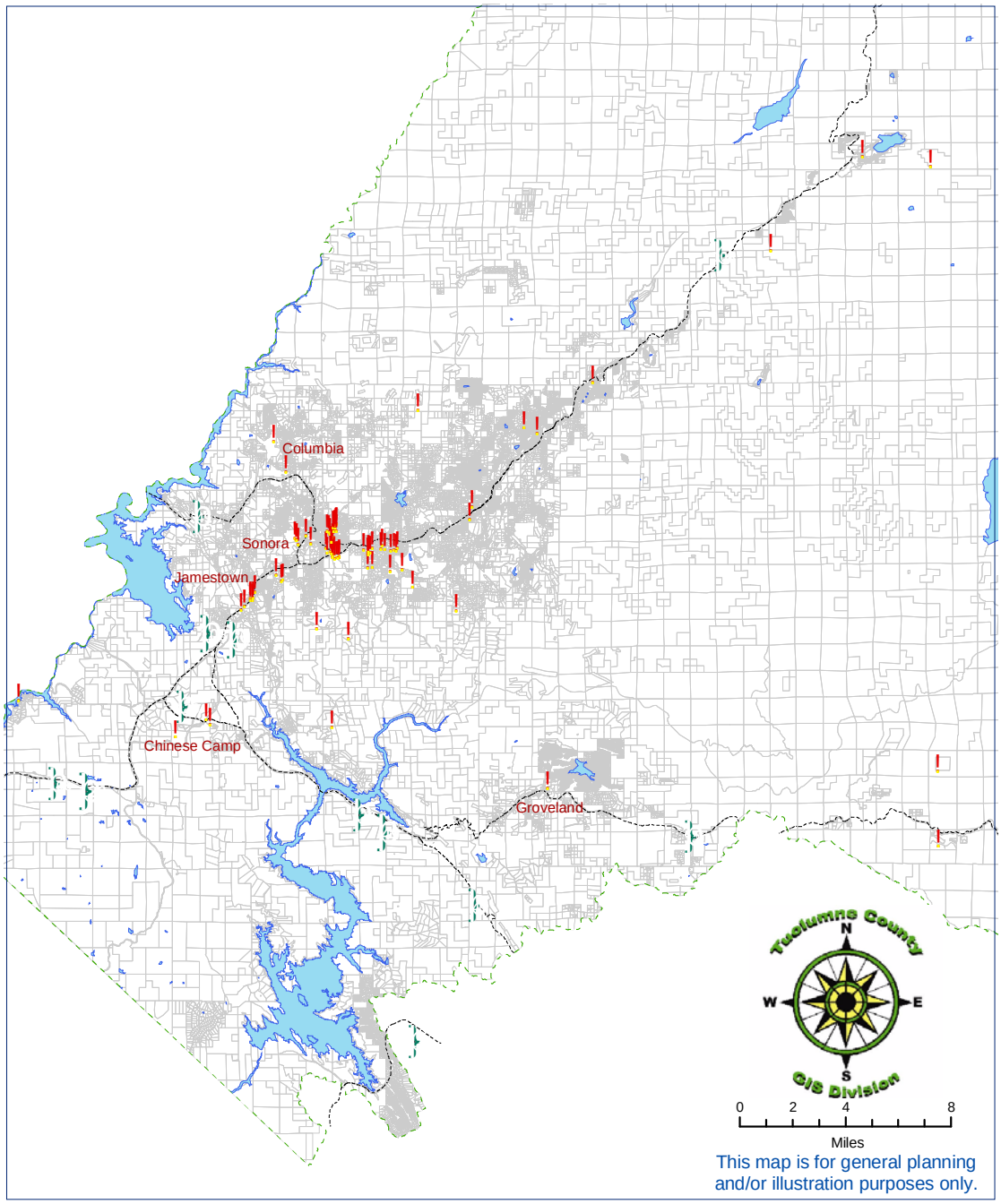
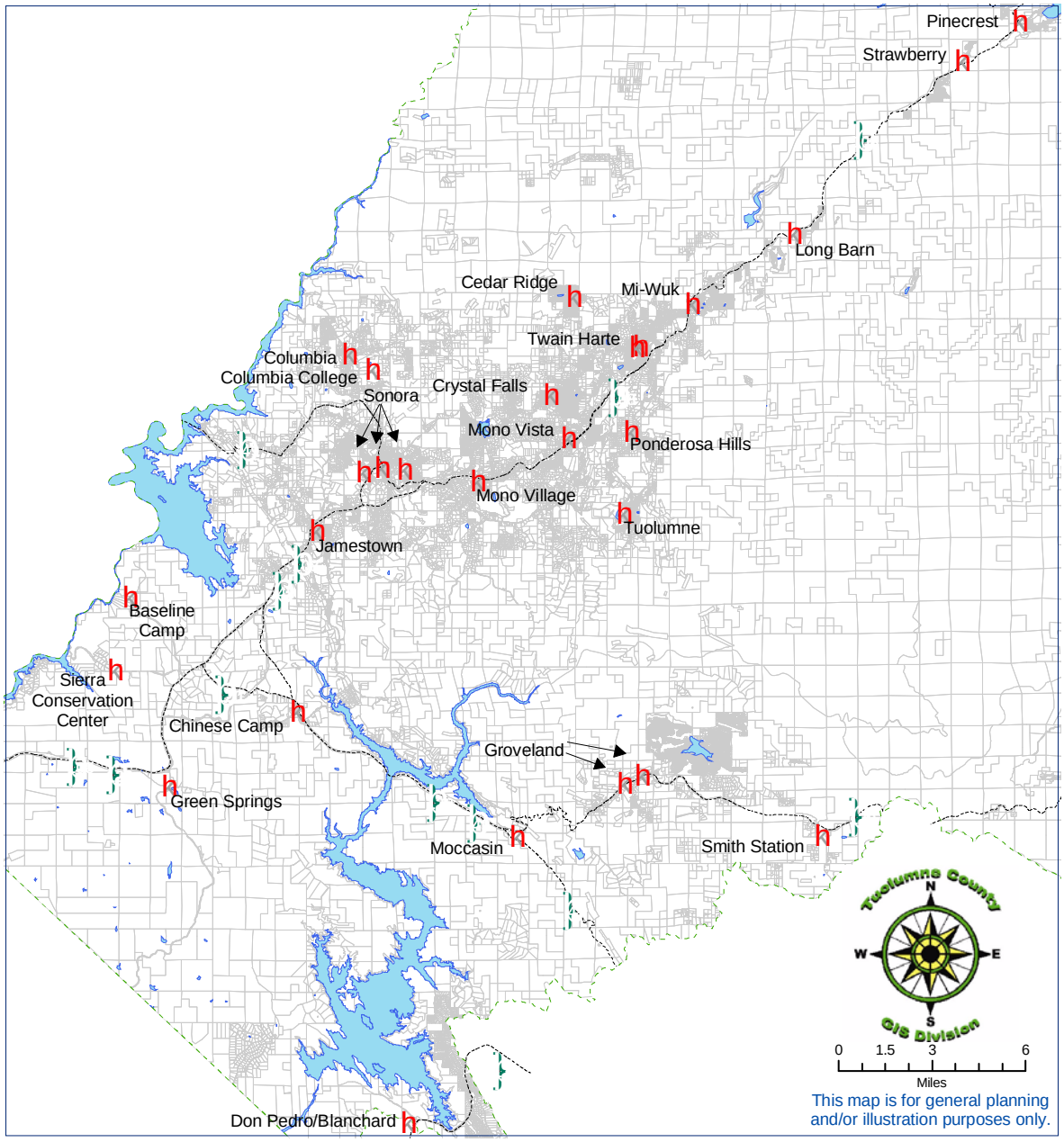


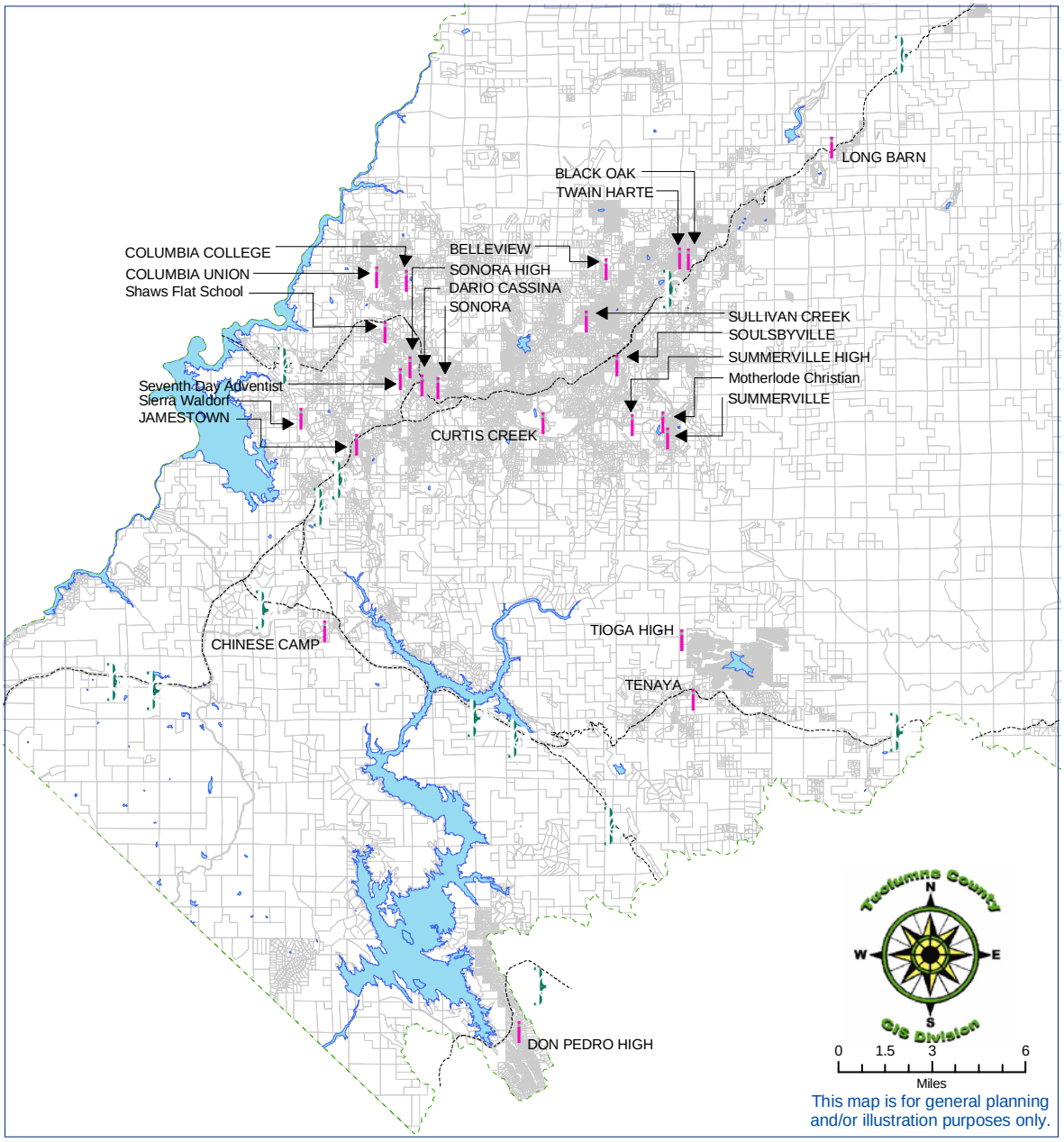
Figure III-10 shows that the majority of the high value properties are located in the vicinity of Sonora, East Sonora, and Jamestown, the portion of the County where most of the commercial development has occurred. More remotely-located high value properties include such developments as Dodge Ridge Ski Resort, private camp complexes, and a few very large residences.

Figure III-11. Location of Fire Stations



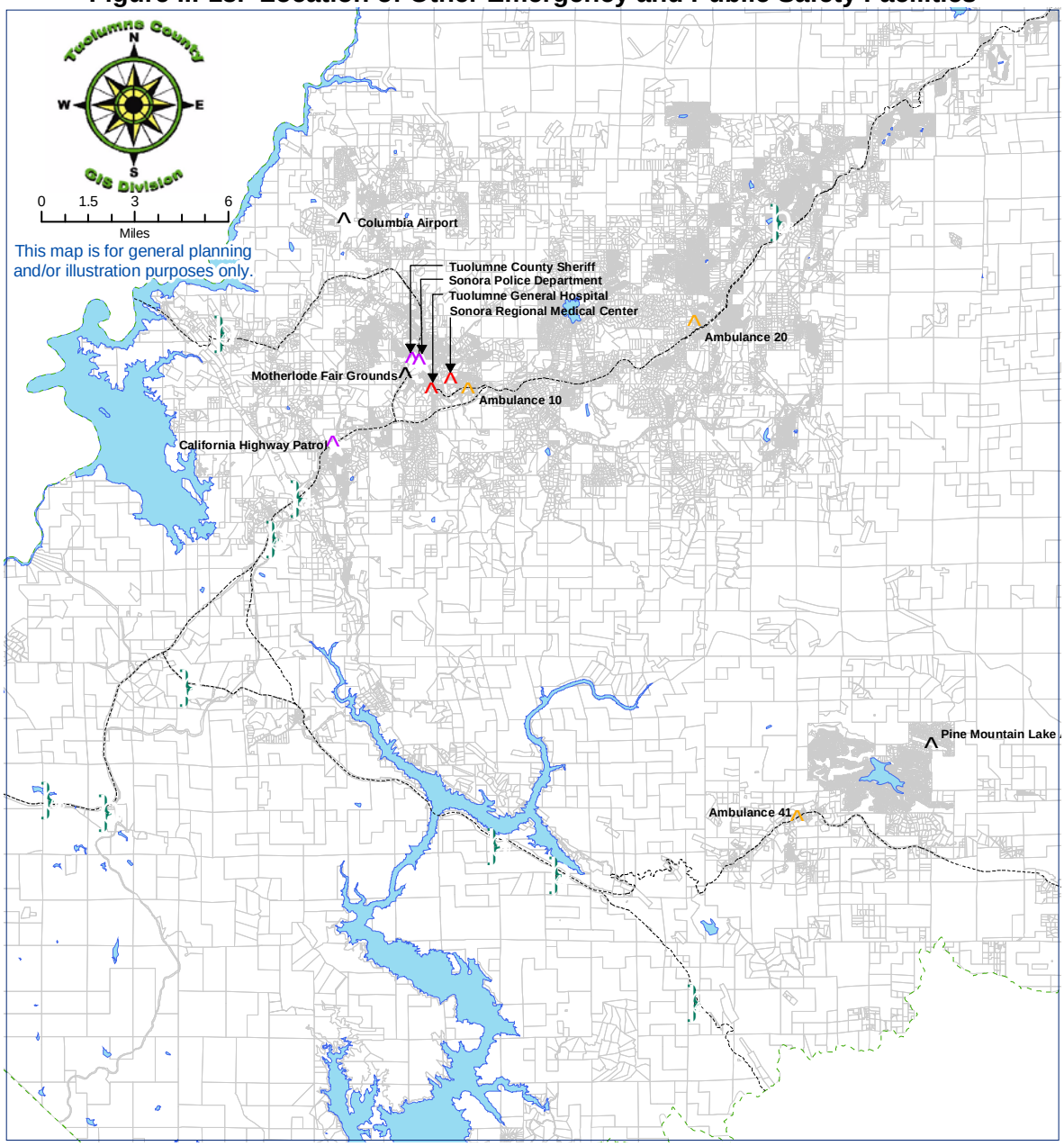
The preceding Figure III-11 shows the location of the primary fire stations in the County. All of these are considered to be critical facilities during any sort of disaster response.

Figure III-12. Location of Schools



The above Figure III-12 shows the location of all of the schools in the County, including public elementary and high schools, private schools, and Columbia College. Please note that the number of schools indicated by HAZUS and documented in the earlier Table III-5 is higher than the number of locations on the above graphic, because HAZUS includes known preschools and daycare providers in its total, and they are not included in the above graphic.

Figure III-13. Location of Other Emergency and Public Safety Facilities



The preceding Figure III-13 shows the location of the primary facilities related to emergency services and public safety: These include law enforcement: the main office locations for the Tuolumne County Sheriff's Office, Sonora Police Department, and California Highway Patrol. Also indicated are the two general aviation airports in the County, the two hospitals, and the ambulance stations. Lastly, the location of the Motherlode Fairgrounds shows the place most often used in the past as an emergency shelter during events that require evacuation.

Critical Transportation-related Facilities

The Tuolumne County Department of Public Works' facilities are critical for response to hazards, or for circulation and access for others to respond to disaster events, or are in some way vulnerable to the hazards being evaluated. The location of these facilities are identified in a number of graphics, Figures III-14 though III-18, which follow:

Figure III-14. Location of County Public Works Maintenance Yards

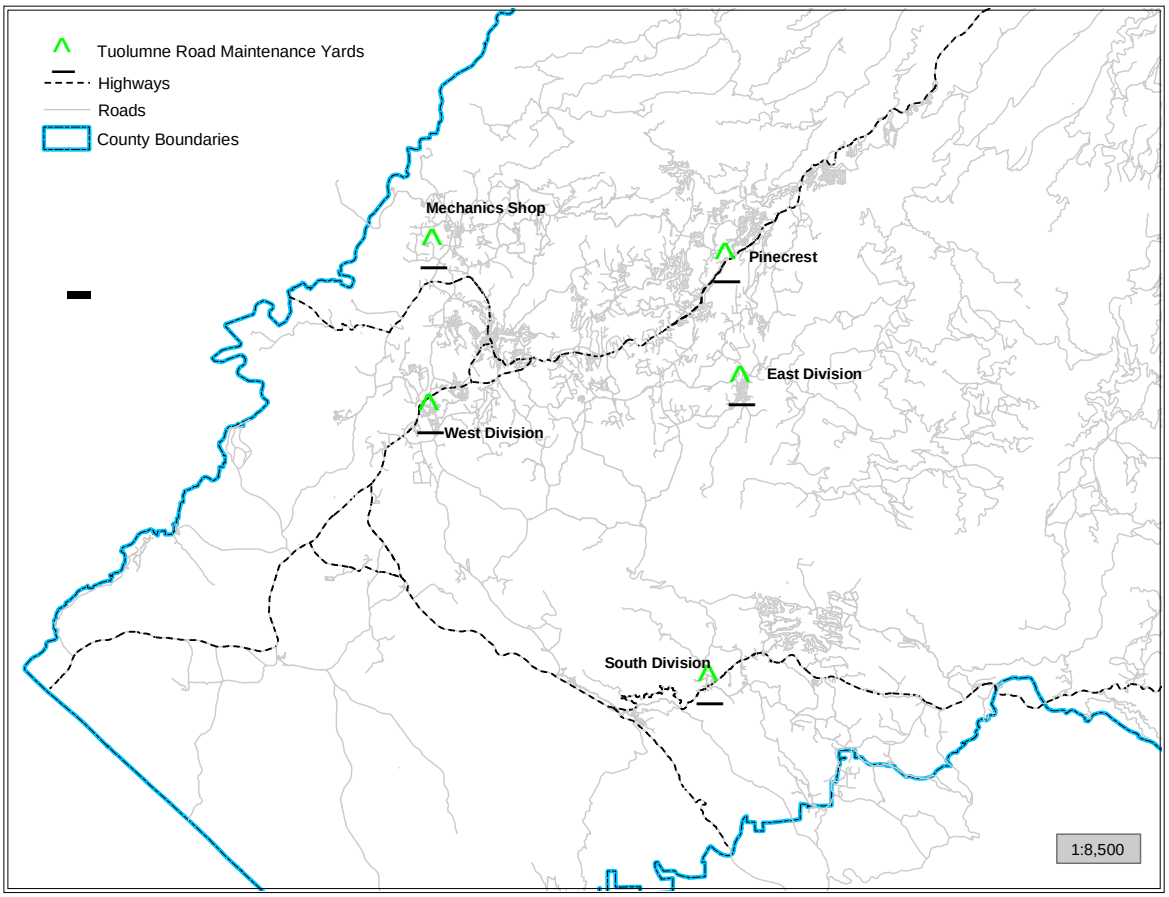


Figure III-14 shows the location of the five Public Works Maintenance Yards. These yards house the principal assets of Public Works for road maintenance, and are used for a variety of storage, repair, and crew functions. They include significant storage areas for equipment and supply stockpiles, as well as crew quarters, garages and other structures.

Another group of critical assets are the bridges on County-maintained roadways spanning the rivers and streams in the County. The following four graphics show the locations of the most significant bridges and larger culverts that are considered critical, all of which are susceptible to damage from hazards such as winter/seasonal storms, flooding, and earthquakes:

Figure III-15. Location of County Road Bridges, Northeastern Portion of County

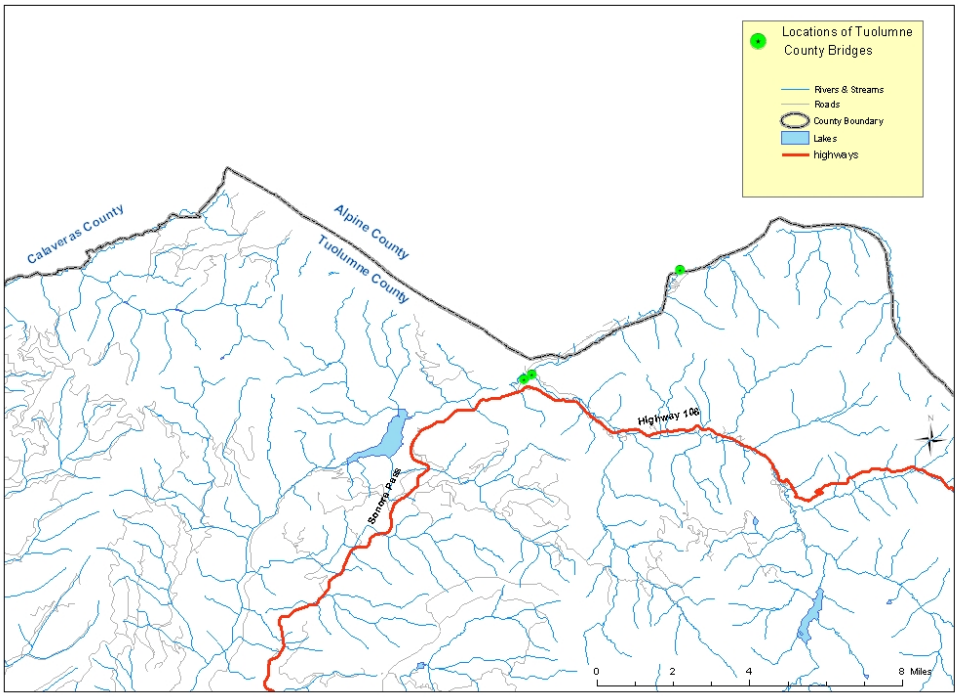


Figure III-16. Location of County Road Bridges, Jamestown to Mi-Wuk Village

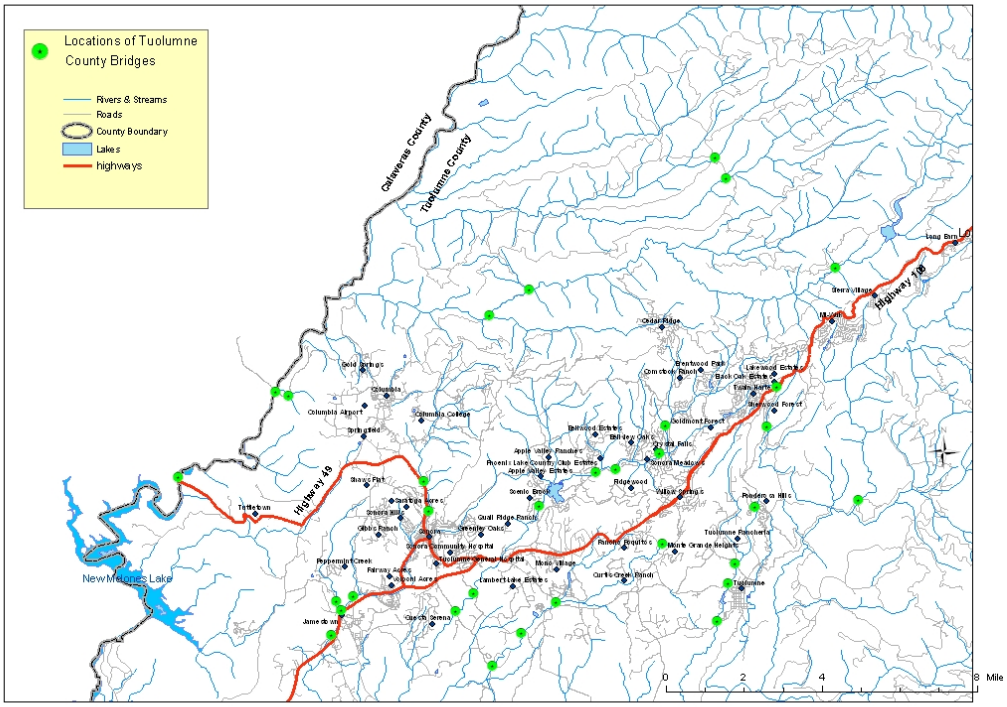


Figure III-17. Location of County Road Bridges, Western County

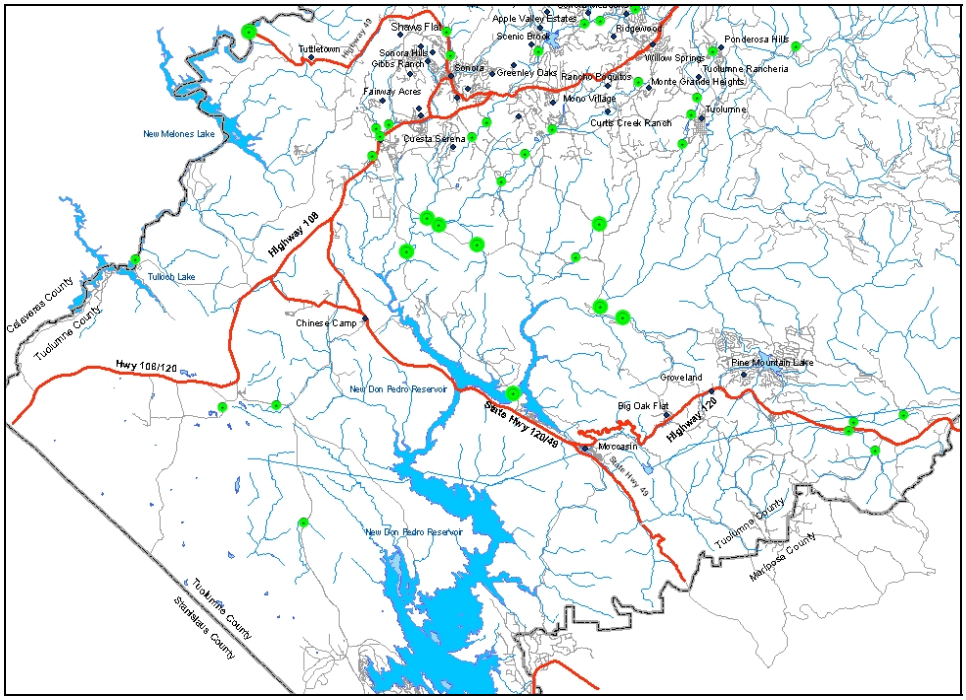
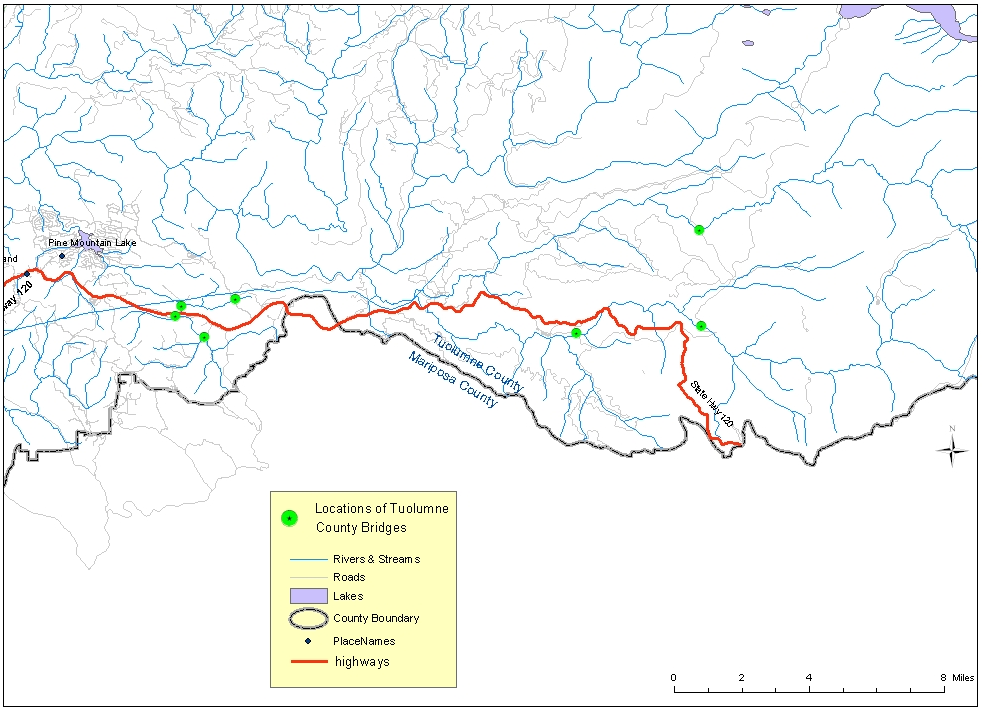


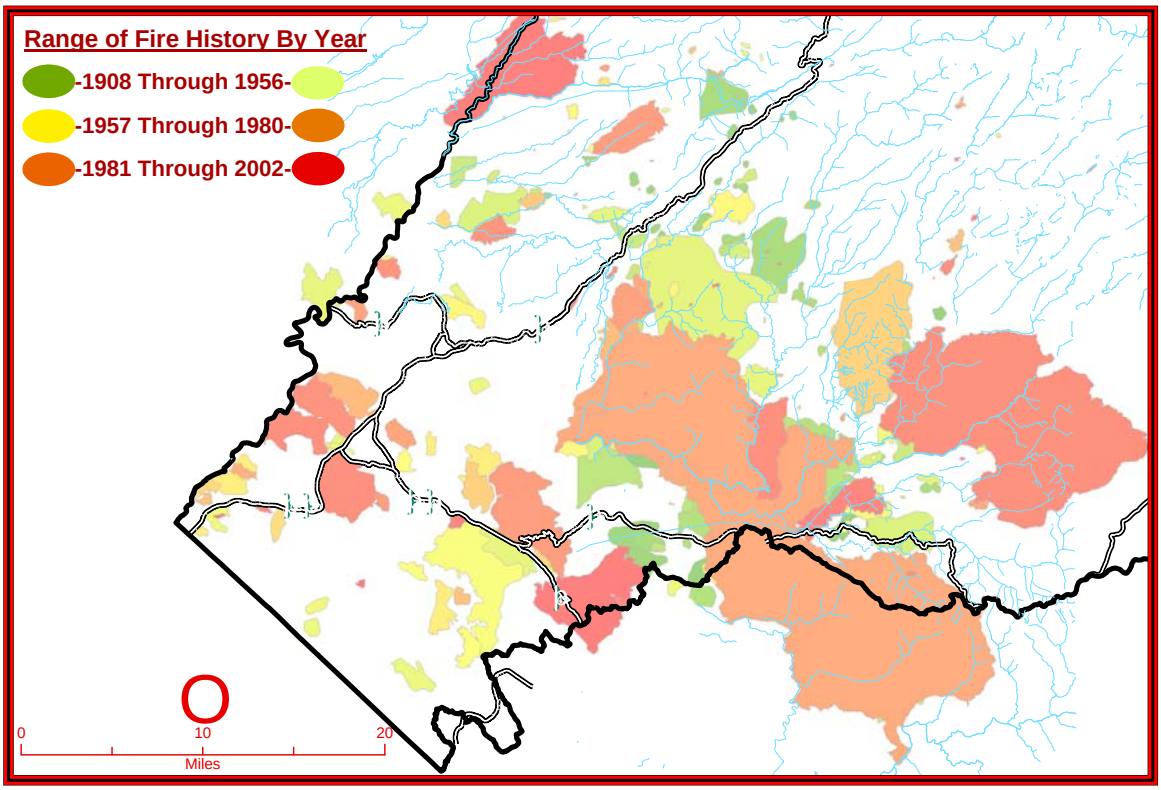
Figure III-18. Location of County Road Bridges, Southern County



Wildfire

The hazard of wildfire can be well understood from examining the historical record, but that is only one factor in determining the vulnerability of Tuolumne County to the wildfire hazard. The wildfire history graphic below shows the areas of the County that have burned over the last century. Figure III-19 is based on the historical records compiled by the California Division of Forestry and Fire Protection (CDF), as acquired from the Stanislaus National Forest for the period 1908 to 2002 and from CDF itself for the period 1950-2002. The minimum size of the fire event that was added to the record to create this graphic changed over the years, but the result is that

Figure III-19. Fire History Map of Tuolumne County

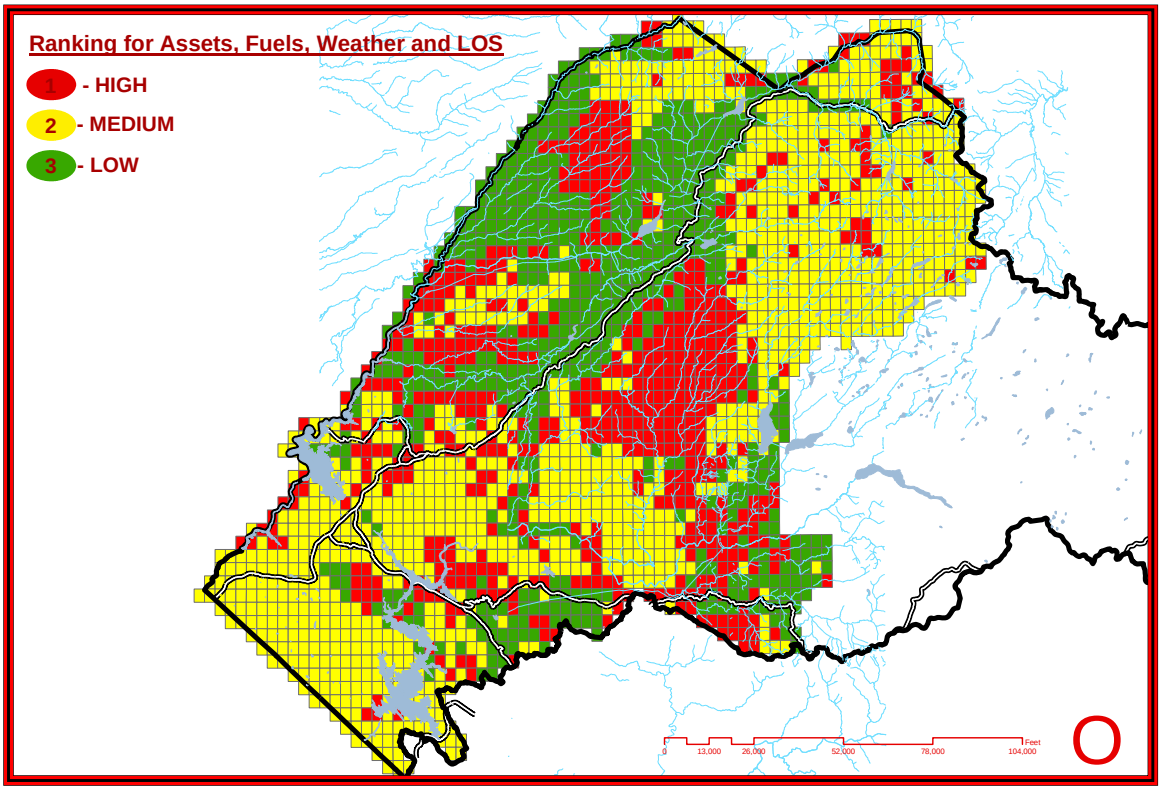


The above graphic shows that the majority of fires of larger scale have burned in the Stanislaus National Forest, other federal land, or in more remote areas of lesser development. The fewer numbers of large fires in heavily developed areas is due to accessibility to fire fighting resources, aggressive deployment of those resources to save lives and property damage, skill and efficiency of the fire service personnel, and some luck. That does not mean that more heavily populated areas are not at risk. To the contrary, the risk is very high for much of the developed portions of the County during the peak fire season (summer and fall – after the vegetation has dried out and prior to commencement of the rainy season). The risk may have actually increased over the last 50 years due to a combination of factors. The last 50 years have been a time of

aggressive suppression of fires and a resultant buildup of litter, brush, dead wood and other fuels throughout the forested areas in general. At the same time; an increase in population and development in the wildland interface has occurred. The combination results in greater risk of catastrophic fire, and more people and structures potentially in peril.

Similar to the above graphic showing fire history, the California Division of Forestry and Fire Protection (CDF) has analyzed the existing level of fire risk for all of the developed portions of the County and most of the Stanislaus National Forest as well. Yosemite National Park was not included in this analysis. CDF divided the County into polygons of like size by dividing the area covered by a USGS 7.5 minute quadrangle map into 9 rectangular polygons of equal size. A large number of attributes were assembled for each polygon that in some way address fire potential and risk. These attributes include factors for slope, vegetation type, aspect, accessibility and other factors related to the potential for burning or for suppressing fires. Other factors such as housing density, water supply, and value of assets such as structures and wildlife habitat are included as attributes to give value to what can be lost if the polygon burns. There are grouping of various attributes to arrive at ranking criteria, and the most illustrative is the combined ranking for assets, fuels, weather, and level of service (greater distance from firefighting stations and lesser accessibility via road networks creates a lower level of service). This combined ranking divides the polygons into low, medium, and high ranks, the highest having the worst fuels, weather, and level of service, and the greatest number of assets at risk. The following graphic, Figure III-20, shows the combined ranking for the majority of Tuolumne County.

Figure III-20. Wildfire Potential in Tuolumne County



Both of these primary datasets, fire history and wildfire potential, have limitations as described above and in Chapter II. However, they are the best data available to be used to prepare a County-wide model to estimate the potential economic risk of wildfire as a hazard. This model will not attempt to estimate the risk for individual portions of the County, the level of data needed for that analysis is not available. However, wherever possible, compensation must be built into the model to allow for the limitations of the data. For example, a direct comparison of the fire history and wildfire potential graphics shows that although most of the developed western portions of the County have not experienced catastrophic fires in the last 50 years, that area does have significant risk factors that are ranked either medium or high. The analytical process that was then followed attempted to represent that level of risk in the vulnerability assessment and not rely too heavily on an abbreviated fire history map.

The third primary dataset used in the process was the locally maintained file based on the ownership of land by an assembly of the Tuolumne County Assessor's Maps. Data available for each parcel include ownership as well as attributes identifying what government districts apply (such as school or utility service districts) as well as general current land use or level of development. The primary use of this dataset was to determine which parcels within the historically burned areas were developed or probably developable, and calculate the acreage of each type of the fire risk types were burned during the 52 year period of available records.

Next, for each of the fire risk types, a density of development was calculated. This density was calculated by looking at the numbers of Assessor's Parcels that were developed residentially within each of the fire risk polygons, a density based on the numbers of acres per typical residence was derived for each of the fire risk types. Then, the number of acres that typically burned each year was divided by the density (acres/residence) to arrive at the number of residences per year that are typically at risk. The number of residences was converted into a value, based on the cost of replacing the typical home and contents in Tuolumne County. The total of these values then becomes the annualized risk to residential structures as a result of the wildfire hazard. The calculations of the steps described above to arrive at the annualized risk are detailed in the following table:

Table III-6. Table of Values Used to Arrive at Annualized Fire Risk to Residences

Risk Zone	Density of Development typical of each Risk Zone (as acres / dwelling unit)	Mean Acres of Developable Land Burned Per Year over Last 52 years	Typical Number of Dwellings at Risk of Burning Per Year	Estimated Value[12] of Residences at Risk of Wildfire (Annualized)
3 (Highest Risk)	1.75	229	131	$35,370,000
2 (Medium Risk)	2.90	340	117	$31,590,000
1 (Lowest Risk)	5.34	734	138	$37,260,000
			Annualized Risk to Residential Structures	**$104,220,000**

Based on the model described above for estimating the vulnerability to wildfire, the annualized potential risk to residential structures was $104,220,000 per year.

<u>High Potential Loss Properties, Critical Facilities and HAZMAT Sites</u>

The above model is only able to estimate the risk of wildfire to typical residences in Tuolumne County. Estimating risk to high potential loss properties, critical facilities, and HAZMAT sites presents a difficult task. Although the vast majority of structures in the urban/wildland interface areas are residences, there are other structures such as schools, commercial and industrial buildings also at risk. Catastrophic wildfire events, particularly in the higher elevation communities, would result in loss to all structures within those communities. For the most part, the high potential loss residences have been accommodated by use of a typical replacement value for a lost residence. This was

[12] As discussed earlier in this section, the value of a loss of a residence for the purposes of this document has been estimated to be $270,000 for both structural and contents, assuming that the contents value is typically 50% of the structure value. This does not consider the value of non-residential structures at risk.

established as $270,000 for structure and contents, which although arguably conservative, attempted to balance the value of an expensive residence with the more typical smaller, older, vacation cabin found in much of the wildland/urban interface area.

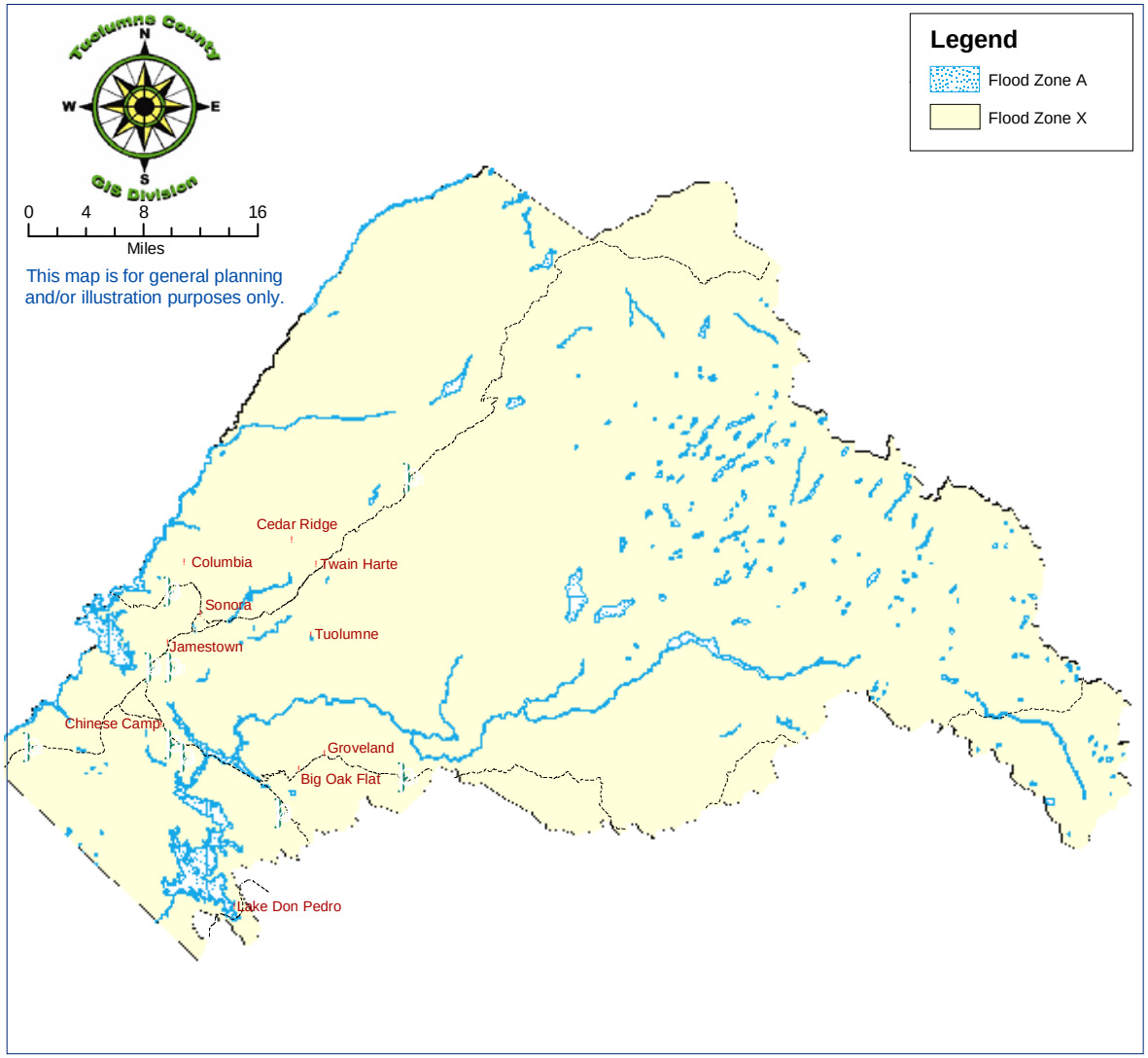
Other high potential loss properties such as commercial and industrial structures, and recreational camp complexes, present a more difficult situation. Most are found in proximity to highways and access roads, but not all. The more modern such developments have many fire hazard reduction features, such as sophisticated sprinklers and metal construction, but some do not. The scale and value of these developments vary widely from a large shopping center complex, to a modest converted residence. Many are found in cleared areas away from the immediate wildland/urban interface, but again not all. Even those located in urban areas could be enveloped in a catastrophic fire of a community that begins in the wildland/urban interface. Based on these limitations, it was not practical to attempt to quantify the wildland fire risk for these developments, although it can certainly be safe to consider that, at least in qualitative terms, that risk is significant.

As to critical facilities and HAZMAT sites, they present a very similar problem to that described above for high potential loss properties. Many schools are located adjacent to the wildland/urban interface, on the periphery of urban areas where the land was available for constructing these complexes. However, the surrounding fields of yards and turf grasses may provide some buffer from wildland fires, and schools have to meet standards for fire resistance and suppression capability. Estimating the potential losses was not attempted due to this complexity. Emergency and public safety facilities are somewhat centralized around Sonora, the County seat, but fire and ambulance stations are also located in other areas to provide a quicker response time to incidents. Those facilities can also be subject to loss from wildland fire, but not in a quantifiable manner. Critical transportation facilities such as remote shops can be subject to wildland fire loss, but structures such as bridges are not likely to be damaged. The HAZMAT sites are not located in the GIS files, and the County does not have a business license system that locates such facilities. Therefore, in general, it is not feasible to estimate the quantifiable risk of wildland fire to these critical or HAZMAT facilities beyond saying that in qualitative terms, the risk would again likely be significant.

Flood

The vulnerability assessment for flooding in Tuolumne County is based on a detailed GIS analysis utilizing data from FEMA and data provided by the county. The FEMA data are based on the current Flood Insurance Rate Maps (FIRM), and provided by FEMA on a copy of the Q3 Flood Data, Compact Disc 1 – California. Figure III-21 shows a graphic representation of the GIS files identifying flood zones A (combined with AE) and X on a countywide scale. Flood zone A lies within the 100-year floodway according to the FEMA model, Zone AE is also within the 100-year floodway but an elevation has been estimated for that 100-year event, and zone X is for all other areas not within a floodway.

Figure III-21. Flood Zones A (and AE) and X Countywide



It should be acknowledged that the FEMA provided FIRM maps and the GIS files based on that data are not fully complete. There are some portions of floodplains in the County that have never been mapped by FEMA and therefore are identified on the map sheets and data files as zone X, meaning outside of the 100 year flood zone. However, it is very likely that some of these areas, particularly in proximity to Woods Creek and Sonora Creek in the City of Sonora, and in proximity to Woods Creek in the community of Jamestown, would be zone A if the model addressed these areas. If engineering analysis was done on these areas to clearly define the 100 year floodplain using standard floodplain modeling programs, that could be the basis for determining vulnerability of structures in the vicinity to flood hazards. However, lacking that, this exercise must rely on available data, meaning that the following statistics must be viewed with the limitations just described.

AT-RISK STRUCTURES

A GIS analysis was accomplished by comparing the FEMA FIRM mapping locations of the A and AE zones with the assessor's parcels and related data. Also used was an orthophoto layer acquired from the USGS compiled from aerial photography taken in 1998. The datasets were compared in order to ascertain the total number of parcels that are at least partially within the floodplain, the number of those parcels that have been developed with structures (presumed to be residences), and the number of parcels that had structures that could be identified on the orthophoto as being within the floodplain. An "annualized" estimate was created by multiplying the number of residences estimated to be within the 100-year floodplain by the typical value of a residence, and dividing that by 100. This is the typical method used to annualize potential flood risk, as used by the US Army Corps of Engineers in estimating benefits of proposed flood control projects. These benefits are then used in a cost/benefit study of a proposed flood control project which would assumedly remove or lower the risk of flooding. In the case of this analysis, the object is to simply create an annualized risk for flooding of residences.

The results of this analysis are presented in Table III-7 which follows:

Table III-7. Overview of At-Risk Residential Structures in Tuolumne County (100-Year Floodplain)

Total Number of Parcels with some portion within the 100 year floodplain	1,815
Parcels within the floodplain that are developed with a residence	394
Developed parcels that appear to have a structure within the 100 year floodplain	187
Typical value of residence (Structure and contents – contents assumed as 50% of structure value)	$270,000
Total value of potentially affected residences	$50,490,000
Annualized Loss Estimate	$504,900

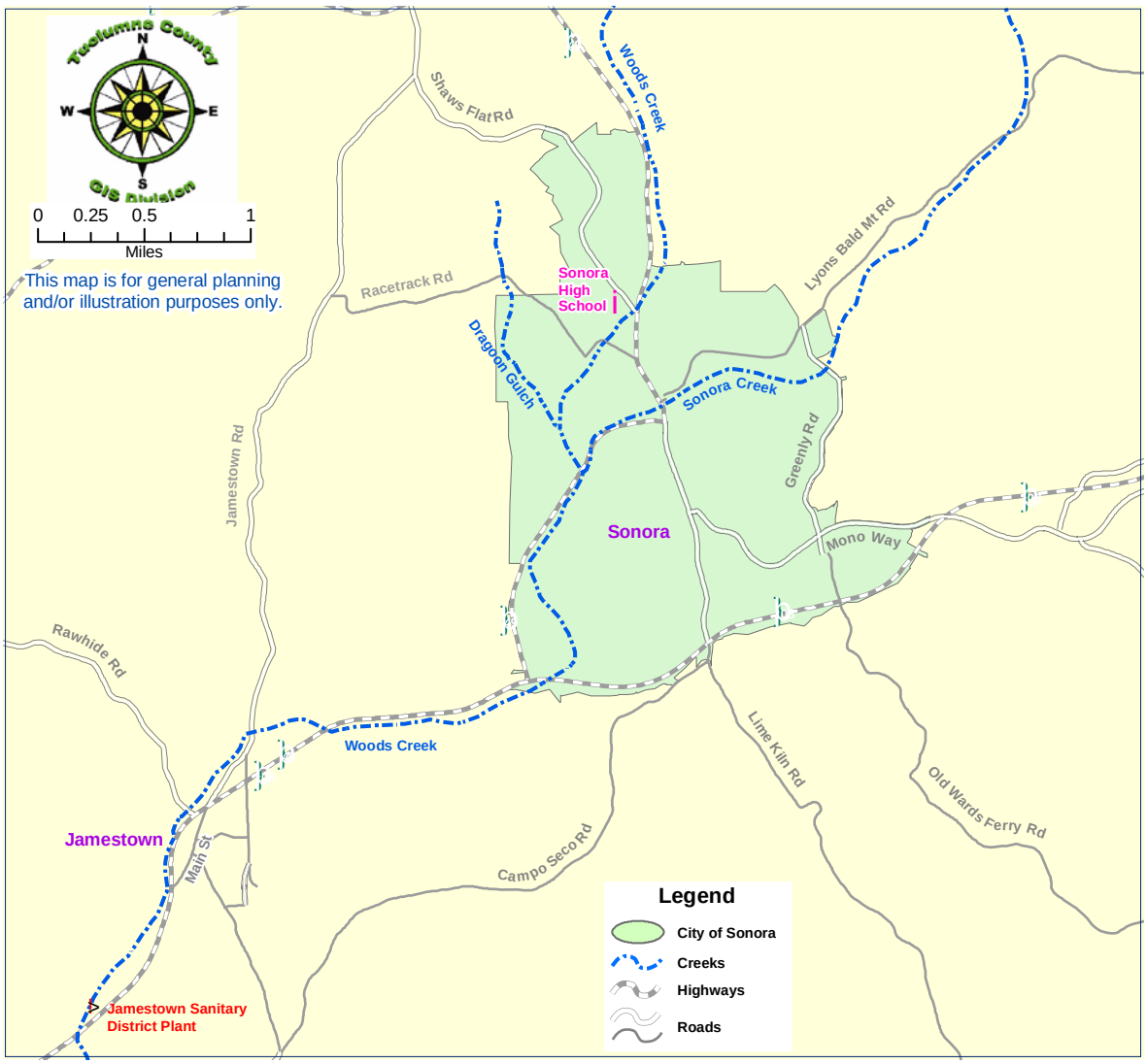
High Potential Loss Properties, Critical Facilities and HAZMAT Sites

Due to the topography of Tuolumne County, it is more possible to define the risk of flooding for most high potential loss properties, critical facilities, and HAZMAT sites. Again based on the FEMA FIRM maps, the location of most of these sites was considered against the predicted flood hazard areas. Within Tuolumne County, there are 83 privately-owned properties with an assessed value greater than $1 million. Of those 83 properties, only one has at least one structure that is likely located in a flood hazard area. Within the areas of the County defined by the FEMA FIRM maps, no other critical facilities such as schools, hospitals, fire stations, or hazmat sites have been identified as being within the floodplain.

As discussed previously, not all of the probable floodplains in Tuolumne County have been mapped by the FEMA FIRM maps. Two likely areas that should be considered for floodplain mapping are the streams passing through sections of the City of Sonora (Sonora Creek and Woods Creek), as well as the lower reaches of Woods Creek in the vicinity of Jamestown. The following graphic, Figure III-22, shows the general location of

the City of Sonora, Sonora High School, Jamestown, and the Jamestown Sanitary District plant in respect to the two creeks.

Figure III-22. Sonora and Jamestown Location Map Showing Creeks



Sonora Creek is a tributary to Woods Creek, combining with Woods Creek prior to Woods Creek leaving the southern boundary of the City of Sonora. Sonora Creek includes a developing portion of Sonora and Tuolumne County within its watershed, and the lower floodplain includes both residential and commercial development. The lower portion is almost entirely within culverts or channelized, and flooding has occurred due to the inability of the lower channels to pass the required flows.

Woods Creek in Sonora passes through the campus of Sonora High, and there has been a history of school facilities being damaged by flooding. This issue is more specifically addressed in the appendix to this plan prepared by the Sonora Union High School District. Woods Creek also has a developed floodplain in the vicinity of Jamestown. Both commercial and residential development has occurred in areas probably within the 100

year floodplain, however; no engineering analysis has mapped those boundaries. Downstream (west) of Jamestown, a small area of floodplain has been used for the site of the Jamestown Sanitary District treatment plant. Flooding has occurred here in the past, and the site is probably within the 100 year floodplain.

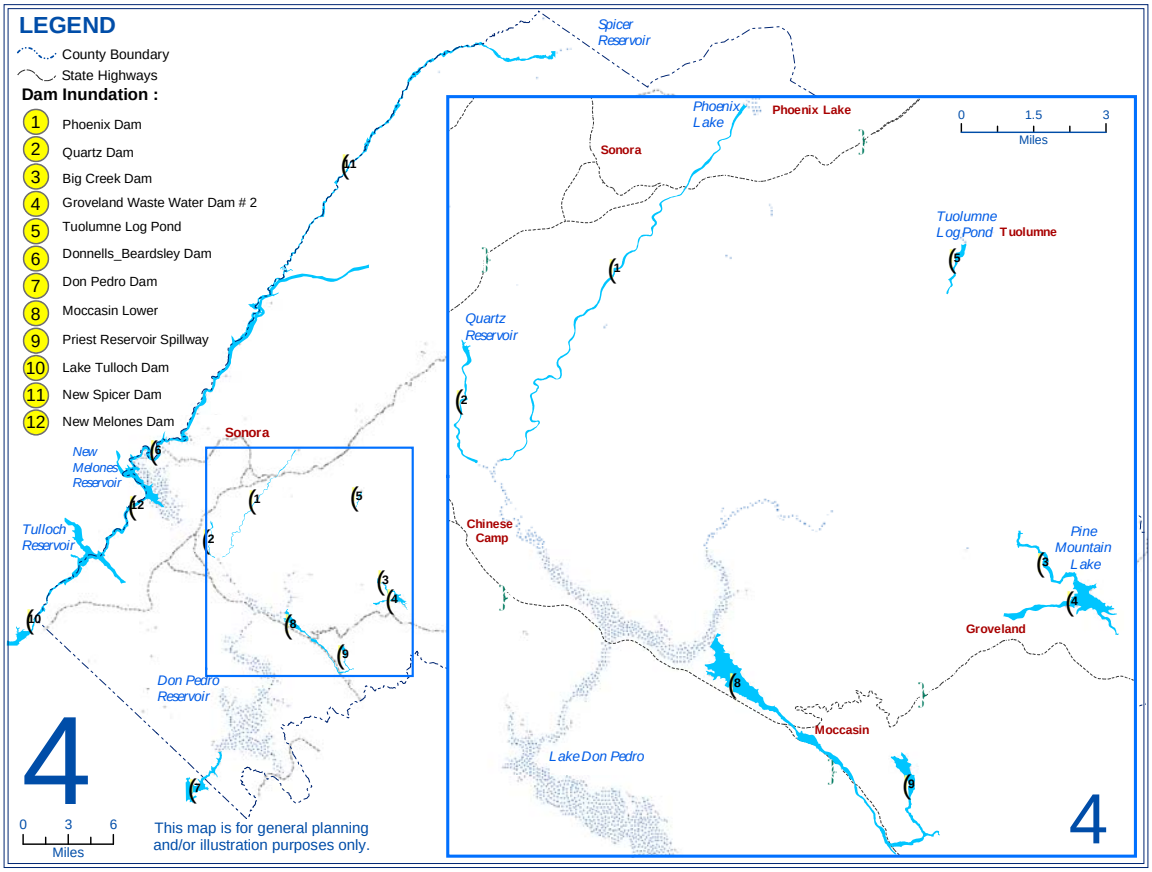
Due to the lack of a FIRM map or similar modeling to define the 100 year floodplain for the above areas, the risk from flooding to Sonora, Jamestown, and possibly other areas not cited cannot be quantified or further defined at this time. Beyond the sewage treatment plants addressed under high potential loss properties, no critical facilities such as medical centers, schools and fire stations were found to be located in identified flood hazard areas and none are known to be at-risk. Due to the nature of bridges and culverts, it can be assumed that many of those assets on County roads and State Highways would be at risk of flooding.

Dam Failure/Inundation

The vulnerability assessment for dam failure in Tuolumne County is based on a detailed GIS analysis utilizing data from dam operators and data provided by the county. Dam operators are required to prepare dam failure inundation maps by the State Office of Emergency Services (OES) for any dam where potential flooding in the event of partial or total failure of any dam that would result in death or personal injury. The OES has the responsibility to distribute inundation maps for these areas, and the maps are to be kept on file with the OES and the State Department of Water Resources. A notice is to be posted at the County Recorder's Office, County Assessor's Office, and County Planning Agency that identifies the location of the map and any subsequent information received by the county regarding changes to the inundation areas. The Tuolumne County Community Development Department maintains copies of the inundation maps for use by realtors and property owners in determining natural hazard disclosure items for properties up for sale.

The inundation maps were scanned and those images registered as GIS images. They were compared to the ownership maps derived from the Assessor's Parcel files, to determine which inundation areas actually affected developed properties, or properties which could be developed (areas owned by government agencies such as the Stanislaus National Forest or one of the reservoir-owning irrigation districts are considered not "developable" and therefore were not counted). Those dams with inundation areas that affected no developable land were not analyzed any farther. The dams that had inundation maps that were available and digitized, are shown below:

Figure III-23. Dams and Their Inundation Areas That Affect Developable Parcels



Those dams where developable properties fell within the predicted inundation areas were then processed so the inundation footprints were converted to GIS files for further consideration.

The remaining process was similar to that carried out for FEMA flood zones in the section of this document concerning flooding. All of the developable properties that fell within the inundation zones were counted, and those parcels known to be developed with residences and/or other structures were counted. A sample location was chosen to estimate the number of residences or obvious structures, based on the USGS digital orthophotos, that had actually been constructed within the actual inundation zone. The sample showed that 75% had actually been constructed within the inundation area. That estimate was used then to predict the total number of residences/structures at risk to inundation from any of the dams based on the probability that 75% of all developed parcels have structures that would be lost. Engineering criteria for design are based on the maximum anticipated load, including a flood occurrence of a 10,000 year event, and an anticipated seismic event of 7.5 on the Richter Scale. Assuming the anticipated seismic event has a similar interval of 10,000 years, these factors were used in determining the annualized risk, ie. it is likely that a dam failure would happen once every 10,000 years.

The following table shows the results:

Table III-8. Results of Potential Dam Inundation Analysis

Total Parcels that fall within a Dam Inundation Area	Developed Parcels within a Dam Inundation Area	75% of Parcels that Potentially have Structure Affected	Value of Structures at Risk of Dam Failure Inundation	Annualized Risk based on 1/10,000 Threat of Dam Failure
1015	**458**	**344**	**$92,880,000**	**$9,300**

High Potential Loss Properties, Critical Facilities and HAZMAT Sites

There is only one known privately-owned high-value structure that falls within the footprint of any of the probable inundation areas below any of the dams in Tuolumne County; that private residence is located adjacent to the Tulloch Reservoir and within the inundation areas of the dams located higher in the watershed. Of the other critical facilities and high risk structures such as schools, hospitals, and public safety facilities, only the fire station at Moccasin appears to be within the dam inundation area below the Moccasin Reservoir. Of course, multiple bridges and culverts on County roads and State Highways lie within the inundation zones should there be any dam failures. These transportation facilities and associated roadways would likely receive severe damage should a dam fail above the road. No known HAZMAT sites have been identified within any of the mapped dam inundation areas. In general, although the estimated risk of dam inundation on high potential loss properties, critical facilities, and HAZMAT sites has not been quantified the qualitative estimate is for localized damage because of a dam failure of a potentially significant cost. However, the extent of that damage would not be great due to the small areas possibly inundated, and the assumption that such an event is unlikely to happen.

Earthquakes, Landslides and Sinkholes

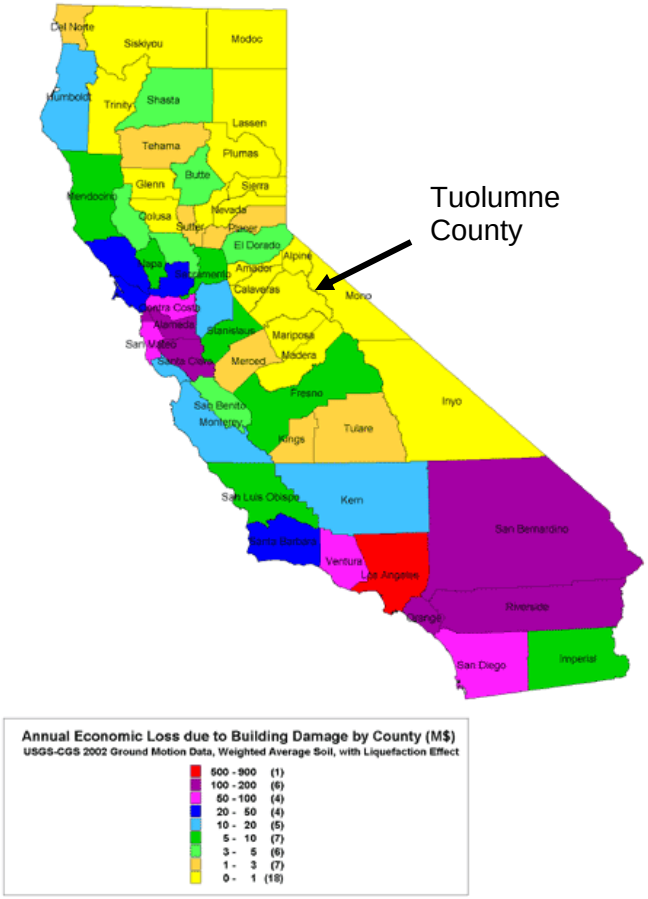
EARTHQUAKES

Risk for earthquake for the area, as well as potential losses due to earthquake impact, is considered to be low relative to much of California. Table III-9 provides loss estimates for the 100-, 500-, 1,000- and 2,500-year return periods based on probabilistic scenarios using HAZUS. The annualized loss estimate for the earthquake hazard is less than $1million, as demonstrated by a graphic comparing the annualized loss estimate for the counties of California (Figure III-24).

Table III-9. Estimates of Potential Losses for Earthquake

Level of Event	Estimated Losses in Tuolumne County
100-year Event	$131.1 million
500-year Event	$318.9 million
1,000-year Event	$448.7 million
2,500-year Event	$601.8 million

Figure III-24. Comparison of Annual Losses by County



The above attempts to quantify the annual risk vulnerability to earthquakes does not take into account the possible impacts to the numbers of historic buildings that are particularly vulnerable. Built prior to modern code requirements, these buildings are either of masonry or wood construction, but generally lack the reinforcement and other provisions that are included in the structural design of modern buildings. It is not practical to attempt an estimate for those structures, as they cannot be replaced.

High Potential Loss Properties, Critical Facilities and HAZMAT Sites

Earthquakes are a wide-spread phenomenon that would most likely originate outside of the County, but if a severe one occurs it would affect the entirety of the County. All structures would experience ground motion that could result in damage ranging from broken contents to total destruction. As mentioned above, the most susceptible buildings would be historic structures which lack modern reinforcements or other structural accommodations. Some of these historic structures are used for commercial purposes, and would be considered high potential loss properties. More modern commercial and industrial buildings are designed to accommodate ground motion from earthquakes and would be less likely to be damaged or destroyed. In general terms, the HAZUS projections described earlier in this section address those structures along with others and can be used to estimate the risk from earthquake.

All schools are required to meet modern seismic standards, and the design standards should make them capable of withstanding all but the most extreme, and unlikely, earthquake event. Other critical facilities, such as emergency facilities, public safety, bridges and similar structures, and HAZMAT sites are all designed to withstand the predictable loads from most earthquakes. Those events that could destroy such facilities would be catastrophic in nature, and would result in widespread devastation throughout the region. Those events can neither be predicted, mitigated, or be estimated for purposes beyond that already addressed by the HAZUS model.

SINKHOLES

There are no known incidences where structural or other property damage has occurred due to the formation of natural sinkholes in the County. Based on the available evidence, classic sinkholes as a result of solution of limestone rock are not considered to be a hazard of consequence to Tuolumne County.

Subsidence as a result of previous underground mining activity could prove to be consequential in portions of Tuolumne County where significant underground mining activity has occurred. Most of the underground mining happened in the areas of the County that overlie the Mother Lode gold veins, or in “pocket” mine areas of isolated gold ore that are found to the east of the Mother Lode. Fortunately, most of the mined areas have not been substantially developed, so if subsidence occurs then the losses should be minimized to a few structures. However, portions of the City of Sonora are underlain by mine workings, and the threat could be more significant for Sonora.

Without an historical record of significant failures or damage associated with subsidence, an approach to attempt to quantify the hazard has not been identified. Therefore, the annualized losses for sinkhole hazards are considered to be negligible, and the annualized losses for subsidence are unknown.

High Potential Loss Properties, Critical Facilities and HAZMAT Sites

In order to predict the potential losses due to subsidence, a scientific analysis would have to undertaken to determine the location and probability of underground workings that would likely subside. This would have to be compared to the actual surface locations of any of the high potential loss properties, critical facilities or HAZMAT sites. Without this depth of analysis it is not possible to quantify the risk of the hazards associated with sinkholes and subsidence. It is known that the potential for this hazard is very limited geographically.

LANDSLIDES

As discussed in the Hazard Identification and Analysis Chapter II, there have been rare occurrences of landsliding or general instability in Tuolumne County. There are no known records of any significant financial damages or personal injury as a result of these occurrences, and no comprehensive mapping of these isolated areas that may have experienced landslides or are prone to experience landslides in the future. The Tuolumne County Geohazard Maps and Updated Geotechnical Safety Issues Report, associated with the Tuolumne General Plan, do report some landsliding potential associated with extreme slopes. The particular example referred to in the Report are the slopes associated with the Table Mountain landform found in western Tuolumne County, where continued erosion of the steep slopes as boulders or rubble could put development in jeopardy if located too close to the base of the mountains. The Tuolumne County General Plan land use diagrams do not allow for any type of dense development in these mostly rural areas, so the possible hazards of sloughing or sliding of these slopes is not considered a potential hazard of any consequence. At this time, the overall hazard and potential losses from landslides is considered negligible.

High Potential Loss Properties, Critical Facilities and HAZMAT Sites

There are no known high potential loss properties, critical facilities or HAZMAT sites at risk from landslides.

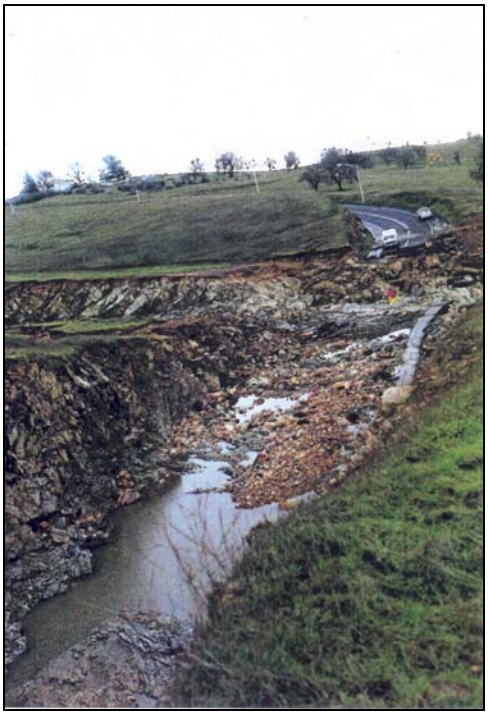
Winter/Seasonal Storms

Winter and seasonal storms can affect large geographic areas and often impact multiple counties, or they can be very localized. The classic winter storm involves a cold front accompanied by strong winds, bringing low elevation snow to the mountains and foothills and rainfall to the lowest elevations. The snow and freezing rain brings down trees, which cuts powerlines resulting in power outages, as well as causing snarls traffic, and isolating communities. Other seasonal storms are a result of intense rainfall in certain areas (a storm "cell"), which overwhelm drainage systems and cause flooding of basements and road or bridge failures.

Although these events can happen in almost any part of the County, it is difficult to assess the vulnerability of the County assets to this risk. Seasonal, localized flooding due to inadequate drainage or general development impacts can be felt in Sonora, Jamestown, and some of the other communities. More isolated events due to particular circumstances have resulted in flooding of the Tuolumne General Hospital basement, with resultant damages to mechanical systems and computer networks. Infrastructure damage, particularly damages to roadways, culverts, bridges, and other parts of the County road network are more common and difficult to predict due to the unknown location of future storm cell events.

Although there are historical records of these events happening over the years, there is not a thorough accounting of the damages that can be used to quantify the risks. There have been occurrences that were compounded by chains of events, such as an intense rainfall on top of snow cover in the watershed of the Tuolumne River. This 1997 event caused an unanticipated rapid filling of the Lake Don Pedro reservoir, and the resultant release over the spillway severely damaged the roadway as shown in the following photograph.

Figure III-25. Damage to Roadway below Lake Don Pedro Spillway



The County Department of Public Works does have records for damages attributable to two recent storm events. Over the 10 year period form 1992 to 2002, there were two events that caused significant damages; storms in 1995 and 1997 both caused more than $1.1 million in damage. Although the sample period is very short, the annualized cost is estimated at $220,000. Potential losses may be further inflated by additional factors not represented in this estimate, such as removal of snow from roadways, debris clean-up, some indirect losses from power outages, etc.

A qualitative facet of vulnerability in Tuolumne County is the broad manner in which severe seasonal storms, particularly snowfall, causes general disruption. Utilities like water and electricity can be lost for extended periods, and normal mobility is lost. Roadways become clogged with accidents and vehicles stuck in snow or otherwise unprepared for winter's severe weather. Particularly for tourists and new residents, the lack of preparedness causes hardship for all and magnifies the difficulty of dealing with storms. Difficult to quantify on a gross scale, these impacts are significant and result in a high ranking for this hazard based on a qualitative understanding.

<u>High Potential Loss Properties, Critical Facilities and HAZMAT Sites</u>

As described above, it is difficult to estimate the potential damages from storms to any structures, let alone those considered high potential loss properties, critical facilities, or HAZMAT sites. The past damages from storms that are quantified above are for critical transportation facilities, particularly roadways and bridges. Again, despite the inability to quantify the risk, it can be assumed that in qualitative terms that risk can be considered significant.

Drought/Extreme Heat

Drought conditions in Tuolumne County result from inadequate precipitation during the normal rainy season, which usually comes in the form of rainfall in the lower elevations and snowfall in the upper elevations. Inadequate precipitation causes low soil moisture during what should be the rainy season, and a thin snowpack in the higher elevations.

Dry soil conditions during winter and early spring result in poor plant growth. Most native trees and shrub species are drought resistant, and can withstand some deviation in rainfall. However, severe or prolonged drought (low rainfall for successive winters) stress woody plants and can result in higher than normal insect depredation or other biological stressors and causes mortality. During previous drought periods, the insect damage to pine trees resulted in significant mortality in some areas of the County, and a substantial though undefined financial loss to the silviculture industry.

Lack of growth of annual grasses or other forage for livestock is a typical result of drought periods. Grasses and similar plants grow shorter or less dense as a result of lack of rainfall, and the forage available for grazing animals is significantly reduced. Dry land grazing ranchers are then forced to move the animals to other pasture, or reduce the herd by selling them off if alternative pasture is not available. The carrying capacity of the pastures is reduced, as are the economic benefits of ranching. Most of the grazing in Tuolumne County is “dry land” (not-irrigated), so lack of rainfall can make the difference between a profitable year or not. These economic losses can be considerable, and successive losses can drive a ranching concern out of business, often resulting in sale of the land to developers or others not dependent on deriving a living from the land and therefore less rainfall dependent.

Drought also affects water supplies. Inadequate rainfall and snowpack reduces the runoff to the reservoirs supplying most of the potable water in the County. The reserved pools of water in those systems are not of adequate size to withstand a sustained drought of multiple years without either adding to the supply or rationing the water. In some cases, additional surface water can be obtained at a higher cost, but that is not always available. Supplemental water can be obtained from wells, but the underground supply is very limited and also subject to reduced volumes during sustained droughts.

Extreme high temperatures, which can occur during summer months, can have economic and health effects. As the County commonly experiences periods of high temperatures over 100 degrees in mid-summer at the lower elevations, these events can usually be accommodated. However, extremely high temperatures for a sustained period can overtax electricity supplies regionally causing blackouts or rotating outages. This can cause stock losses in grocery outlets and other economic damage. The elderly or other sensitive populations can have severe health impacts from high temperatures when air conditioning is not working, or not available due to poverty. Agriculture suffers because the growing turkey industry has increased mortality from extended high temperatures, as well as stresses on the general population of foraging animals (mostly cattle). The more intensive agricultural operations, such as apple orchards, rely on wells and surface water supplies for irrigation and sustained heat when accompanied by drought limits the water supply.

In general, the impacts of the drought / high temperatures hazard can be substantial, but are not well documented. Therefore, it is not possible to provide a quantifiable estimate of the vulnerability at this time.

High Potential Loss Properties, Critical Facilities and HAZMAT Sites

The most obvious result of drought or high heat conditions could be failure of the water supply system to meet the demand. Critical facilities such as hospitals would be particularly hard hit, and losses could be high if there is a fire without a water supply to be used for fire suppression. It is likely that a hospital or similar facility without a water supply could not remain open, so the risk to human life would then be mitigated or prevented. However, the public water purveyors have to monitor conditions and maintain a minimum water supply even during drought conditions, so all rationing and other conservation mechanisms would have to be exhausted before drought conditions would dry up the system. This is very unlikely to happen. Therefore, the risk to high potential loss properties, critical facilities, or HAZMAT sites from drought/high temperatures is not able to be estimated, but assumed to be relatively low.

Erosion

As described in the Hazard Identification and Analysis Chapter, erosion is a natural function that moves soil material from higher points to lower points. In a County with areas of particularly steep gradient, it is expected that erosion will continue over time to reduce the slopes to lower and lower elevations. However, this normal function is slow and incremental as to be imperceptible. This can change if the erosion functions are accelerated by events, predominantly human activities related to development and grading.

Grading and development usually only affects relatively small areas, and the increased erosion as a result has a corresponding limited effect. Although the erosion gullies and sedimentation of improper grading or land clearing practices can be substantial locally, they usually do not cause widespread or long term problems or economic impacts.

Wildfires can also eliminate the ground cover of plants that result in increased erosion. This is usually limited to the area burned, or the watershed that includes a burned area. However, some wildfires affect tens of thousands of acres, causing significant problems in that watershed, and resulting sedimentation runoff. Normal reseeding and planting processes after wildfires can reduce the impacts however, if erosion occurs that reduces the topsoil available for reestablishment of trees and vegetation as well as sedimentation downstream. As all of the watersheds in the County eventually end up in flat water reservoirs, the sediment is normally deposited in the pool of a reservoir. The reservoir then has a reduced capacity and eventually will shorten the effective lifespan of the reservoir.

Because Tuolumne County has minimal traditional cropland-style agriculture, there are no direct impacts of erosion related to tilling and farming as can happen with traditional field agriculture.

In general, erosion impacts from grading and development are typically on a very small scale and present no quantifiable vulnerability to the community. Nor does Tuolumne County agriculture present a significant or quantifiable risk. Erosion and sedimentation as a result of denuded watersheds after wildfires could be a more significant hazard, but the economic impacts are either not available or clearly defined. Therefore, the overall vulnerability of erosion as a hazard to the County is either negligible or currently undefined.

<u>High Potential Loss Properties, Critical Facilities and HAZMAT Sites</u>

There are no know risks to high potential loss properties, critical facilities, or HAZMAT sites from erosion.

Unique Risks for Local Jurisdictions

The Tuolumne County Hazard Mitigation Advisory Committee considered that the hazards discussed in this document are those which, for the most part, are common to the County in general and to many of the participating jurisdictions. As explained in the Introduction to this Plan, the Plan serves as both a multi-jurisdiction hazard mitigation plan, and as hazard mitigation plan for the County of Tuolumne. The preceding analyses of risks and hazard vulnerability are summarized sufficiently for the County of Tuolumne, without need for any supplement.

For the other participating jurisdictions, each was asked to consider any hazard or vulnerability that is in some way unique or different according to the circumstances of that jurisdiction. The representatives on the overall Advisory Committee were requested to identify and analyze those circumstances unique to its jurisdiction in their own planning process. Documentation of the results is found in the appendix prepared by each jurisdiction and attached to this overall plan. For example, if a district found that its jurisdictional boundaries included a particular flood hazard that was not addressed specifically in the broad County-wide approach found in this main Plan, it would address that specific hazard and the vulnerability to that hazard in its appendix. Those appendices are found attached to this plan.

Conclusions on Hazard Risk

As explained in "Methodologies Used," a hybrid approach was employed to reconcile findings from both a quantitative assessment (based on HAZUS and GIS analysis) and a qualitative assessment (based on a scoring and ranking system scored by general consensus of the Hazard Mitigation Advisory Committee). Table III-10 summarizes the annualized expected losses for each hazard which are a culmination of the quantitative assessment. The top three hazards identified through this process are the wildfire hazard, the earthquake hazard, and the flood hazard.

Table III-10. Summary of Potential Annualized Losses (From Quantitative Assessment)

Hazard	Estimated Annualized Losses
Wildfire	$104,220,000
Floods	$504,900
Dam Failure	$9,300
Earthquakes, Sinkholes and Landslides	$1,000,000[13]
Winter Storms	$220,000

[13] Potential losses from earthquake only, based on HAZUS analysis by California Geologic Survey and documented in Figure III-24. No quantified losses are available for sinkholes or landslide hazards.

Drought/Extreme Heat	Unknown/Negligible
Erosion	Unknown/Negligible
Volcano	Negligible

Based upon the qualitative approach defined in detail under Methodologies Used, the risk from natural hazards in Tuolumne County was weighed by the Hazard Mitigation Advisory Committee and criteria was used to assign values to the likelihood of occurrence, spatial extent affected, and potential impact of each hazard. These values combined to form a total rating for each hazard (Table III-11). The dominant hazard identified through this process is the wildfire hazard followed by the winter or seasonal storm hazard.

Table III-11. Hazard Risk Ratings (From Qualitative Assessment)

Hazard	Likelihood	Spatial Extent	Potential Impact	HAZARD RATING
Wildfire	Highly Likely (3)	Moderate (2)	Catastrophic (4)	**9**
Floods	Possible (1)	Small (1)	Critical (3)	**5**
Dam Failure	Unlikely (0)	Small (1)	Catastrophic (4)	**5**
Earthquakes, Sinkholes and Landslides	Likely (2)	Moderate (2)	Critical (3)	**7**
Winter / Seasonal Storms	Highly Likely (3)	Moderate (2)	Critical (3)	**8**
Drought/ Extreme Heat	Possible (1)	Large (3)	Limited (2)	**6**
Erosion	Possible (1)	Small (1)	Minor (1)	**3**
Volcano	Unlikely (0)	Large (3)	Minor (1)	**4**

The conclusions drawn from the qualitative and quantitative assessments, combined with final determinations from the Hazard Mitigation Advisory Committee, were fitted into three categories for a final summary of hazard risk based on High, Moderate or Low designations (Table III-12). The two high risk hazards identified through this process are the wildfire and winter/seasonal storm hazards. The four moderate risk hazards identified are the floods; dam failure; earthquakes / sinkholes / landslides, and drought / seasonal storms hazards.

Table III-12. Estimated Risk Levels for Tuolumne County (Combination of Qualitative and Qualitative Assessments)

HIGH RISK HAZARDS	Wildfire Winter / Seasonal Storms
MODERATE RISK HAZARDS	Floods, Dam Failure Earthquakes, Sinkholes, and Landslides; Drought / Extreme Heat
LOW RISK HAZARDS	Erosion Volcano

It should be noted that although some hazards may show Moderate or Low risk, hazard occurrence is still possible. Also, any hazard occurrence could potentially cause a sizable

impact and losses could be extremely high (e.g. a volcanic eruption from a close, previously unknown source).

In conclusion, while Tuolumne County is susceptible to a wide range of natural hazards to varying degrees, the hazards of Wildfire and Winter/Seasonal Storms are of the utmost, immediate concern to the County and its communities with regard to hazard mitigation practices and policies. This is further reflected in the *Mitigation Strategy* Chapter of this Plan.

IV. Mitigation Considerations
A. Mitigation Capabilities Assessment

INTRODUCTION

This portion of the Plan assesses Tuolumne County's current capacity to mitigate the effects of the natural hazards analyzed in Chapter II, Hazard Identification and Analysis; and Chapter III, Community Vulnerability Assessment. The Mitigation Capabilities Assessment includes a comprehensive examination of the following local government capabilities:

1. *Staff & Organizational Capability*
2. *Technical Capability*
3. *Policy & Program Capability*
4. *Fiscal Capability*
5. *Legal Authority*
6. *Political Willpower*

The purpose of conducting this capabilities assessment is to identify potential hazard mitigation opportunities available to the County of Tuolumne and the participating jurisdictions through their operation as local governments and districts. Careful analysis should detect any existing gaps, shortfalls or weaknesses within existing government activities that could exacerbate community vulnerability. The assessment will also highlight the positive measures already in place or being done at the local level, which should continue to be supported and enhanced if possible through future mitigation efforts. The focus in this section, similar to the other sections, is on the County as a whole, rather than on the individual jurisdictions which are part of this overall plan. However, as explained in the Introduction to this Plan, this main Plan serves a dual purpose: the main part of a multi-jurisdiction hazard mitigation plan, and the hazard mitigation plan for the County of Tuolumne. Towards the latter function, this section will focus on the mitigation capabilities of the County of Tuolumne. The appendices to this overall Plan deal specifically with the mitigation capabilities of the other participating jurisdictions.

The capabilities assessment serves as the foundation for designing an effective hazard mitigation strategy, which will be addressed in the accompanying part 2 of this Chapter IV. This assessment provides the basis to establish the goals and objectives for Tuolumne County to pursue under this Plan, and helps to ensure that those goals and objectives are realistically achievable under given local conditions.

1. STAFF & ORGANIZATIONAL CAPABILITY

County of Tuolumne

Tuolumne County has limited staff and organizational capability to implement hazard mitigation strategies.

Tuolumne County is governed by an elected five-member **Board of Supervisors** who bear the responsibility of serving the people and improving the quality of life in the county. The County has a number of professional staff departments to serve the residents of Tuolumne County and to carry out day-to-day administrative activities. These include the following:

Assessor/Recorder	***Auditor/Controller & Elections***	***General Hospital***
Community Development	***Health Department***	***Sheriff***
Administration / Emergency Services	***Ag Advisor/ Weights & Measures/ Air Pollution***	***Information Systems and Services***
Airports	***Facilities Management***	***Probation***
Fire Department	***District Attorney***	***Public Defender***
Public Works	***Tax Collector***	***County Counsel***
Farm Advisor / Cooperative Extension	***Recreation***	***Library Services***
Social Services		

The Tuolumne County **Fire Department** is managed under a contract arrangement with the California Division of Forestry and Fire Protection (CDF), and has fire protection responsibilities over most of the structures in the County. Primary staffing is through a system of volunteers, who also provide “first response” to a variety of non-fire emergencies. Additionally CDF provides seasonal wildfire protection, as well as “mutual aid” support to the Tuolumne County Fire Department as well as the other fire protection districts that serve individual communities. The mutual aid arrangement ties all of these fire suppression agencies together whenever the need arises.

The **Community Development Department** includes the Divisions of Building and Safety, Planning, Fire Prevention, Code Compliance and GIS (Geographic Information System). This Department enforces the California Building Code, the National Flood Insurance Program, the California Fire Code, and other applicable local codes through a program of inspection and permitting. It also conducts both long range and current planning including review of development projects and land divisions.

The **Sheriff, Assessor/Recorder**, **Auditor/Controller** and **District Attorney** are elected every four years. The **Sheriff’s Department** has primary responsibility for law enforcement within the unincorporated areas of Tuolumne County.

The Tuolumne County **Farm Advisor/Cooperative Extension** office seeks to help individuals, families, and communities put research-based knowledge to work to improve their lives. California’s Cooperative Extension is based at the land grant institution, the University of California, but offices are located in all the counties of the State.

The **County Administrative Office** is responsible for the oversight and management of the County's budget and fiscal programs, including the administration of state and federal grants. A function of the Administrative Office, the **Office of Emergency Services** is responsible for the mitigation, preparedness, response and recovery operations that deal with both natural and man-made disaster events.

The **Health Department** includes the Environmental Health Division, which regulates food vendors, water systems, and most sewage disposal systems, as well having responsibilities for controlling overall health risks to the community.

The **Department of Public Works** is responsible for maintaining and improving the greatest capital asset of County government, the network of roads, bridges, and other transportation improvements that provide access to most portions of the County. Their tasks include maintaining, designing, and adding to the County-owned or maintained road infrastructure. They also are responsible for general transportation planning; planning for future improvements and managing the changes to roadways and traffic due to new development. Public Works other functions include acting as the County Surveyor, reviewing and approving maps that create new properties, merge lots, or otherwise move or monument property lines. Public Works also have a solid waste division, regulating waste disposal and recycling activities.

Other Jurisdictions

Within the overall county, there are numerous other local governmental functions. The only incorporated city in the County is the **City of Sonora**, which has its own Fire Department, Police, Public Works, and community development functions. Again, the mutual aid arrangement works both ways between the City and other jurisdictions for emergency service support. More details about the City of Sonora can be located in Appendix 3 of this plan.

There are also a variety of "districts" which are defined subsets of the County created to provide certain services. Many of these jurisdictions are participating in this Plan, and those districts are summarized in the following table. More details about each of the participating jurisdictions are found in the appendix to this report referred to in the last column of the table.

District	Area Served	Primary Function(s)	Appendix Reference
Sonora Union High School District	Sonora, Columbia, Jamestown and vicinity	Secondary Education	1
Tuolumne Band of Me-Wuk	Tuolumne Rancheria	Tribal Government and Administration	2
Jamestown Fire Protection District	Jamestown community	Fire Protection and Suppression	4
Mi-Wuk Sugar Pine Fire Protection District	Communities of Mi-Wuk and Sugar Pine	Fire Protection and Suppression	5
Tuolumne Utilities District	Northern Tuolumne County	Public Water and Sewage Disposal Systems	6
Twain Harte Community Services District	Community of Twain Harte	Public Water System and Sewage Collection; Fire Protection and Suppression; Recreation	7
Columbia College (Yosemite Community College District)	All of Tuolumne County and beyond	Community College	8
Columbia Fire Protection District	Community of Columbia	Fire Protection and Suppression	9
Groveland Community Services District	Groveland, Big Oak Flat and Pine Mountain Lake area	Public Water and Sewage Disposal systems; Fire Protection and Suppression; Recreation	10
Jamestown Sanitary District	Community of Jamestown	Sewage Disposal	11
Jamestown Fire Protection District	Community of Jamestown	Fire Protection and Suppression	12

2. TECHNICAL CAPABILITY

Tuolumne County has limited technical capability to implement hazard mitigation strategies.

Technical Expertise

Tuolumne County has a Community Development Department that includes planners, building and safety inspectors, and fire prevention officers on staff to administer the County's hazard mitigation programs. The County has licensed engineers and related technical experts on the Public Works staff, and other personnel trained in emergency services coordination in both the Community Development and Fire Departments, as well as the Emergency Operations Coordinator at the Administration Office.

Tuolumne County has an Information Systems and Services (ISS) Department who acts as Information Technology (IT) staff to internal County functions, but it has recently been expanded to include a Webmaster who has instituted a County Internet presence. The internet has come to be an expected and necessary tool for public information about emergencies and hazards, and will be used to enhance local government operations and the County's ability to develop and maintain a state-of-the-art hazard mitigation program.

Geographic Information Systems (GIS)

GIS systems can best be described as a set of tools (hardware, software and people) used to collect, manage, analyze and display spatially-referenced data. Many local governments are now incorporating GIS systems into their existing planning and management operations. Tuolumne County was an early local government in the implementation of GIS technology, and has GIS functions integrated into the Community Development and Public Works Department functions. GIS is currently used for hazard mitigation purposes, and further enhancement of these functions is possible.

Internet Access

Internet access opens up an enormous door for local officials to keep abreast of the latest information relative to their work and makes receiving government services more affordable and convenient. County officials and employees have had high speed access to the Internet at their desktops for several years. Many citizens have access through a variety of Internet service providers (ISP), usually limited to lower speeds depending on their location. In the past, webpages offering information about current events, such as fires or weather conditions, have been limited to those provided by ISP's and local media outlets. About the time of approval of this Plan, Tuolumne County will be initiating access to a webpage that serves a variety of purposes, including information about hazards. The initial focus has been to provide timely information about any current hazards or events, particularly widespread hazards, such as wildfires. Development of useful mapping and other tools provided by GIS is ongoing, and public information pages are being improved and added on a regular basis. Using the County webpage to inform the public of a variety of government functions, including hazard mitigation, helps bridge the gap created by a widely dispersed public.

It is believed that Internet access will help further the County's hazard mitigation awareness programs, but should be supplemented with more traditional and less technical means as well.

3. FISCAL CAPABILITY

Tuolumne County has limited fiscal capability to implement hazard mitigation strategies. For Fiscal Year 2003-2004, Tuolumne County continued to experience revenue reductions across the board. Most of the financial decisions affecting Tuolumne County are not made locally, but by past and present legislative actions in Sacramento. This has resulted in program and staff reductions. It is anticipated for this financial trend to continue for some time.

The most profound impact in the 2003-2004 budget is due to the change in the State's allocation of Vehicle License Fees (VLF). Tuolumne County, as in all counties, not only loses the potential growth in VLF, but loses a substantial portion of our base appropriation. Tuolumne County is also concerned about the potential loss of several Federal/State grants in coming years, especially in the area of Criminal Justice.

It is highly unlikely that Tuolumne County could afford to provide the local match for the existing hazard mitigation grant programs considering the current budget deficits at both the State and local government level. Combined with the apparent increased reliance on local accountability by the Federal government, this is a significant and growing concern for Tuolumne County.

4. POLICY AND PROGRAM CAPABILITY

This part of the capabilities assessment includes the identification and evaluation of existing plans, policies, practices, programs, or activities that either increase or decrease the community's vulnerability to natural hazards. Positive activities, which decrease hazard vulnerability, should be sustained and enhanced if possible. Negative activities, which increase hazard vulnerability, should become targeted for reconsideration and be thoroughly addressed within Mitigation Strategy for Tuolumne County.

Recent Hazard Mitigation Efforts

SWIFT

The SouthWest Interface Team (SWIFT) is a collaborative partnership established in March 1999. This partnership was established to mitigate the very serious wildland fire hazards in Southern Tuolumne County. City, County, State and Federal agencies, and local citizens are working in a cooperative effort to help protect life, property, and resources within the project area. The SWIFT Coordinator is funded by an allocation from the Tuolumne County General Fund via the Secure Rural Schools Act (Title III).

The project area is 132,000 acres in the southern portion of the County. Protection of people and property in this area is of major concern. Large and destructive fires are common in this area. Efforts to design a network of strategically placed fire systems and well-prepared pre-fire plans will provide mitigation to the fire loss potential.

Actual work completed in the field includes over 40.5 miles (12,905 acres) which have been treated. Treatments include fuel break reductions, mechanical shredding, prescribed burning, animal grazing and hand clearing and thinning.

Fire Safe Councils

Fire Safe Councils are a coalition of public and private sector organizations that share a common interest in reducing loses from wildfire. Tuolumne County, with the assistance of the California Department of Forestry and the United States Forest Service, established two Fire Safe Councils. The Councils meet monthly to carry out the following goals:

- Educate the public so as to significantly increase public awareness about fire risks and ways in which they can reduce such a risk.

- Monitor and support programs to ensure that the minimum legal requirements for preventive clearance and safety are met every year on all private property, timberlands, and public lands within the Council's area of influence.

- Develop creative ways to make compliance with fire safe regulations easier and more effective for property owners.

- Serve as the community's contact to increase effective communication between fire agencies and the general public.

- Build community support for gaining additional funding, programs, and equipment in order to meet suppression and preventative needs in the local region.

The Fire Safe Councils have been integral in creating at least two pilot projects in the County. One project was able to establish a fuel break between a remote subdivision and the adjoining wildlands. Another created a program of collecting and safely disposing of vegetation removed during fuel clearing by property owners in another area also particularly vulnerable to wildland fires.

Community Rating System Activities

Communities that regulate development in floodplains are able participate in the National Flood Insurance Program (NFIP). In return, the NFIP makes federally-backed flood insurance policies available for properties in the community. Tuolumne County participates in the NFIP by adopting the Flood Damage Prevention Ordinance, Chapter 15.24 of the Tuolumne County Ordinance Code (TCOC). This Ordinance attempts to reduce flood losses by the following methods:

- Restricting or prohibiting 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;
- Requiring that uses vulnerable to floods including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;
- Controlling fill, grading, dredging, and other development which may increase flood damage; and,
- Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas. (Section 15.24.040 of the TCOC)

These methods of flood damage prevention are applied to development projects and other construction requiring a County permit, which are located in areas considered to be “special flood hazard”. The special flood hazard areas are those identified by FEMA by the Flood Insurance Study and by the Flood Insurance Rate Maps (FIRM), all dated September 5, 1990. The Ordinance allows for subsequent amendments and/or revisions from FEMA to also be included, as well as any other mapped areas supplemented by similar special studies. To date, there have been no amendments, revisions, or special studies to be incorporated. This presents a problem, because there are significant developed areas of watersheds not included in the 1990 maps that could be included. These include the two main streams passing through the City of Sonora, Woods Creek and its tributary Sonora Creek. Also missing is the portion of the Woods Creek floodplain that passes through the community of Jamestown. Due to this lack of data concerning flood potential, a mitigation action has been prepared to remedy the situation either by obtaining assistance from FEMA to complete the study for the City and County, or by seeking funding for a qualified consultant to prepare a similar analysis.

Emergency Operations Plan

Tuolumne County has developed and adopted an Emergency Operations Plan which predetermines actions to be taken by government agencies and private organizations in

response to an emergency or disaster event. The Plan was last modified in July 1996. Primarily, the Plan describes the County's capabilities to respond to emergencies and establishes the responsibilities and procedures for responding effectively to the actual occurrence of a disaster.

The Plan does not specifically address hazard mitigation, but it does identify the specific operations to be undertaken by the County to protect lives and property immediately before, during and immediately following an emergency. There are no foreseeable conflicts between this Hazard Mitigation Plan and Tuolumne County's Emergency Management Plan, primarily because they are each focused on two separate phases of emergency management (mitigation vs. preparedness and response). The Plan does identify short and long term recovery policies and procedures to ensure appropriate actions are taken after a disaster. Specific recovery duties and tasks have been assigned to key county staff.

Tuolumne County General Plan

California state law requires each city and county to adopt a general plan "for the physical development of the county or city, and any land outside its boundaries which bears relation to its planning" (Section 65300 of the California Government Code). The California Supreme Court has called the general plan the "constitution for future development." The general plan expresses the community's development goals and embodies public policy relative to the distribution of future land uses, both public and private. The policies of the general plan are intended to underlie most land use decisions. Pursuant to state law, subdivisions, capital improvements, development agreements, and many other land use actions must be consistent with the adopted general plan. In counties and general law cities, zoning and specific plans are also required to conform to the general plan. In addition, preparing, adopting, implementing, and maintaining the general plan serves to:

- Identify the community's land use, circulation, environmental, economic, and social goals and policies as they relate to land use and development.

- Provide a basis for local government decision-making including decisions on development approvals and exactions.

- Provide citizens with opportunities to participate in the planning and decision-making processes of their communities.

For cities, this affects all territory within the city limits, both public and private. Counties must address all unincorporated areas.

Because there is only one incorporated city in the County, the City of Sonora, the County of Tuolumne has jurisdictional responsibility for the general plan for the majority of the County. Both Sonora and Tuolumne County have adopted General Plans. The Tuolumne County General Plan underwent a comprehensive update in 1996, and has been amended as needed since then to keep it current. A major revision to the City of Sonora General Plan is in preparation at this time.

Tuolumne County's general objectives in the Tuolumne County General Plan include the following:

- *To expand the capacity of the County government to analyze local and*

regional conditions and needs in order to respond effectively to the problems and opportunities facing the County.

- *To define the County's environmental, social and economic goals.*
- *To record the County's policies and programs for the maintenance and improvement of existing development and the location and characteristics of future development.*
- *To provide citizens with information about the County and with opportunities to participate in setting goals and determining policies and standards for the County's development.*
- *To foster the coordination of County development and environmental protection activities among local, regional, state and federal agencies.*
- *To guide and coordinate the many actions and day-to-day decisions of the County government that are necessary in developing and protecting the County.*
- *To provide local decision-makers and the County with a forum for resolving conflicts among competing interests and values.*

General plans in California are required to have seven mandatory elements, and the Tuolumne County General Plan includes those seven plus several other optional elements for a total of thirteen: Land Use; Circulation; Housing; Conservation and Open Space; Noise; Safety; Public Facilities and Services; Recreation; Cultural Resources; Economic Development; Agricultural; Air Quality; and Community Identity. Natural hazards and mitigation are addressed directly or indirectly in at least four of these elements: Land Use; Conservation and Open Space; Safety; and Public Facilities and Services.

<u>Land Use Element</u>

The purpose of the Land Use Element is to establish what land uses can be conducted in which locations. The anticipated pattern of development is defined by a series of land use diagrams, as well as goals, policies, and implementation programs. Criteria used in establishing new or continuing growth areas on the land use diagrams included minimizing exposure to various natural hazards, particularly by encouraging infill and discouraging continued expansion of development in the wildland/urban interface area. More directly, the Land Use Element includes such implementation programs as the following:

1.F.m Fire Protection

Continue to require all new commercial development to have adequate fire protection which may include design and maintenance features that contribute to the protection of the County from losses associated with wildland fire. Periodically update the County’s fire protection standards to reflect new information and technology concerning fire prevention in wildland areas.

Similar implementation programs are included to address residential and industrial development as well. In addition, Implementation Program 1.G.a stipulates that land to be designated as industrial should take place in a "location outside areas of extreme fire hazard". All of these policies and implementation programs are being considered during the review process for all proposals to change land use designations, which will help to create new development that minimizes exposure to natural hazards.

Conservation and Open Space Element

The Conservation and Open Space Element is organized to address the general areas of timberland resources, mineral resources, energy resources, scenic resources, biological resources, and water resources. Several of these sections of the Conservation and Open Space Element deal with hazard prevention or mitigation in a direct or indirect way. For example, the biological resources section provides for conservation, and if possible, preservation, of wetland habitat (Implementation Program 4.J.c) and "second priority" wildlife habitat (Implementation Program 4.J.d). The County's Biological Resources Conservation Handbook defines streams, lakes, and wet meadows some of the second priority wildlife habitat types. These programs substantially reduce the development potential to those wetlands and water resources which indirectly also limit the ability to develop in areas that are potentially flooded.

The water resources section of the Conservation and Open Space Element provides for several implementation programs related to hazard prevention or mitigation. The primary program is to develop a conservation program for water resources (Implementation Program 4.L.a) which has the goal of reducing the impacts of development on water resources. This multi-stepped program includes adoption of Best Management Practices (BMP's) to reduce the risk of erosion and sedimentation problems resulting from development. A CalFed grant has been obtained to be used to hire a consultant to design BMP's, and results of that effort are expected to be completed in approximately two years. Once drafted, it is intended that the BMP's be adopted and then applied to a variety of development projects that require grading and land alteration. It also allows use of flexible development standards that could reduce the amount of grading necessary for development, and therefore reduce the risk of creating unstable slopes or erosion/sedimentation problems.

Implementation Program 4.L.b is also intended to preserve water quality in the water supply system by limiting the potential development above open reservoirs or canals unless public water and sewer is available. This would reduce the inadvertent water supply impacts of a malfunctioning septic tank and leach field near these vulnerable water supply features.

Safety Element

The Safety Element underwent significant revision in the overall update process completed in 1996. The Safety Element includes specific sections addressing geologic hazards, flood hazard, fire protection, criminal justice system, emergency services, and hazardous materials and waste. The Safety Element has been reviewed for purposes of this Hazard Mitigation Plan, with special attention paid to those portions which address natural hazards. The section addressing geologic hazards includes a series of Implementation Programs (6.B.a through 6.F.a) that attempt to limit the exposure to the geologic hazards of earthquakes, landslides, unstable slopes, and erosion. Of particular note, Implementation Program 6.F.a would consider amending the Tuolumne County Grading Ordinance "in order to protect soil stability and natural topography and to prevent soil erosion and creation of

unstable slopes". Amendments to the Grading Ordinance have been under consideration for some time, and will certainly be amended when the Best Management Practices (BMP's) described above have been adopted, in order to reflect those provisions.

The Flood Hazard section of the Safety Element has multiple policies and implementation programs that are applicable to this Plan. The implementation programs range from development of a flood hazard inventory (Implementation Program 6.G.a) to provide for mitigation of impacts on downstream drainage facilities from new development (Implementation Program 6.G.k). Most of these implementation programs are considered when reviewing new development, to see that new or increased hazards are not created or exacerbated, and to see that new structures or occupants are not put in harm's way. There are two implementation programs that are not yet fully implemented:

6.G.b Notification That Land is Within Designated Flood Zones

Based upon the Flood Insurance Rate Maps, provide notification to the owners of property within designated floodplains of the consequences of constructing within the floodplain. The County shall mail a letter to the owner and record a notice on the property, stating that all or a portion of the property is located in a designated floodplain, and is subject to building and/or use restrictions. This information would be revealed to potential buyers during title search.

6.G.f Dam Failure Evacuation Plan

Update the Tuolumne County Emergency Plan to accommodate evacuations due specifically to dam failure.

At the time of initial adoption of this Plan, neither of those Implementation Programs have been completed yet. Therefore, mitigation actions have been included as part of this Plan in order to complete each of these programs.

Public Facilities and Services

Chapter 7 of the Tuolumne County General Plan, the Public Facilities and Services Element, includes several sections addressing specific public services not directly addressed in the other elements. These include sections on public water supplies and sewer system, both of which are related to hazard mitigation.

The public water supplies section includes requirements that public water supplies be used for new urban residential development and most commercial development. Besides allowing for a more reliable public water system for potable supply, having a public water system allows for better fire suppression. Either through a system of hydrants strategically located in a new development, or exterior hydrants and interior sprinklers in most new commercial buildings, a public system generally has a greater volume of water available for fire suppression than an isolated private system. Many hazards typically generate structure fires, from wildfire events to earthquakes, and being able to respond requires an ample supply of fire suppression water.

In addition, Goal 7.F states that Tuolumne County should "Promote coordination between Tuolumne County and water supply purveyors". Because the three largest water purveying

agencies in the County are very active participants in the preparation of this Plan, and are three of the participating jurisdictions in this multi-jurisdiction Plan, the planning process has served as a catalyst towards meeting that goal. In addition, the communication between the water agencies has been extensive during the planning process, and is expected to continue. At least two of the mitigation actions included in the Plan deal directly with collaboration between the water purveyors in order to provide better service during disasters or difficult conditions, as well as achieve greater economies of scale. The proposed Hazard Mitigation Steering Committee will continue the communication and collaboration once the Plan has been adopted.

The Sewer System section of the Public Facilities and Services Element of the Tuolumne County General Plan also addresses hazards. Tuolumne County has a history of development patterns for commercial and dense residential development beyond the reach of the existing sewer collection systems. Originally constructed with on-site sewage disposal based on septic tanks and leach fields, many of these areas are now experiencing widespread septic system failures causing expensive repair or replacement. The failures can create localized hazards associated with exposed untreated sewage on the surface or entering the watersheds, but these hazards are not particularly susceptible to the natural hazards or catastrophic events featured by the Plan. However, there are a series of policies and implementation programs in that section that stipulate public sewage systems for denser residential development, require other residential development to make use of public sewage systems if they are reasonably available, and require public sewage for most commercial development.

Stormwater Management Plan

Tuolumne County does not currently have an adopted stormwater management plan, but does apply stormwater management provisions through its subdivision regulations, as well considering stormwater implications during review of projects requiring a permit, such as a grading permit. As discussed in the above section on the Tuolumne County General Plan's Conservation and Open Space Element, best management practices for erosion and sediment control are going to be formulated in the near future, and those BMP's will be applied to a variety of development projects that cause land disturbance. .

County Ordinances

Tuolumne County has adopted several ordinances that are relevant to hazard mitigation. The three portions of the Tuolumne County Ordinance Code (TCOC) that apply most directly to hazards and hazard mitigation are the following: Title 17, the Tuolumne County Uniform Zoning Ordinance; Chapter 15.24, Flood Damage Prevention; and Chapter 15.20, Fire Safety Standards.

<u>Title 17, Tuolumne County Uniform Zoning Ordinance</u>

The land use policies and standards of the General Plan are implemented on a day-to-day basis through zoning, which imposes specific development and land use regulations. The zoning regulations apply to all of the privately-owned parcels within the unincorporated area of the County (the City of Sonora has a similar set of ordinances), and each parcel has a primary zoning district. Some properties are divided into more than one zoning district, but most have only one. The primary zoning district has a set of permissible land uses defined in Title 17, which stipulate those land uses approved for that district. Two of the primary zoning districts are Open Space (O) and Open Space –1 (O-1). Both are used in most

cases to restrict construction of structures from occurring or to prevent ground disturbance within the portion of the property zoned as O or O-1. The O-1 zoning district is more restrictive than the O district in what land uses are permissible. These zoning districts are proposed for properties during the review process for a project to change the land use designation, zoning district, or gain approval for a development. Usually the area proposed for O or O-1 zoning contains an environmental or cultural resource that is notable, and should be preserved. It is not coincidental that wildlife habitat value, the most common reason for Open Space zoning, is usually chosen for the protective zoning in an area of a water feature, such as a stream. The O or O-1 zoning then serves a dual purpose, protecting the wildlife habitat associated with stream courses and preserving the ability of the stream to carry water and flood naturally.

Chapter 15.24, Flood Damage Prevention

A discussion on this ordinance is found in the above portion of the section "Community Rating System Activities"

Chapter 15.20, Fire Safety Standards

The Fire Safety Standards define a number of conditions that are applied to residential, rural, commercial and industrial development projects in order to make the property defensible, reduce the risk of loss of life and property due to fire, provide safe ingress and egress, and make the property accessible for emergency services response vehicles. The Fire Prevention Bureau of the Community Development Department reviews all applications to build structures or develop property, to ascertain that projects meet the standards and intent of the ordinance. Section 15.20.110 also serves to adopt the appropriate State and National fire codes. Due to the continuing seasonal fires in the State that often cause significant losses, as well as the continued growth in the wildland/urban interface, the codes related to fire prevention and safety change and evolve frequently. Although Chapter 15.20 was revised only a recently, it would be worthwhile establish a regular program of reviewing the of regulations frequently to update and consider changes to the standards. Therefore, a mitigation action is being added to this plan to have the Fire Prevention Bureau periodically prepare a review and set of recommendations about possible changes to the ordinance, and bring that item to the Board of Supervisors Planning Committee for consideration of additional action.

5. LEGAL AUTHORITY

Local governments in California have a wide range of tools available to them for implementing mitigation programs, policies and actions. A hazard mitigation program can utilize any or all of the four broad types of government powers granted by the State of California, which are (a) Regulation; (b) Acquisition; (c) Taxation; and (d) Spending.

A. Regulation

GENERAL POLICE POWER

California's local governments have been granted broad regulatory powers in their jurisdictions. The legislature of the State has in Government Code Sections 65302, 65560

and 65800 conferred upon local government units authority to adopt regulations designed to promote the public health, safety and general welfare of its citizenry. The general police power of Tuolumne County is usually enacted and enforced with ordinances, which define, prohibit, regulate or abate acts, omissions, or conditions detrimental to the health, safety, and welfare of the people, and to define and abate nuisances, including public health nuisances.

Since hazard mitigation can be included under the police power as protection of public health, safety and welfare, towns, cities and counties may include requirements for hazard mitigation in local ordinances. Local governments may also use their ordinance-making power to abate "nuisances," which could include any activity or condition making people or property more vulnerable to a hazard. The ordinances of Tuolumne County related to hazard reduction or prevention are summarized previously in this Chapter, in Section 4. Policy and Program Capability.

BUILDING CODES AND BUILDING INSPECTION

Many structural mitigation measures involve constructing and retrofitting homes, businesses and other structures according to standards designed to make the buildings more resilient to the impacts of natural hazards. Many of these standards are imposed through the building code. For example, although Tuolumne County is located in one of the lesser areas of earthquake related risk for the State, the level of risk still mandates that construction be subject to the standards of the California Building Code (CBC) for Seismic Risk Zone #3. These codes stipulate that structures are designed to withstand a certain amount of ground shaking without failure or creation of obvious threats to occupant safety. Other sections of the CBC relate to safe occupancy in a variety of ways, and mandate that all occupied structures have an acceptable level of safety for the occupants. Review of proposed building plans and inspections during the construction process ensure that the appropriate codes are followed, and that future occupants have an acceptable level of safety and security. The Building and Safety Division of Tuolumne County's Community Development Department (CDD) provides this service to the unincorporated parts of Tuolumne County, and the City of Sonora's Community Development Department provides a like service for incorporated Sonora (the only incorporated city in the County).

The Fire Prevention Bureau (CDD) also reviews proposed construction for enforcement of the California Fire Code. As well as stipulating certain elements of a proposed building, the CFC also regulates aspects of the overall development for fire suppression and emergency services. For example, the access driveway and fuel reduction aspects of the property undergoing development are considered during this review process. The City of Sonora has a similar review process using the Sonora Fire Department's Fire Prevention Officer.

LAND USE

Regulatory powers granted by the state to local governments are the most basic manner in which a local government can control the use of land within its jurisdiction. Through various land use regulatory powers, a local government can control the amount, timing, density, quality, and location of new development. All these characteristics of growth can determine the level of vulnerability of the community in the event of a natural hazard. Land use regulatory powers include the power to engage in planning, enact and enforce zoning ordinances, floodplain ordinances, and land division controls.

Each local community possesses the ability to prevent unsuitable development in hazard-prone areas or require that development projects be modified in a way that prevents the development and its future occupants from being unduly at risk from a hazard, or from exacerbating the risk of an existing hazard. That ability is summarized below under the following three headings; Planning, Zoning, and Development Review:

Planning

The State of California mandates that local jurisdictions formulate and adopt a General Plan to guide the growth and physical development within their respective boundaries (Section 65300 et seq. of the California Government Code). The Tuolumne County General Plan guides development within the unincorporated areas of the County, while the City of Sonora General Plan similarly applies to the incorporated City. The preceding Section 4. Policy and Program Capability describes fully the implications of hazard mitigation found within the Tuolumne County General Plan.

Zoning

Zoning is the traditional and most common tool available to local governments to control the use of land. Broad enabling authority for municipalities in California to engage in zoning is granted in Section 65800 et seq. of the California Government Code. A more thorough discussion of the portions of the Tuolumne County Ordinance Code that applies to hazard mitigation is found in the previous Section 4. Policy and Program Capability.

Development Review

Reviews of new development projects proposed for the unincorporated areas of Tuolumne County are coordinated by the Tuolumne County Community Development Department (CDD). Development is considered to be any creation of new lots or parcels of land, as well as multi-family residential complexes, commercial construction, or industrial projects. As well as considering the implications of the development project in accordance with the General Plan and zoning code, the overall environmental impacts of the project are considered through implementation of the California Environmental Quality Act (CEQA). All known hazards are addressed in this process, as well as implications on the general health, safety, and welfare of the community (adequacy of access roads, emergency services, etc). A similar process is followed in the City of Sonora for any new development projects proposed within the city limits.

B. Acquisition

The power of acquisition can be a useful tool for pursuing local mitigation goals. Local governments may find the most effective method for completely “hazard-proofing” a particular piece of property or area is to acquire the property (either in fee or a lesser interest, such as an easement), thus removing the property from the private market and eliminating or reducing the possibility of inappropriate development occurring. California legislation empowers cities, towns and counties to acquire property for public purpose by gift, grant, devise, bequest, exchange, purchase, lease or eminent domain

Tuolumne County has used acquisition as a local mitigation tool in a somewhat similar situation. The County owns a general aviation airport that was originally developed as an amenity to a large subdivision. The original developer sold lots at one end of the runway in an area now considered to be too close to the runway and in what is now designated as the "Runway Protection Zone". Policies in a subsequently adopted airport land use plan prevent the construction residences on those lots due to safety concerns. The County recognized that the owners of those few lots had lost their development rights and has since completed the purchase at least one piece of property off the end of the runway and will purchase the rest when funds become available. Although the hazard that caused the acquisition example just described is not of the type addressed by this Plan, it does serve as an example where Tuolumne County has committed to acquiring property due to known hazards. If there were a situation where a risk from a natural hazard was known to be so severe that all development rights had to be curtailed, Tuolumne County may be able to make a similar commitment. However, just as demonstrated by the example, having available funding is crucial, and the current funding environment makes that commitment unlikely.

C. Taxation

The power to levy taxes and special assessments is an important tool delegated to local governments by California law. The power of taxation extends beyond merely the collection of revenue, and can have a profound impact on the pattern of development in the community. Communities in some states have the power to set preferential tax rates for areas which are more suitable for development in order to discourage development in otherwise hazardous areas. California does not allow cities or counties to increase tax rates beyond the base rate, except with voter approval. A community can pursue voter approval of a bond or similar mechanism to increase the property tax to be used for a specific purpose. Often used for schools, the increase could be used for a fuel break program or other hazard reduction program. However, voter approval of such measures are difficult to obtain and has not happened in Tuolumne County.

D. Spending

The fourth major power that has been delegated to local governments is the power to make expenditures in the public interest. Hazard mitigation principles can be made a routine part of all spending decisions made by the local government, including the adoption of budgets and a Capital Improvement Plan (CIP).

A CIP is a schedule for the provision of municipal or county services over a specified period of time. Capital programming, by itself, can be used as a growth management technique, with a view to hazard mitigation. By tentatively committing itself to a timetable for the provision of capital to extend services, a community can control growth to some extent especially in areas where the provision of on-site sewage disposal and water supply are unusually expensive.

In addition to formulating a timetable for the provision of services, a local community can regulate the extension of and access to services. A CIP that is coordinated with extension and access policies can provide a significant degree of control over the location and timing of growth. These tools can also influence the cost of growth. If the CIP is effective in directing growth away from environmentally sensitive or high hazard areas, for example, it can reduce environmental costs.

6. POLITICAL WILLPOWER

Most Tuolumne County residents are quite knowledgeable about the potential hazards that their community faces, and in recent years, they have become more familiar with the practices and principles of mitigation. Several pilot projects that deal with reducing fire risk by removing excess fuels from brush, understory, and overstocked timber areas in the urban/wildland interface areas have been initiated by both governmental agencies and neighborhood groups with positive results. It is strongly believed that such tangible and visual changes within the community have created a greater sense of awareness among local residents, and that hazard mitigation is a concept that they are beginning to readily accept and support.

Because of this fact, coupled with Tuolumne County's history with natural disasters, it is expected that the current and future political climates are favorable for supporting and advancing future hazard mitigation strategies.

IV. Mitigation Considerations
B. Strategy

INTRODUCTION

This portion of the Plan outlines Tuolumne County's overall strategy to reduce its communities' vulnerability to the effects of natural hazards. It has been separated into the following four distinct sections:

1. *Community Goals*
2. *Objectives*
3. *Mitigation Techniques*
4. *Proposed Mitigation Actions*

The **Community Goals** identify the goal statements established by Tuolumne County and the participating jurisdictions for purposes of this Hazard Mitigation Plan. Each Goal is meant to be general and broad in nature, and can only be achieved through the long-term implementation of more specific objectives.

The **Mitigation Objectives** are designed to support and correspond directly with the *Community Goals*, and were developed to provide Tuolumne County with some measurable, mid-range targets (2-5 years). Each objective is numbered (eg., "1.1"), with the first digit representing the corresponding Community Goal.

The **Mitigation Techniques** are based on the possible activities that could be undertaken to achieve the stated goals and objectives, and lessen the vulnerability of Tuolumne County to the effects of natural hazards. The techniques fall into six broad categories: prevention; property protection; natural resource protection; structural projects; emergency services; and public information and awareness.

The **Mitigation Actions** are short-term, specific measures to be undertaken by Tuolumne County in order to achieve the identified objectives. Most of these actions are also hazard-specific. Each action identifies the objective(s) it is intended to achieve, includes some general background information to justify the proposed action, and provides measures to assure successful and timely implementation.

Also important to note is that each Mitigation Objective and Mitigation Action is designed to be performance-based, making it easier for Tuolumne County to measure the Plan's progress over time and during the Plan's future evaluations. It is expected that while the *Community Goals* may remain the same for an extended period of time, the objectives and actions included in this *Mitigation Strategy* will be updated and/or revised through regular enhancements to this Plan.

1. COMMUNITY GOALS

It is intended that each Goal listed below will be more specifically addressed and realized through the implementation of short-term mitigation objectives and actions established and maintained in *Section III: Mitigation Strategy*.

GOAL #1

Increase Tuolumne County's and participating jurisdictions' internal capabilities to mitigate the effects of natural hazards.

GOAL #2

Enhance existing or design new County and participating jurisdiction's policies that will reduce the potential damaging effects of hazards without hindering other community goals.

GOAL #3

Protect Tuolumne County's most vulnerable populations, buildings and critical facilities through the implementation of cost-effective and technically feasible mitigation projects.

GOAL #4

Protect public health, safety and welfare by increasing the public awareness of existing hazards and by fostering both individual and public responsibility in mitigating risks due to those hazards.

2. MITIGATION OBJECTIVES

Objective 1.1 Improve the County's Insurance Service Office (ISO) Ratings through improved infrastructure of hydrants and water availability, and by reducing response time with a greater number of strategically placed and fully staffed fire stations.

Objective 1.2 Enhance the County's capability to conduct hazard risk assessments, demonstrate funding needs, and track mitigation activities throughout the county.

Objective 1.3 Ensure that current emergency services are adequate to protect public health and safety.

Objective 2.1 Modify the County's policies over development in the urban/wildland interface area to further reduce the risk to lives and property from future wildfires.

Objective 2.2 Review the County's and City of Sonora's policies and available data concerning development in floodplains to ensure lives and property are not at risk to future flood conditions.

Objective 2.3 Ensure that all new construction is completed in a way most resistant to loss or damage from natural disasters.

Objective 2.4 Encourage participation in a cooperative mutual aid and emergency response plan between districts of similar functions to provide assistance at time of a natural disaster.

Objective 3.1 Maximize the use of available hazard mitigation grant programs to protect the County's most vulnerable populations and structures.

Objective 3.2 Ensure that all vital / critical facilities are protected from the effects of natural hazards to the maximum extent possible.

Objective 4.1 Increase the level of knowledge and awareness for Tuolumne County residents on the hazards that routinely threaten the area.

Objective 4.2 Educate property owners on the affordable, individual mitigation and preparedness measures that can be taken before the next hazard event.

3. MITIGATION TECHNIQUES

In formulating this Mitigation Strategy, a wide range of activities were considered in order to help achieve the goals of the community and to lessen the vulnerability of Tuolumne County to the effects of natural hazards. In general, all of these activities fall into one of the following broad categories of mitigation techniques.

Available Mitigation Techniques

1. **Prevention**

   Preventative activities are intended to keep hazard problems from getting worse. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:
   - Planning and Zoning
   - Open space preservation
   - Floodplain regulations
   - Stormwater management
   - Drainage system maintenance
   - Capital improvements programming
   - Building setbacks
   - Fuel clearance requirements

2. **Property Protection**

   Property protection measures protect existing structures by modifying the building and or its surroundings to withstand hazardous events, or removing structures from hazardous locations. Examples include:
   - Acquisition
   - Relocation
   - Design considerations for new construction (roofing materials, etc)
   - Building elevation
   - Critical facilities protection
   - Retrofitting (eg., windproofing, floodproofing, seismic design standards, etc.)
   - Insurance
   - Fuel Breaks
   - Fuel Reduction
   - Safe rooms

3. **Natural Resource Protection**

   Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their mitigative functions. Such areas include floodplains, wetlands and dunes. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:
   - Floodplain protection
   - Riparian buffers
   - Fire resistant landscaping
   - Erosion and sediment control

- Watershed protection
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization

4. Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event. They are usually designed by engineers and managed or maintained by utility or public works staff. Examples include:

- Utility infrastructure improvements (water distribution, storage, etc.)
- Capital Improvements (eg. fire stations)
- Reservoirs
- Channel modification
- Storm sewers
- Drainage improvements
- Replacement bridges or culverts to improve capacity

5. Emergency Services

Although not typically considered a "mitigation technique," emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Increased staffing
- Pre-event planning
- Warning systems
- Evacuation planning and management
- Sandbagging for flood protection

6. Public Information and Awareness

Public Information and awareness activities are used to advise residents, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Webpage applications
- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children education
- Hazard expositions

4. PROPOSED MITIGATION ACTIONS

The mitigation actions proposed for Tuolumne County to undertake are listed on the pages that follow this introduction. Each action has been designed to achieve the goals and objectives identified through this Hazard Mitigation Plan. A standard format has been devised to introduce each proposed action, and when possible, the following pages follow that format by including:

(1) a number (for organization only, with no implication of ranking or value);

(2) the appropriate category for the mitigation technique;

(3) the hazard it is designed to mitigate;

(4) the objective(s) it is intended to help achieve;

(5) some general background information;

(6) a summary description of the proposed action;

(7) the priority level for its implementation (high, moderate or low);

(8) potential funding sources, if applicable;

(9) which of the participating jurisdictions[1] are involved by this action;

(10) the agency/person assigned responsibility for carrying out the strategy;

(11) a target completion date[2].

Again, it is important to note that these mitigation actions are short-term, specific measures to be undertaken by Tuolumne County or the other jurisdictions participating in this Plan. It is expected this component of the Plan will be the most dynamic; it will be used as the primary indicator to measure the Plan's progress over time and will be routinely updated or revised through future planning efforts. It is also worth repeating that the order the proposed actions are presented should not be considered as a priority list, or ranking by importance or any other value.

The assignment of a priority level for each Mitigation Action was accomplished after several rounds of consideration of all of the proposed Mitigation Actions during meetings of the ad hoc Mitigation Plan Advisory Committee. Agreement on the priority levels that

[1] "All" means all of the participating jurisdictions are involved; "County" means only the County of Tuolumne; "Fire Districts" include the City of Sonora, Tuolumne Fire Protection District (FPD), Mi-Wuk Sugar Pine FPD, Columbia College, Groveland Community Services District (CSD), and Jamestown FPD; "Water Districts" include Tuolumne Utility District (TUD), Twain Harte CSD, and Groveland CSD; "Sewer Districts" include TUD, Twain Harte CSD, Groveland CSD, and Jamestown Sanitary District.

[2] The dates indicated in the following descriptions for each Mitigation Action, as well as within the Mitigation Action Plan in the Chapter V of this document, should be clearly understood to be "target" dates. Many are tied to yet-to-be identified funding sources, actions by other agencies, or other factors which could cause slippage in achieving the desired goal by the target date. Inability to achieve the target dates should not be considered a failure by the responsible agencies, nor should an inability to achieve a target date for a Mitigation Action cause the Action to be discarded or otherwise deemed unworthy of achieving at a later time, should funding or other opportunities arise subsequent to the original date that makes completing that action possible.

were assigned was achieved by consensus by that group after soliciting input from all attendees and subsequent discussion. As most of the Mitigation Actions are implemented through a change in policy or program versus a specific project, the costs were often not clearly understood, but rather considered in vague or round terms. Similarly, the technical expertise level of the Advisory Committee members was high, but actual numeric benefits of the proposed Mitigation Actions were not feasible to estimate. Rather, the Committee relied on the collective experience of the participants to consider if the benefits compare favorably to the possible costs, and incorporated that general knowledge into the decision-making process for rating the priorities for the Actions as High, Moderate, or Low. In many cases, the benefits were determined high if that Action has the potential for mitigating a hazard that could result in a larger scale personal or economic loss, versus a hazard with a smaller scale loss in numbers of casualties or structures. In other cases, the Actions received a higher priority rating due to the nature of the action as having a cost primarily in staff time, otherwise known as a “soft” cost, which makes the implementation easier to bear by the participating jurisdictions.

It should be clearly understood that it was not the intent of the Advisory Committee or this Plan to prevent or delay the implementation of a Moderate or Low priority Mitigation Action in deference to a High priority Action, should the means be found to accomplish the lower priority Action first. Neither should the County, a participating jurisdiction, or any other entity consider itself restrained from implementing a lower priority Action should the means for implementing that Action be found just because a higher priority Action remains unfulfilled.

As described in the Introduction, this main body of the Plan serves two purposes: as the multi-jurisdiction hazard mitigation plan for a variety of local government entities in the County, and as the hazard mitigation plan for the County of Tuolumne. Towards that end, the following action item descriptions include a line describing which of the participating jurisdictions are involved in that item, as well as the agency or person responsible for implementation. Those items that involve the County of Tuolumne would then indicate which office or function of the County government is responsible for implementation. As this main Plan is also functioning as a multi-jurisdiction plan, those action items that may not include the County as involved agency but do include more than one of the other participating jurisdictions are also found in this section. If an action item involves only one participating jurisdiction other than the County, then that action item is described in the appropriate appendix.

Action #1

Establish a Hazard Mitigation Steering Committee

Category:	Prevention Emergency Services
Hazard:	All
Objective(s) Addressed:	2.4
Background:	Tuolumne County is vulnerable to multiple possible natural hazards, which have the potential to cause loss and damage. This plan will help to minimize the effects of a natural disaster but the County has not had a forum to continue tracking and use of this plan. Tuolumne County does not have a specific Committee to address mitigation actions and track results. The ad hoc Hazard Mitigation Plan Committee responsible for drafting this plan recognizes the value of a cross-functional group of management, line staff, and other stakeholders that actively oversee the implementation and maintenance of the plan. The functions could range from general oversight to actual project or program management. Key roles would likely include tracking efforts, gathering input for periodic reports, setting priorities, considering goals and objectives, and terminating projects (as appropriate). Above all, a system of collaboration and information sharing would be established that would benefit all of the agencies' abilities to plan and implement hazard mitigation efforts on a County-wide basis.
Action Summary	Create a Hazard Mitigation Steering Committee (HAMSC) comprised of representatives of all of the participating jurisdictions, plus other involved parties. Either at the staff or official level, the group would be primarily responsible for overseeing the implementation of this plan, reviewing progress, and recommending changes or amendments.
Priority:	High
Funding Sources:	Borne by Participating Agencies
Jurisdictions Involved:	All
Responsibility Assigned to:	Overall coordination of the committee provided by the County Emergency Services Coordinator
Target Completion Date:	Beginning in January , 2005

Action #2

Develop and Adopt a Comprehensive Tuolumne County Wildland Pre-Fire Management and Suppression Plan

Category:	Prevention Property Protection Natural Resources Protection Structural Projects Emergency Services Public Information and Awareness
Hazard:	Wildland Fire
Objectives Addressed:	1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 4.1, 4.2
Background:	The fire environment in Tuolumne County is conducive to large, damaging fires. The urban interface problem in the County is critical and the potential loss of life, improved property and structures is high in the event of wildfire. The topography contains many steep canyons, which, in some cases, are inaccessible. Fighting fires with fire engines and bulldozers is difficult, if not impossible, in much of the County due to this rugged terrain. Severe fire weather occurs on 35% of the days during the fire season in much of the County. This coupled with the rugged terrain and the high hazard fuels, increases the probability that large damaging fires will occur on a regular basis.
Action Summary:	In order to prevent and combat such fires all fire agencies within the County must work together. Therefore, a comprehensive county fire plan must be formulated. The goals of the plan will be to analyze the existing fire hazard and fire management conditions, and propose programs and actions to reduce the identified fire hazards and suppress wildfires that threaten lives, property and resources.
Priority:	High
Funding Sources:	Potential grants, fire agency revenues for staff hours and development.
Jurisdictions Involved:	County, Fire Districts
Responsibility Assigned to:	Assistant County Fire Warden
Target Completion Date	June 1, 2005 with a regular update

Action #3

Develop and Adopt Flood Hazard Mapping for Sonora and Woods Creek Through Sonora and Jamestown Communities Equivalent to FEMA Flood Information Rate Maps or Better

Category:	Prevention Property Protection
Hazard:	Floods, Winter/Seasonal Storms
Objectives Addressed:	1.2, 2.2, 2.3, 3.1, 3.2
Background:	The current FEMA Flood Information Rate Maps for the County do not address the majority of the potentially flooded area of Woods Creek, and its tributary Sonora Creek. Both have the potential to flood significant commercial and residentially developed areas. Further development of these areas lacks the nominal flood prevention considerations associated with implementation of the FIRM maps by the City of Sonora and County of Tuolumne during development review.
Action Summary:	Request FEMA amend the current FIRM maps for the County to include mapping the 100-year floodplain elevations of Sonora Creek and Woods Creek to a point one mile below Jamestown. If FEMA is unable to honor the request, hire an engineering consulting company to provide the equivalent analysis, using standard FEMA accepted methods and data or better.
Priority:	Moderate
Funding Sources:	FEMA or other potential grants
Jurisdictions Involved:	County, City of Sonora
Responsibility Assigned to:	Community Development Department; Department of Public Works, and City of Sonora
Target Completion Date	July, 2006

Action #4

Establish Mutual Aid Arrangements for Utility Districts

Category (Technique):	Prevention Emergency Services
Hazard:	Wildfire Winter Storms Flood Dam Failure Earthquake, sinkholes, landslides Drought/Extreme Heat
Objective(s) Addressed:	2.4
Background:	Presently an informal agreement exists among utility districts to assist other utility companies in times of natural disaster, to the extent that service to existing customers is not impacted. An organization called Water Agency Response Network (WARN) exists to provide a statewide mutual assistance arrangement between water and wastewater utilities. Participation of our utilities in WARN or a local similar arrangement could assist districts in handling disaster events. Levels of anticipated assistance are dependent on the nature of the disaster, and the ability of other utilities to provide assistance. The assistance could be as minor as loaning a part or supply that one utility needs until a permanent replacement is obtained, to providing staffing assistance during emergency situations.
Action Summary:	Encourage potential members of WARN to participate in that organization, or create a local version with an official written mutual aid agreement between neighboring utility districts.
Priority:	High
Funding Sources/Costs:	Absorbed by individual utility districts
Jurisdictions Involved:	All Water and Sewer Districts
Responsibility Assigned to:	Individual utility districts and their respective Board of Directors
Target Completion Date:	April, 2005

Action #5

Establish Goals of Continuity of Operations Planning

Category (Technique):	Prevention Emergency Services
Hazard:	Wildfire Winter Storms Flood Dam Failure Earthquake, sinkholes, landslides Drought/Extreme Heat
Objective(s) Addressed:	1.3, 2.4, 3.2
Background:	In many cases, particularly in smaller governmental entities or districts, there is only one way to get a critical service. For example, a small service district usually has one office area and one maintenance facility. Loss of any of these facilities, or even isolation of these facilities during a power outage can disrupt the normal function of the district with possibly catastrophic results. There are numerous other examples of a lack of redundancy in critical infrastructure operations and management, and this item attempts to set policies to create redundancy where possible. The goal of Continuity of Operations Planning (COOP) is to ensure that the essential functions of an organization can operate during and after an emergency event.
Action Summary:	Encourage establishment of a program for back-ups and redundancies for electric supply, communications, computer access and general operation of critical facilities so that services continue with minimal interruptions.
Priority:	High
Funding Sources:	Individual agencies if possible, FEMA
Jurisdictions Involved:	All
Responsibility Assigned to:	Individual Participating Agencies and Districts
Target Completion Date:	April, 2005

Action #6

Planning for Additional Water Storage Facilities

Category (Technique):	Prevention Emergency Services Structural Projects
Hazard:	Wildfire, Earthquake, Drought/Extreme Heat
Objective(s) Addressed:	1.1, 2.3, 3.1
Background:	Most of the County's water supply on the north side of the Tuolumne River is from Lyon's Reservoir, delivered via the PG & E owned Main Canal. The Main Canal is highly susceptible to damage from a variety of natural disasters. In addition, the canal is drained every year in October for cleaning, maintenance and repairs, effectively stopping supply of raw water for the extent of the outage. The primary water supply on the south side of the Tuolumne River is from Hetch Hetchy Reservoir, delivered via the Hetch Hetchy main tunnel and pipeline system owned by the City and County of San Francisco. The tunnel/pipeline has been shutdown for periods of maintenance, causing the Groveland Community Services District to rely on storage. Any damage resulting in a shutdown of the main canal or pipeline, including annual or periodic maintenance shutdowns results in a complete stoppage of supply. During that time, water is available on a limited basis, supplied **only** from storage tanks, reservoirs and supplemental wells. As supply is severely curtailed, any large-scale demand for water, such as use from hydrants during a major fire, could result in a depletion of water in storage. Creating additional storage, by construction of reservoirs and tanks and related infrastructure (eg. distribution lines, pumps, hydrants, etc), would minimize this potentially hazardous situation.
Action Summary:	Encourage participation in a planning effort for additional water storage facilities for use in fire suppression. Consider cooperating with CDF, TCFD, and nearby utility districts on a feasibility study to investigate potential methods and consider priorities of planning, funding, and constructing additional water storage facilities to be located in strategic areas throughout Tuolumne County. Options could include ways of enlarging existing potable water and raw water reservoirs, as well as methods of water transport and delivery that could enhance water availability for emergency use.
Priority:	High
Funding Sources:	FEMA grants or other sources
Jurisdictions Involved:	County, Water Districts
Responsibility Assigned to:	Hazard Mitigation Steering Committee, participating utility districts
Target Completion Date:	January, 2006

Action #7

Maintenance Program for Smaller Dams and Impoundments

Category (Technique):	Prevention Property Protection Structural Projects
Hazard:	Dam Failure
Objective(s) Addressed:	2.3, 3.1, 3.2
Background:	There are numerous small dams and reservoirs in the County, which are used for both domestic and agricultural use. Any dams under 25' in height and with a capacity of less than 50 acre-feet are not reviewed or inspected by the State Department of Dam Safety. Although dams may have been constructed properly, failure to maintain them could lead to significant loss of water if they are stressed, broken or breached during a flood event. An inspection, maintenance and enforcement program helps to ensure continued structural integrity.
Action Summary:	Establish a goal for all utilities or agencies with surface impoundments to create a program, to plan, fund, and implement a dam inspection program for all dams not inspected or reviewed by the State.
Priority:	Moderate
Funding Sources:	FEMA or other grants
Jurisdictions Involved:	Water and Sewer Districts
Responsibility Assigned to:	Utility districts that own or control dams or levees below the threshold size of the Department of Dam Safety
Target Completion Date:	January, 2006

Action #8

Acquire a Portable Filtration Plant

Category (Technique):	Prevention Emergency Services
Hazard:	All
Objective(s) Addressed:	1.1, 3.3
Background:	Most of the existing water treatment plants and potable water distribution systems rely on raw water from the open TUD and PG&E ditch system, or from the Hetch Hetchy tunnel and pipeline system. Natural disasters as well as acts of man could stop either system from delivering water. There are a variety of lakes, reservoirs, and other untreated water sources in the County which could be utilized as a domestic drinking water source, if properly filtered. A portable half million gallon portable filtration plant could provide the County with the necessary means to utilize this resource in an emergency.
Action Summary:	Plan and pursue funding for the purchase a portable filtration plant that could be shared amongst the County's water utilities and used in an emergency situation. The equipment would have be stored and kept maintained for use when needed.
Priority:	High
Funding Sources:	Local funding sources are unknown, FEMA or other grants
Jurisdictions Involved:	Water Districts
Responsibility Assigned to:	Shared responsibility between Tuolumne Utilities District, Groveland Community Services District and Twain Harte Community Services District
Target Completion Date:	July, 2006

Action #9

Policy to Establish Inter-Connections for Water Systems

Category (Technique):	Structural Projects
Hazard:	All
Objective(s) Addressed:	1.1, 1.3, 3.2
Background:	Tuolumne County has numerous water districts, water companies and community water systems, distributing treated water to residents. These water purveyors largely operate autonomously and infrastructure varies from sector to sector. Inter-connections between otherwise separate systems may allow for water to be shared when it would not otherwise be available from the provider normally responsible. Some interconnections exist, others may be possible that could create additional sources of supply for users. In times of emergencies, to have inter-connections available may reduce the risk that a community's water supply is uninterrupted.
Action Summary:	Establish a program to plan, seek funding for, and implement inter-connection programs between utility districts
Priority:	Moderate
Funding Sources:	Unknown
Jurisdictions Involved:	Water Districts
Responsibility Assigned to:	Utility districts
Target Completion Date:	January, 2007

Action #10

Sewer Line Monitoring Program

Category (Technique):	Prevention Structural Projects
Hazard:	Winter/Seasonal Storms Flood Dam Failure Earthquake, Sinkholes and Landslides
Objective(s) Addressed:	1.3, 3.2
Background:	There are a variety of sewer lines transporting raw sewage to wastewater treatment plants in Tuolumne County. Many of these lines are "gravity" lines and have no inline pumps to regulate flow. Some of these lines are old and fragile, and particularly susceptible to failure from a variety of natural hazards. Major health risks could result if these lines were damaged due to earthquake, flooding, erosion, landslide or other earth movement. Lines that cross water features, particularly those on road and highway bridges, are especially susceptible.
Action Summary:	Establish a program to inspect lines, develop priorities to address lines with greatest impact, conduct geo-technical inspections along lines to inspect for slope failure, install meters with supervisory control and data acquisition (SCADA) devices on gravity lines and monitor manholes for discharge
Priority:	Moderate
Funding Sources:	Unknown
Jurisdictions Involved:	Sewer Districts
Responsibility Assigned to:	Individual utility districts
Target Completion Date:	January, 2006

Action #11

Map Sewer Facilities with Emphasis on Flood Hazards

Category (Technique):	Prevention Property Protection Structural Projects
Hazard:	Winter/Seasonal storms Flood Dam Failure Earthquakes, Sinkholes, and Landslides
Objective(s) Addressed:	1.3, 3.1, 3.2
Background:	Wastewater (sewer) treatment plants and related facilities are susceptible to flood hazards, from either streambank flooding or drainage problems. Line or plant failure could result from high levels of water, creating a potential hazard to public health and safety from releases of untreated sewage. Additionally, sanitary sewers can be overloaded with non-sewage runoff due to infiltration and interception of runoff that should properly be handled through a separate storm sewer system.
Action Summary:	Create a goal of mapping potential flooding or drainage problems at wastewater treatment plants or sewer pipelines and set a priority list of areas with greatest potential for damage. Consider adding supervisory control and data acquisition (SCADA) systems inline and on manholes that monitor flow or levels.
Priority:	Moderate
Funding Sources:	FEMA or other grants
Jurisdictions Involved:	Sewer Districts
Responsibility Assigned to:	Individual utility districts
Target Completion Date:	January, 2006

Action #12

Support Local and Regional Efforts to Reduce Fuels and Create Fire Safe Communities

Category:	Prevention
Hazard:	Wildland Fire
Objective(s) Addressed:	1.1, 3.1, 3.2, 4.1, 4.2
Background:	The fire environment in Tuolumne County is conducive to large, damaging fires. The urban interface problem in the County is critical and the potential loss of life, improved property and structures is high in the event of wildfire. Several programs have been started to reduce the fuels on properties or adjacent to developed areas, or to protect areas of development with fuel breaks. These programs have value to the localities getting protected, as well as acting as pilot projects with potential for wider application. These programs include the Fire Safe Councils, SouthWest InterFace Team (SWIFT), and 108 Strategic Group.
Action Summary	Continue to provide support and seek sources of funding for the local and regional groups that are working to reduce fuels and protect structures in the wildland/urban interface.
Priority:	High
Funding Sources:	Grants, Donations, other funds as available
Jurisdictions Involved:	County
Responsibility Assigned to:	Tuolumne County Fire Department, California Division of Forestry and Fire Protection, Emergency Services Coordinator, SWIFT, 108 Strategic Group, Fire Safe Councils
Target Completion Date:	Continuous

Action #13

Acquire Additional Engines and Equipment for Tuolumne County Fire Department

Category:	Property Protection Emergency Services
Hazard:	Wildland Fires
Objective(s) Addressed:	1.1, 1.3, 3.1, 3.2
Background:	The fire environment in Tuolumne County is conducive to large, damaging fires. The urban interface problem in the County is critical and the potential loss of life, improved property and structures is high in the event of wildfire. Fires beginning in difficult and/or remote environments have potential for catastrophic results if suppression is not timely and complete. The lack of available and ready equipment could result in a structure fire or small wildfire becoming a major event. Additional "Type III" fire engines are the most identified deficiency in order to provide acceptable service.
Action Summary	Fund, purchase, equip, and house additional Type III fire engines for wildland and structural fire suppression.
Priority:	High
Funding Sources:	Grants, County tax revenue
Jurisdictions Involved:	County
Responsibility Assigned to:	Assistant County Fire Warden
Target Completion Date:	January, 2006

Action # 14

Create and Maintain a Drainage Manual by Identifying and Mapping Watershed Basins Throughout the County

Category:	Prevention Property Protection
Hazard:	Flood Winter/ Seasonal Storms
Objectives Addressed:	2.2, 2.3, 3.2
Background:	The County currently lacks a comprehensive documentation of the characteristics of the various watersheds and stream networks of the County. Such an analysis would allow standardization of the engineering components in order to consistently and accurately quantify the amount of storm water runoff generated by existing conditions and by new development throughout the County. Prepared under the direction of Public Works, the results would be useful for the County for engineering studies, as well as by the private sector in designing roads, bridges, and similar structures for new development. Not having this analysis contributes to a general lack of nominal flood prevention considerations associated with implementation of the FIRM maps by the City of Sonora and County of Tuolumne during development review.
Action Summary:	Seek funding for engineering consulting assistance to characterize the flood and runoff characteristics of County watersheds, and provide analyses, using standard FEMA accepted methods and data or better.
Priority:	Moderate
Funding Sources:	FEMA, other grants
Jurisdictions Involved:	County, City of Sonora
Responsibility Assigned to:	Public Works, Community Development Department; City of Sonora
Target Completion Date	July, 2006

Action # 15

Notify Owners of Land That is Within Designated Flood Zones

Category:	Prevention Property Protection
Hazard:	Flood Winter/ Seasonal Storms
Objectives Addressed:	2.2, 2.3, 3.2, 4.1, 4.2
Background:	The Conservation and Open Space Element of the Tuolumne County General Plan includes Implementation Program 6.G.b: Notification That Land is Within Designated Flood Zones. Based upon the Flood Insurance Rate Maps, the County will notify owners of property within designated floodplains of the consequences of constructing within the floodplain. The notification would be by letter and recording of a notice on the property. Due to lack of available staff time, this has not been implemented yet. This action would raise the priority of that notification process.
Action Summary:	The County shall mail a letter to the owner of all properties that lie partially or entirely within flood hazard areas as defined by the Flood Information Rate Maps, and record a notice on the property. The notice would state that all or a portion of the property is located in a designated floodplain, and is subject to building or use restrictions. This information would be revealed to potential buyers during title search.
Priority:	Moderate
Funding Sources:	General Fund
Jurisdictions Involved:	County
Responsibility Assigned to:	Tuolumne County Community Development Department
Target Completion Date	January, 2006

Action # 16

Update the Tuolumne County Emergency Operations Plan to Accommodate Evacuations Due to Dam Failure.

Category:	Emergency Services Public Information and Awareness
Hazard:	Dam Failure
Objectives Addressed:	1.3, 2.2, 4.1, 4.2
Background:	The Conservation and Open Space Element of the Tuolumne County General Plan includes Implementation Program 6.G.f: Dam Failure Evacuation Plan. Based upon the dam inundation maps prepared by dam/reservoir owners or agencies, these maps have been compiled into a GIS layer. Using the layer, we can reasonably predict the areas subject to potential flooding if there is a dam failure. .
Action Summary:	The County Community Development Department GIS staff shall prepare appropriate maps or lists of potentially inundated properties, and supply the results to the Emergency Services Coordinator. Amendments to the appropriated emergency plan(s) shall be coordinated by the Coordinator subject to approval by all participating agencies.
Priority:	Moderate
Funding Sources:	General Fund
Jurisdictions Involved:	County
Responsibility Assigned to:	Tuolumne County Community Development Department, Emergency Services Coordinator
Target Completion Date	January, 2006

Action # 17

Devise a creek maintenance strategy for Sonora and Woods Creek from the Cabezut Basin to below Jamestown.

Category:	Prevention Property Protection
Hazard:	Flood Winter/ Seasonal Storms
Objectives Addressed:	2.2, 2.3, 3.1, 3.2
Background:	Vegetative growth occurs in Woods Creek and its tributary Sonora Creek seasonally. If not removed on a regular basis, the overgrowth restricts the flow in the channels and can cause flooding during high flow events. Reductions in State revenues have reduced the availability of community service crews, which used to remove the vegetative growth on an annual basis. The creeks pass through the urbanized area of the City of Sonora and the community of Jamestown, and pass though lands that include mixed private and public ownership. .
Action Summary:	Consider seeking funding for a joint study of the nature of the flooding problems resulting from vegetative overgrowth, coordinated by both the City of Sonora and Tuolumne County, subject to review by State Fish and Game and any other appropriate agencies.. Subsequent implementation is subject to approval by all participating agencies.
Priority:	High
Funding Sources:	Available revenues, and grants
Jurisdictions Involved:	County, City of Sonora
Responsibility Assigned to:	Department of Public Works, City of Sonora
Target Completion Date	January, 2006

Action # 18

Review the Policies and Ordinances Related to Fire Prevention and Protection for New Development Projects

Category:	Prevention Property Protection Natural Resource Protection Public Information and Awareness
Hazard:	Wildland Fire
Objectives Addressed:	1.1, 1.2, 1.3, 2.1, 2.3, 4.1, 4.2
Background:	The Fire Prevention Bureau reviews all development projects for consistency with the State and County fire prevention and protection standards, policies and regulations. Due to increasing development pressure in the wildland/ urban interface and evolving State regulations and codes, the County General Plan policies and programs, as well as County ordinances, should be reviewed and possibly updated on a regular basis. The last review and proposed changes were taken to the Board of Supervisors in July 2004, so a regular schedule will be proposed for future review cycles, the next to be initiated no later than July 2007. .
Action Summary:	The County Community Development Department's Fire Prevention Bureau will review current policies and implementation programs of the General Plan, as well as existing ordinances, for consistency with the current code.
Priority:	High
Funding Sources:	General Fund
Jurisdictions Involved:	County
Responsibility Assigned to:	County Community Development Department
Target Completion Date	July, 2007, and regularly thereafter

Action # 19

Analyze Land Subsidence Potential Due to Abandoned Underground Mine Workings

Category:	Prevention Property Protection Public Information and Awareness
Hazard:	Earthquakes, Sinkholes, and Landslides
Objectives Addressed:	1.2, 2.3, 3.1, 3.2, 4.2
Background:	The mining history of Tuolumne County included a period of gold mining based on excavating shafts and tunnels in pursuit of gold veins. Although some of the workings were loosely backfilled, others remain open or filled with water. Some were dug at too shallow depths, and collapse of the workings will result in subsidence at the surface. Mostly concentrated in the City of Sonora and the Mother Lode or other more isolated gold ore zones, there have been some historical and recent surface failures due to subsidence. The potential exists for more, but a modern geologic and engineering analysis has not been initiated to predict the extent of the problem, probable locations with higher risk, and possible solutions or preventative measures. .
Action Summary:	The City of Sonora and Tuolumne County will consider making a mine subsidence study a priority, and pursue possible funding to hire a qualified consultant to prepare such a study. The study results could include maps of areas with greatest potential and recommended measures to prevent the subsidence or construct safely despite the potential for settling.
Priority:	Moderate
Funding Sources:	FEMA, or other grants
Jurisdictions Involved:	County, City of Sonora
Responsibility Assigned to:	City of Sonora, Tuolumne County Community Development Department and Public Works
Target Completion Date	January, 2006

Action # 20

Prepare a Community Wildfire Protection Plan

Category:	Prevention Property Protection Natural Resources Protection Structural Projects Emergency Services Public Information and Awareness
Hazard:	Wildland Fire
Objectives Addressed:	1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 4.1, 4.2
Background:	The fire environment in Tuolumne County is conducive to large, damaging fires. Significant amounts of development, mostly residential, have occurred in the wildland/urban interface and the threat of loss of life and property to wildfires is critical. Preparation of a Community Wildfire Protection Plan (CWPP) enables the community to take advantage of provisions of the Healthy Forests Restoration Act (HFRA) of 2003 that are not available without a CWPP. Having a CWPP enables the community to define the boundaries of the interface zone, rather than having those boundaries pre-defined. This is important because most grant funded projects under HFRA must occur with that zone. Also, communities with an approved CWPP get priorities for grants over those that lack a CWPP. The three primary elements that must be addressed in a CWPP are collaborating with all stakeholders, proposing priorities for areas for hazardous fuel reduction treatments, and recommending measures that homeowners and communities can take to reduce the ignitability of structures.
Action Summary:	Prepare a Community Wildfire Fire Protection Plan as a collaborative effort including all stakeholders, and including all necessary elements.
Priority:	High
Funding Sources:	Potential FEMA grants, General Fund.
Jurisdictions Involved:	County, Fire Districts
Responsibility Assigned to:	Assistant County Fire Warden, Emergency Services Coordinator, County Fire Marshall
Target Completion Date	April, 2005

Action # 21

Acquire Aerial Photo-imagery Database for Pre-fire Planning and Disaster Response

Category:	Prevention Property Protection Natural Resources Protection Structural Projects Emergency Services Public Information and Awareness
Hazard:	Wildland Fire
Objectives Addressed:	1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 4.1, 4.2
Background:	The fire environment in Tuolumne County is conducive to large, damaging fires. Significant amounts of development, mostly residential, have occurred in the wildland/urban interface and the treat of loss of life and property to wildfires is critical. Having aerial photogrammetry or similar imagery will enable the County's GIS Division to create maps that will be utilized for pre-fire planning and hazard reduction projects, as well as during wild fire events. It will also greatly enhance the County's ability to plan and implement future mitigation measures concerning wildfire hazard reduction. The image databases can be obtained from commercial vendors, either through processing aircraft photography or images obtained from satellites.
Action Summary:	Seek funding to acquire digital photo imagery obtained from aerial flyover or satellite at highest resolution available, and use imagery in GIS mapping and analysis before and during wildfire events.
Priority:	High
Funding Sources:	Potential Pre-Disaster FEMA Mitigation grants, other grant programs.
Jurisdictions Involved:	County
Responsibility Assigned to:	County Geographic Information Systems (GIS) Division; County Department of Public Works; Emergency Services Coordinator
Target Completion Date	November, 2005

TUOLUMNE COUNTY
MULTI-JURISIDICTION HAZARD MITIGATION PLAN

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PURPOSE

The purpose of this chapter is to outline the possible implementation methods of the proposed mitigation actions identified in the preceding chapter. This chapter begins with a summary table of those action items, the Mitigation Action Plan. Following is a discussion of the processes that may be necessary for implementation, including a summary of additional requirements, such as state and federal environmental laws and regulations. The third part of this chapter is identification of known or possible funding sources that can used to cover the costs of implementation.

A. MITIGATION ACTION PLAN (MAP)

The following table is the Mitigation Action Plan (MAP), which briefly outlines the mitigation actions described in the preceding Chapter IV. The intent of the MAP is not only to act as a summary of the identified mitigation action items, but to act as a tool for tracking progress of those programs over time. Towards that end the MAP includes a column marked as “Status” which will be used for a summary of whether that action is in the planning or implementation stages or awaiting funding, etc. as well as the intent that many will be able to marked as “completed” in the future.

Mitigation Action Plan

Action #	Action	Hazard	Category	Objective	Priority	Funding Sources	Responsibility Assigned to:	Target Completion Date[1]	STATUS
1	Establish a Hazard Mitigation Steering Committee	All	Prevention; Emergency Services	2.4	High	Borne by Participating Agencies	Emergency Services Coordinator	January, 2005	
2	Develop and adopt a comprehensive Tuolumne County Wildland Pre-Fire Management and Suppression Plan.	Wildland Fire	Prevention; Natural Resources Protection; Property Protection; Structural Projects; Emergency Services; Public Information and Awareness	1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 4.1, 4.2	High	Potential Grants, fire agencies for staff hours and development	Assistant County Fire Warden	June, 2005 with regular updates	
3	Develop and adopt flood hazard mapping for Sonora and Woods Creek.	Floods; Winter/ Seasonal Storms	Prevention; Property Protection	1.2, 2.2, 2.3, 3.1, 3.2	Moderate	FEMA or other grant programs	TC CDD, City of Sonora, Public Works	July, 2006	

[1] The dates in this Mitigation Action Plan should be clearly understood to be "target" dates. Many are tied to yet-to-be identified funding sources, actions by other agencies, or other factors which could cause slippage in achieving the desired goal by the target date. Inability to achieve the target dates should not be considered a failure by the responsible agencies, nor should an inability to achieve a target date for a Mitigation Action cause the Action to be discarded or otherwise deemed unworthy of achieving at a later time, should funding or other opportunities arise subsequent to the original date that makes completing that action possible.

Action #	Action	Hazard	Category	Objective	Priority	Funding Sources	Responsibility Assigned to:	Target Completion Date[1]	STATUS
4	Encourage participation in a mutual aid arrangement for utility districts	All	Prevention; Emergency Services	2.4	High	Utility Districts	Individual Utility Districts	April, 2005	
5	Establish goals of continuity of operations planning for infrastructure providers	All	Prevention, Structural Projects; Emergency Services	1.3, 2.4, 3.2	High	Individual agencies, possible FEMA or other grant programs	Participating Utility Districts	April, 2005	
6	Planning to provide for additional water storage	Wildfire; Earthquake; Drought/ Extreme Heat	Prevention; Emergency Services; Structural Projects	1.1, 2.3, 3.1	High	FEMA Grants, other grant programs	HAMSC, Utility Districts	January, 2006	
7	Establish a maintenance and inspection program for smaller dams and levees (smaller than the size threshold for State oversight)	Dam Failure	Prevention; Property Protection; Structural Projects	2.3, 3.1, 3.2	Moderate	FEMA or other grants	Utility Districts	January 2006	
8	Acquire a portable water filtration plant for joint use	All	Prevention; Emergency Services	1.1, 3.3	High	FEMA or other grants	Shared between TUD, GCSD and THCSD	June, 2006	

Action #	Action	Hazard	Category	Objective	Priority	Funding Sources	Responsibility Assigned to:	Target Completion Date[1]	STATUS
9	Establish inter-connections for water systems	All	Structural Projects	1.1, 1.3, 3.2	Moderate	Utility Systems	Individual Utility Districts	January, 2007	
10	Establish a program to inspect and monitor sewer lines	Winter/ Seasonal Storms; Flood; Dam Failure; EarthquakeSinkholes and Landslides	Prevention; Structural Projects	1.3, 3.2	Moderate	FEMA or other grants	Wastewater Districts	January, 2006	
11	Map sewer facilities with emphasis on flood hazards, and set priority repair/replacement list based on potential failure	Winter/ Seasonal Storms; Flood; Dam Failure; Earthquake Sinkholes, and Landslides	Prevention; Property Protection; Structural Projects	1.3, 3.1, 3.2	Moderate	FEMA or other grants	Wastewater Districts	January, 2006	
12	Continue to support local and regional groups working to reduce fuels and fire hazards in the wildland/urban interface.	Wildland Fire	Prevention	1.1, 3.1, 3.2, 4.1, 4.2	High	Resource Allocation Committee (RAC); General Fund; Grants, Donations	TCFD[2], Emergency Services Coordinator; SWIFT, 108 Strategic Group, Fire Safe Councils	Continuous	

[2] Acronyms: Tuolumne County Fire Department (TCFD)
SouthWest InterFace Team (SWIFT)

Action #	Action	Hazard	Category	Objective	Priority	Funding Sources	Responsibility Assigned to:	Target Completion Date[1]	STATUS
13	Acquire additional fire engines and equipment for Tuolumne County Fire Department.	Wildland Fire	Property Protection; Emergency Services	1.1, 1.3, 3.1, 3.2	High	Grants, County tax revenue	Assistant County Fire Warden	January, 2006	
14	Seek assistance in preparation of a drainage manual by identifying and mapping watershed basin characteristics throughout the County.	Flood Winter/ Seasonal Storms	Prevention; Property Protection	2.2, 2.3, 3.2	Moderate	Grants	Public Works, City of Sonora	July, 2006	
15	Notify owners of land that is within FEMA designated flood zones.	Flood Winter/ Seasonal Storms	Prevention; Property Protection	2.2, 2.3, 3.2, 4.1, 4.2	Moderate	General Fund	Community Development Department (CDD)	January, 2006	
16	Update the Tuolumne County Emergency Plan(s) to accommodate evacuations due to dam failure.	Dam Failure	Emergency Services; Public Information and Awareness	1.3, 2.2, 4.1, 4.2	Moderate	General Fund	CDD and Emergency Services Coordinator	January, 2006	
17	Devise a creek maintenance strategy for Sonora and Woods Creek from the Cabezut Basin to below Jamestown	Flood Winter/ Seasonal Storms	Prevention; Property Protection	2.2, 2.3, 3.1, 3.2	High	Available revenues, and grants	City of Sonora, Department of Public Works	January, 2006	

Action #	Action	Hazard	Category	Objective	Priority	Funding Sources	Responsibility Assigned to:	Target Completion Date[1]	STATUS
18	Review the Policies and Ordinances Related to Fire Prevention and Protection for New Construction and other Development Projects	Wildland Fire	Prevention; Property Protection; Natural Resource Protection; Public Information and Awareness	1.1, 1.2, 1.3, 2.1, 2.3, 4.1, 4.2	High	General Fund	CDD	July, 2007	
19	Analyze Land Subsidence Potential Due to Abandoned Underground Mine Workings	Earthquakes Sinkholes, and Landslides	Prevention; Property Protection; Public Information and Awareness	1.2, 2.3, 3.1, 3.2, 4.2	Moderate	FEMA; or potential grants	City of Sonora, CDD and Public Works	January, 2006	
20	Prepare a Community Wildfire Protection Plan	Wildland Fire	Prevention; Natural Resources Protection; Property Protection; Structural Projects; Emergency Services; Public Information and Awareness	1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 4.1, 4.2	High	FEMA or other grants, General Fund	Assistant County Fire Warden, Emergency Services Coordinator, County Fire Marshall	April, 2005	

Action #	Action	Hazard	Category	Objective	Priority	Funding Sources	Responsibility Assigned to:	Target Completion Date[1]	STATUS
21	Acquire Aerial Photo-imagery Database for Pre-Fire Planning and Disaster Response	Wildland Fire	Prevention; Natural Resources Protection; Property Protection; Structural Projects; Emergency Services; Public Information and Awareness	1.1, 1.2, 1.3, 2.3, 3.1, 3.2, 4.1, 4.2	High	Pre-Disaster FEMA Mitigation grants, other grant programs	County GIS Division; County Department of Public Works; Emergency Services Coordinator	November, 2005	

B. PROCESS

The Tuolumne County Hazard Mitigation Plan will be implemented through the delegation of assignments by the County Emergency Services Coordinator, and as specified within this Plan. In *Chapter IV: Mitigation Considerations* and as summarized in the preceding Mitigation Action Plan, there are 19 mitigation actions listed and assigned specific implementation measures which include the assignment of responsibilities to County departments and/or specific County staff or the participating jurisdictions, along with the establishment if a target completion date for each proposed mitigation action. When applicable, potential funding sources were also listed.

It will be the responsibility of the County Emergency Services Coordinator, as chairman of the proposed Hazard Mitigation Steering Committee (Action Item #1), to oversee the implementation of the proposed actions are ultimately carried out no later than the target completion dates unless reasonable circumstances prevent their implementation (i.e., lack of funding availability). Otherwise, the completion of each proposed mitigation action has been determined feasible within the timeframe allowed.

Specific procedures for regular monitoring and reporting progress on the proposed mitigation actions are provided in *Chapter V: Evaluation and Enhancement.*

ADDITIONAL REQUIREMENTS

Many of the action items listed in the preceding Mitigation Action Plan are goal oriented, and will not necessarily result in structural changes or construction of a project. Those that may will require formal approval of a project by the County or one of the participating jurisdictions prior to enactment of the action. An example would be the goal of increasing storage of water to be used in fire suppression (Action Item #6). The utility district that would be constructing a new tank or reservoir would have to include that project in its capital improvement list, or go through a similar budgeting or approval process, prior to the actual construction. At that time, the water agency would have to consider the environmental impacts of the project. If a project is based on federal funds or grant programs, then the environmental review would include not only those State requirements, but could also be subject to federal environmental protection and historic preservation laws and requirements.

Adoption of this plan does require consideration of whether or not adoption itself constitutes a “project” under the State Guidelines for the Implementation of the California Environmental Quality Act (CEQA). The County’s Environmental Coordinator has determined that adoption of the Plan does not result in any construction of any project or any other change in the physical environment, and therefore no further environmental review is necessary at this time. However, subsequent approvals of actual projects related to this plan could require CEQA review, and as mentioned above, federal environmental review consideration as well. The following provides a summary of the types or nature of those review considerations that could apply, dependent on the project:

Federal Environmental Protection and Historic Preservation Laws:

- **National Environmental Policy Act (NEPA)**

NEPA is the federal environmental law that is applied when there is a development project proposed on federal land or if that project is receiving federal funding. Since FEMA provides funding for the hazard mitigation program, they are also the lead agency for ensuring NEPA compliance. In this capacity, FEMA examines each proposed hazard mitigation project and determines how NEPA should be applied and, if required, the type of NEPA environmental document that must be prepared. The County or the other jurisdictions can assist FEMA in this process, when they are so requested, by providing environmental data or additional information about their projects or, by setting up and participating in site visits.

- **Executive Order 11990 Wetland Protection**
  If a project may affect wetlands, the proposal will be subject to Executive Order 12898 Wetland Protection. The project will be subject to the 8-step process outlined in 44 Code of Federal Regulations (CFR) Part 9.

- **Executive Order 11988 Floodplain Management**
  If a project may affect a floodplain, the proposal will be subject to Executive Order 11988 Floodplain Management. The project will be subject to the 8-step process outlined in 44CFR Part 9.

- **Clean Water Act (Section 404**)
  If the project site is located within the Waters of the United States defined by the Army Corps of Engineers or contains wetlands that fall under the jurisdiction of the Army Corps of Engineers, the County or jurisdiction acting as the project proponent will be responsible for complying with the Clean Water Act (Section 404) and will be responsible for obtaining the necessary permits.

- **Clean Water Act (Section 401)**
  If the project requires permitting by the Army Corps of Engineers the County or jurisdiction acting as project proponent will also need a certification or waiver from the California Regional Water Quality Control Board under Section 401 of the Clean Water Act.

- **Executive Order 12898 Environmental Justice**
  Projects that may have a disproportionate adverse affects on or disproportionate benefits to low-income or minority groups, will need to comply with Executive Order 12898 Environmental Justice. Information regarding socioeconomic characteristics of the affected community or communities can be found on the United States Census “American Factfinder” Website.

- **Wild and Scenic Rivers Act**
  The Tuolumne River has been designated as a Wild and Scenic River. A project in the watershed area of the Tuolumne River would have to be analyzed to determine if the project has any impacts on the river.

- **National Historic Preservation Act**
  Tuolumne County has a rich heritage of prehistoric and historic properties. If a project may affect properties on or eligible for listing on the National Register of Historic Places, a Section 106 Consultation with the State Historic Preservation Office (SHPO) will be required.

- **Endangered Species Act**
  If federally endangered or threatened species may be affected by a project then the County or the jurisdiction acting as project proponent will have to enter into a Section 7 Consultation with the US Fish and Wildlife Service (USFWS).

California Environmental Protection Laws:

- **California Environmental Quality Act (CEQA)**
  All counties, cities, special districts and other local government entities in California are subject to the CEQA in their normal course of business, and projects generated as a result of this plan would not be any different. As the lead agency under CEQA, the County or the jurisdiction acting as project proponent must evaluate their projects and determine how CEQA applies and how they will comply with those requirements. All local government agencies in California have these responsibilities, so processing a project for hazard mitigation would be subject to the same CEQA process as any other capital improvement or other project being considered. Tuolumne County has adopted Guidelines for the Implementation of CEQA, and would follow these for any project that would be an outcome of this plan. The participating agencies have similar processes that would apply.

- **Farmland Protection Act**
  Projects that impact farmland, could need to be evaluated under the Famland Protection Act. However, the Farmland Protection Act protects prime or unique farmland, and there are no prime or unique farmlands found within Tuolumne County. Therefore, consideration under the Farmland Protection Act would not be a requirement for projects addressed by this plan.

C. FUNDING SOURCES

Although all mitigation techniques will likely save money by avoiding losses, many projects are costly to implement. Due to limited budgets, Tuolumne County and the participating jurisdictions will continue to seek outside funding assistance for mitigation projects in both the pre- and post-disaster environment. This portion of the Plan identifies the primary Federal and State grant programs to consider, and also briefly discusses local and non-governmental funding sources.

FEDERAL

The following federal grant programs have been identified as funding sources which specifically target hazard mitigation projects:

Title:	**Pre-Disaster Mitigation Program**
Agency:	**Federal Emergency Management Agency**

Through the Disaster Mitigation Act of 2000, Congress approved the creation of a national program to provide a funding mechanism that is not dependent on a Presidential disaster declaration. The Pre-Disaster Mitigation (PDM) Program provides funding to states and communities for cost-effective hazard mitigation activities that complement a comprehensive mitigation program, and reduce injuries, loss of life, and damage and destruction of property.

The funding is based upon a 75 percent Federal share and 25 percent non-Federal share. The non-Federal match can be fully in-kind or cash, or a combination. Special accommodations will be made for “small and impoverished communities”, who will be eligible for 90% Federal share, 10% non-Federal.

FEMA provides PDM grants to states that, in turn, can provide sub-grants to local governments for accomplishing the following eligible mitigation activities.

- State and local hazard mitigation planning
- Technical assistance (eg. risk assessments, project development)
- Mitigation projects
- Acquisition or relocation of vulnerable properties
- Hazard retrofits
- Minor structural hazard control or protection projects
- Community outreach and education (up to 10% of State allocation)

Title:	**Flood Mitigation Assistance Program**
Agency:	**Federal Emergency Management Agency**

FEMA's Flood Mitigation Assistance program (FMA) provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program (NFIP). FMA was created as part of the National Flood Insurance Reform Act of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP.

FMA is a pre-disaster grant program, and is made available to states on an annual basis. This funding is available for mitigation planning and implementation of mitigation measures only, and is based upon a 75 percent Federal share, 25 percent non-Federal share. States administer the FMA program and are responsible for selecting projects for funding from the applicants submitted by all communities within the state. The state then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

Title:	**Hazard Mitigation Grant Program**
Agency:	**Federal Emergency Management Agency**

The Hazard Mitigation Grant Program (HMGP) was created in November 1988 through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP assists states and local communities in implementing long-term mitigation measures following a Presidential disaster declaration.

To meet these objectives, FEMA can fund up to 75 percent of the eligible costs of each project. The state or local cost-share match does not need to be cash; in kind services or materials may also be used. With the passage of the Hazard Mitigation and Relocation Assistance Act of 1993, federal funding under the HMGP is now based on 15 percent of the federal funds spent on the Public and Individual Assistance programs (minus administrative expenses) for each disaster.

The HMGP can be used to fund projects to protect either public or private property, so long as the projects in question fit within the state and local government's overall mitigation strategy for the disaster area, and comply with program guidelines. Examples of projects that may be funded include the acquisition or relocation of structures from hazard-prone areas, the retrofitting of existing structures to protect them from future damages; and the development of state or local standards designed to protect buildings from future damages.

Eligibility for funding under the HMGP is limited to state and local governments, certain private nonprofit organizations or institutions that serve a public function, Indian tribes and authorized tribal organizations. These organizations must apply for HMGP project funding on behalf of their citizens. In turn, applicants must work through their state, since the state is responsible for setting priorities for funding and administering the program.

Title:	**Public Assistance (Infrastructure) Program, Section 406**
Agency:	**Federal Emergency Management Agency**

FEMA's Public Assistance Program, through Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, provides funding to local governments following a Presidential disaster declaration for mitigation measures in conjunction with the repair of damaged public facilities and infrastructure. The mitigation measures must be related to eligible disaster-related damages and must directly reduce the potential of future, similar disaster damages to the eligible facility. These opportunities usually present themselves during the repair/replacement efforts.

Proposed projects must be approved by FEMA prior to funding. They will be evaluated for cost effectiveness, technical feasibility, and compliance with statutory, regulatory and executive order requirements. In addition, the evaluation must ensure that the mitigation measures do not negatively impact a facility's operation or risk from another hazard.

Public facilities are operated by state and local governments, Indian tribes or authorized tribal organizations and include:

- Roads, bridges and culverts
- Draining and irrigation channels
- Schools, city halls and other buildings
- Water, power and sanitary systems
- Airports and parks

Private nonprofit organizations are groups that own or operate facilities that provide services otherwise performed by a government agency and include, but are not limited to the following:

- Universities and other schools
- Hospitals and clinics
- Volunteer fire and ambulance
- Power cooperatives and other utilities
- Custodial care and retirement facilities
- Museums and community centers

Title:	**SBA Disaster Assistance Program**
Agency:	**U.S. Small Business Administration**

The SBA Disaster Assistance Program provides low-interest loans to businesses following a Presidential disaster declaration. The loans target businesses to repair or replace uninsured disaster damages to property owned by the business, including real estate, machinery and equipment, inventory and supplies. Businesses of any size are eligible, along with non-profit organizations.

SBA loans can be utilized by their recipients to incorporate mitigation techniques into the repair and restoration of their business.

Title:	**Community Development Block Grants**
Agency:	**U.S. Department of Housing and Urban Development**

The Community Development Block Grant (CDBG) program provides grants to local governments for community and economic development projects that primarily benefit low- and moderate-income people. The CDBG program also provides grants for post-disaster hazard mitigation and recovery following a Presidential disaster declaration. Funds can be used for activities such as acquisition, rehabilitation or reconstruction of damaged properties and facilities and for the redevelopment of disaster areas.

STATE

Title:	Homeland Security Grant Program
Agency:	**Governor's Office of Emergency Services**

The federal Department of Homeland Security consolidated the administration of three programs within one application package and California OES has followed suit. Applications can be submitted through OES for three distinct programs: the State Homeland Security Program (SHSP), the new Law Enforcement Terrorism Prevention (LETPP), and the Citizen Corps programs (CCP). Although the goal and intent of the Homeland Security Grant Program is to avoid, prevent, or respond to an act of terrorism, some of the possible uses of the Grant program could also have application to a disaster that may occur that has natural causes. In addition, some of the "natural" hazards addressed in this plan could occur as a result of a terrorist act. For example, a wildfire could be caused by terrorists, as could an intentional dam failure. Therefore, the Homeland Security Grant Program is included in this discussion.

Under the State Homeland Security Program (SHSP) this past year (Fiscal Year 2003), California was awarded nearly $134 million for its state and local agencies. Like last year's grant, the FY 04 distribution continues to provide funding for planning, equipment, training, exercises and management/administrative purposes. The LETPP, a new program for FY 04, distributes nearly $40 million to support various law enforcement prevention activities, including information sharing, target "hardening" or protection, threat recognition, and interoperable communications. While funds may be used to pay for equipment, training, exercises, planning and management/administration, the LETPP unlike the SHSP, also allows 20% of the funds to pay for such operational activities as overtime costs for personnel to participate in informational, investigative and intelligence sharing activities. Finally, the state was awarded nearly $2.8 million to support Citizen Corps Councils for the planning, outreach and management of Citizen Corp programs and activities.

LOCAL

Local governments depend upon local property taxes as their primary source of revenue. These taxes are typically used to finance services that must be available and delivered on a routine and regular basis to the general public. If local budgets allow, these funds may be used for other purposes in the general public interest. Many times these funds are used to match Federal or State grant programs when required for large-scale projects.

The participating jurisdictions on this plan include fire protection, utility, school, and community service districts. For fire and school districts the majority of their revenue are property taxes or another form of tax-based revenue provided through the State. For districts such as the utility providers and community services, they may also receive an allotment of property tax revenue, but function primarily by collecting fees from users for connections and metered service. These fees are generally set by the directors of the

district, and are based on actual costs to provide the service and maintain the infrastructure. There is seldom extra revenue in their budgets to fund significant projects that could result in extra levels of protection against natural hazards, so the ability of the districts to finance identified improvements is limited without access to some sort of outside grant source.

NON-GOVERNMENTAL

Another potential source of revenue for implementing local mitigation projects are monetary contributions from non-governmental organizations, such as private sector companies, churches, charities, community relief funds, the Red Cross, hospitals, Land Trusts and other non-profit organizations.

VI. Evaluation and Enhancement

A. MONITORING AND REPORTING

Periodic monitoring and reporting of the Plan is required to ensure that the goals and objectives for Tuolumne County and the participating jurisdictions are kept current and that local mitigation efforts are being carried out. The Plan has therefore been designed to be user-friendly in terms of monitoring implementation and preparing regular progress reports.

ANNUAL REPORTING PROCEDURES

Except as otherwise provided, the Tuolumne County Multi-Jurisdiction Hazard Mitigation Plan shall be reviewed at least **annually**, as part of the work program of the Hazard Mitigation Steering Committee, or as situations dictate such as following a disaster declaration.

Each year, the County Emergency Services Coordinator will take responsibility for coordinating an overall review of the main plan (not including the appendices prepared by the participating jurisdictions) by assigning responsibility for conducting the review of particular sections or topics to a specific staff department or individual. This purpose of this review is to ensure the following:

1. The results of the review will be briefed to the Hazard Mitigation Steering Committee (Action Item #1). The Committee will consider the review report and discuss the status of implementation of the Plan. This report will include, at a minimum, a completed, printed version of the ***Mitigation Action Plan (MAP)***. The MAP table summarizes the action items and is intended to be used a tool for monitoring this Plan's implementation and for reporting progress to the Committee and subsequently all of the decision making authorities for each of the local governments participating in the plan. A similar report will be expected from each of those participating local governments as well.

2. The report will include an evaluation of the effectiveness and appropriateness of the mitigation actions proposed in the Plan.

3. The report will recommend, as appropriate, any required changes or amendments to the Plan.

4. All meetings of the Hazard Mitigation Steering Committee, including the annual review process, shall be open to the public and located in a publicly accessible place, and all agendas and relevant documents shall be made available in advance to any interested agencies, groups, or individuals. Opportunities for comment on the agenda items or any relevant issues shall be extended to all attendees including the general public.

If after consideration of the reports and discussion by the Committee there is a determination that modifications to the Plan are warranted, then either the County of Tuolumne or the appropriate participating local jurisdiction can initiate a Plan amendment, or in the case of a participating jurisdiction, an amendment to their appendix, as described in Section B.

B. REVISIONS AND UPDATES

Periodic revisions and updates of the Plan are required to ensure that the goals and objectives of the Plan and its appendices are kept current. More importantly, revisions may be necessary to ensure the Plan is in full compliance with Federal regulations and State statutes. This portion of the Plan outlines the procedures for completing such revisions and updates.

THREE (3) YEAR PLAN REVIEW

The three background portions of the Plan (*Chapters II. Hazard Identification and Analysis, III. Community Vulnerability Assessment, and IV.A. Mitigation Capabilities Assessment*) should be reviewed **every 3 years** to determine if there have been any significant changes in Tuolumne County that would affect the Mitigation Plan. Significantly increased development, development in an area that increases the risk to hazards, increased exposure to certain hazards, the development of new mitigation capabilities or techniques, and changes to Federal or State legislation are examples of changes that may affect the condition of the Plan.

Further, following a disaster declaration, the Plan will need to be revised to reflect on lessons learned or to address specific circumstances arising out of the disaster.

The results of this three (3) year review should become summarized in the annual report prepared for this Mitigation Plan under the direction of the County Emergency Services Coordinator. The annual report will include an evaluation of the effectiveness and appropriateness of the Plan, and will recommend, as appropriate, any required changes or amendments to the Plan. Similar annual reports can be initiated and presented by any of the participating local jurisdictions that determines a report is warranted.

If after consideration by the Hazard Mitigation Steering Committee, the Tuolumne County Board of Supervisors determines that the recommendations warrant modification to the Plan, the Board may either initiate a Plan amendment as described below or, if conditions justify, may direct the County Emergency Services Coordinator to undertake a complete update of the Plan.

PLAN AMENDMENTS

An amendment to the Plan should be initiated only by the Board of Supervisors, either at its own initiative or upon the recommendation of the County Emergency Services Coordinator, the Hazard Mitigation Steering Committee, any of the participating local jurisdictions, or some other person or agency.

Upon initiation of an amendment to the Plan, the County will schedule a public meeting of the Hazard Mitigation Steering Committee. Notice of the meeting along with any existing information on the proposed amendment shall be sent to all participating jurisdictions and to all other interested parties including, but not limited to, all affected County departments, residents and businesses. The notice shall also be publicly posted and advertised locally to inform any other interested parties of the amendments to be considered. Information will also be forwarded to the Governor's Office of Emergency Services. If the amendment is determined to be valuable by the Committee, then a summarization of the proposed

amendment(s) will be sent out in order to seek input on the proposed Plan amendment for not less than a forty-five (45) day review and comment period. That notice will be distributed to all of the affected parties mentioned above, as well as any interested parties that have been identified subsequently to the initial scheduling by the Steering Committee.

At the end of the comment period, the proposed amendment and all review comments will be forwarded to the members of the Steering Committee for consideration at a public meeting. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly. The County Emergency Services Coordinator, acting as Chair of the Steering Committee will review the proposed amendment along with the comments received from other parties, and submit a recommendation to the Board of Supervisors and the decision-making authorities of each of the participating jurisdictions within sixty (60) days.

In determining whether to recommend approval or denial of a Plan amendment request, the following factors may be considered:

1. There are errors or omissions made in the identification of issues or needs during the preparation of the Plan;
2. New issues or needs have been identified which were not adequately addressed in the Plan;
3. There has been a change in information, data, or assumptions from those on which the Plan was based.

Upon receiving the recommendation of the County Emergency Services Coordinator or his/her designee, the Board of Supervisors shall hold a public hearing. The Board would review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the Board of Supervisors could take one of the following actions:

1. Adopt the proposed amendment and the associated resolution as presented.
2. Adopt the proposed amendment and associated resolution with modifications.
3. Refer the amendments request back to the County Emergency Services Coordinator for further consideration.
4. Defer the amendment request for further consideration and/or hearing.

Prior to final approval of an amendment by the Board of Supervisors, each of the participating jurisdictions will given the opportunity to consider any changes to the Plan that affect their district or their mission, as well as any changes proposed for the appendix for their jurisdiction, following a similar procedure as outlined in the paragraph above.