El Dorado County

Multi-Jurisdictional Hazard Mitigation Plan

EL DORADO COUNTY SHERIFF

OFFICE OF EMERGENCY SERVICES

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El Dorado County

Multi-Jurisdictional Hazard Mitigation Plan

Executive Summary

This multi-jurisdictional, Local Hazard Mitigation Plan was prepared by El Dorado County, the incorporated communities of Placerville, and South Lake Tahoe, and participating local Districts.

The purpose of El Dorado County's Local Hazard Mitigation Plan is to reduce or eliminate the effects that natural or man-made hazards may cause to people and property should an event occur. This plan has been prepared to meet the Disaster Mitigation Act of 2000 (DMA 2000) requirements in order to maintain El Dorado County's eligibility for FEMA Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Programs (HMGP). More importantly, this Plan and its planning process lay out the strategy that will enable El Dorado County to become less vulnerable to future disaster losses.

The process followed the methodology prescribed by FEMA. It began with the formation of a Hazard Mitigation Planning Committee (HMPC) compromised of key County, City, Special District, and Stakeholder Representatives. The planning process examined the recorded history of losses resulting from natural disasters, identified the elements of risk and analyzed the future threat posed to the County by these hazards. The greatest risk and vulnerability to the County are associated with wild land fires and floods. The HMPC puts forth several mitigation goals and objectives that are based on the results of the risk assessment. The Plan also puts forth specific recommendations for actions that can mitigate losses from possible future disasters.

The Plan is based on a hazard identification and risk assessment of all the areas in El Dorado County that could be impacted and includes a review of the County's current hazard reduction capabilities. Specific recommendations have been made to reduce the risks and the effects of local disasters should they occur.

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I. Introduction

This section provides a general introduction to the El Dorado County Hazard Mitigation Plan. It is broken down into the following six sections:

- *Background*
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- *Participants in the Planning Process*
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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 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 construction in hazardous areas. 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 best way for a community to implement 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;
- educating the community in the role they can play in insuring their own 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 "prepositioned" 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 California Emergency Management Agency (Cal EMA) and FEMA have encouraged multi- jurisdictional hazard mitigation plans, and this plan has been designed to serve a multi-jurisdictional function. Besides the County of El Dorado, this plan serves the jurisdictions of the Cities of South Lake Tahoe and Placerville. El Dorado Irrigation District, El Dorado County Office of Education, and South Tahoe Public Utilities District also have Local Hazard Mitigation Plans that have been included as Annex's. Later versions of this plan may also include other jurisdictions, because broadening the multi-jurisdictional function is the intention of El Dorado 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.

El Dorado County, with a population of 176.075 (US Census Bureau estimate for 7/1/2008) 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.

El Dorado 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 landowners 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 El Dorado County General Plan to carefully plan development projects in light of the hazards, to promote safe, and thoughtful growth.

In an effort to sustain this local commitment to hazard mitigation, El Dorado County prepared the first version of its Hazard Mitigation Plan in 2004. At its most inner core, the Plan recommended specific actions to combat the forces of nature and protect its residents from hazard losses. These actions go beyond recommending localized solutions to reduce existing vulnerability, such as fuel reductions and fire break projects. Local policies on community growth and development, incentives for natural resource protection, and public awareness and outreach activities are examples of other actions considered to reduce El Dorado County's future vulnerability to natural hazards. The Hazard Mitigation Plan was designed to be a living document with implementation and evaluation procedures included to help achieve meaningful objectives and successful outcomes.

The current Hazard Mitigation Plan (2010) makes use of the 2004 plan as a foundation, then incorporates the lessons and strategies learned from recent disaster events that have occurred both locally and state wide to expand on the recommended mitigation measures.

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.

SCOPE

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

The geographic scope for the Hazard Mitigation Plan includes all unincorporated areas of El Dorado County, as well as the area encompassed by the boundaries of all of the participating jurisdictions. As a multi-jurisdictional plan, each of the participating agencies will also address specific or unique hazards to their jurisdiction in an appendix to the overall plan.

AUTHORITY

This Hazard Mitigation Plan has been adopted by the El Dorado County Board of Supervisors. 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.

PARTICIPANTS IN THE PLANNING PROCESS

The participants in the development of this Hazard Mitigation Plan include the persons and agencies listed in the following table. Those who participated in a lead role are identified with one asterisk (*) after their name. Agencies with two asterisks (**) are new to the update of this hazard mitigation plan. All others are continuing from our previous hazard mitigation planning effort. Those agencies who did not participate in this update planning process include The City of South Lake Tahoe, the Sacramento Municipal Utility District, and the United State Forest Service.

Name	Agency /Community
Sgt. Bernie Morton	Sheriff's Office of Emergency Services
Marty Hackett	EDC Emergency Services Authority – Fire Districts **
Tom Celio *	El Dorado County Department of Transportation
Peter Maurer*	El Dorado County Planning Department
Chief George Nielsen*	City of Placerville – Police Department
Lt. Bryan Golmitz *	Sheriff's Office of Emergency Services
Mike Bristow *	El Dorado Irrigation District
Vicky Yorty *	El Dorado County Fire Safe Council
Kathy Daniels *	El Dorado County Office of Education
Phyllis Banducci *	CAL FIRE
Aaron Pratt *	City of Placerville – Police Department **
Eric Peterson	Diamond El Dorado Fire **
Greg Schwab *	Georgetown Fire **
Blake Bartel	Marble Mountain CSD **
Walt Rivas	Garden Valley CSD **
Chris Couper	Latrobe Fire Protection District **
Randy Hackbarth	Nashville Trail CSD **
Steven Gau	Georgetown PUD **
Gary Miller	Cameron Estates CSD **
Joe Tyler	Cameron Park CSD **
Chris Sauer	Fallen Leaf Lake CSD **
Rob Cima *	El Dorado County Fire **
Tiffany White	Cameron Park Airport District **
Bob Bryant	Tahoe City PUD **
Robert Gill *	Pioneer Fire Dept **
Bob Davis *	Mosquito Fire **
Dennis Planje	El Dorado Hills Fire **
Heather Schelske	Georgetown Divide Recreation **
Dana Murphy	Cameron Park Estates CSD **
Jeff Michael *	Lake Valley FD **
John Pang *	Meeks Bay FD **
John Poell	Lake Valley FD **
Cynthia lewis	Showcase CSD **
Hank White	Georgetown PUD **

Tom Keating *	Rescue FD **
Bob Hollis	Rolling Hills CSD **
Bob Hovland	Grizzly Flats CSD **
Prestin Skinner	EDC Mental Health **
Carol velasquez	Marshall Hospital **
Dave Boucke	Consumnes River CSD **
Chris Weston *	EDC Public Health **
Tammy Stoelting	Marble mountain CSD **
Chrystie Davis	Golden West CSD **
Edwin White	Golden West CSD **
Norman Allen	Rising Hill road CSD **
Jose Crummett *	EDC GIS
Dave Johnston *	EDC Environmental Management
Ross Johnson	S. Tahoe PUD

DESCRIPTION OF THE PLANNING PROCESS

El Dorado County OES utilized the process recommended by the California Emergency Management Agency (Cal EMA) to develop this Hazard Mitigation Plan. Participants were asked to consider Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLEE) criterion as they identified hazards, vulnerabilities, and mitigation strategies. A LHMP Planning Team was also established to research past disaster events that have occurred in or near the county, research new technologies that have been developed to address mitigation, analyze the information gathered and assemble that information into this plan. Following a thorough hazard, risk and vulnerability analysis by all who have participated in this effort, mitigation strategies were then developed to eliminate, and/or mitigate the dangers that exist to life and property. When participants (Community members, first responders, Disaster Council, LHMP Planning Team) were asked to identify and rate in priority the hazards they had identified, there was a very clear consensus that wildfire was number one (1), with flooding number two (2), threats from avalanche and rock slides being number three (3), and acts of terrorism number four (4). The prioritization of mitigation actions followed this list of priorities. There was little interest from those involved in the plan update to address in the Mitigation Action Plan those hazards that have a low frequency of occurrence and low/high level of impact potential. By establishing achievable goals and objectives the various groups involved in the LHMP update planning process can see that their efforts are making a difference and involvement in other mitigation efforts can be achieved. The process included the following steps, listed in 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 El Dorado County that can threaten human life and damage property. It includes historical data of past occurrences, events that have occurred in other similar jurisdictions, and input from public and private agencies, and the community at large.

Step 2, The Community Vulnerability Assessment, was completed through investigative research, community outreach for input, and GIS data, and data received through research studies. It includes tabular and narrative descriptions on community characteristics, such as El Dorado County's geographic, economic and demographic profiles, and discusses future development trends and implications for hazard vulnerability. To graphically depict hazard vulnerability, this section 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 planning and efforts.

Step 3, the *Mitigation Capabilities Assessment,* provides a comprehensive examination of El Dorado County's capacity to implement meaningful mitigation strategies, and identifies existing opportunities for program enhancement. Capabilities addressed in this section 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. Community members were asked to provide insight on mitigation strategies to prevent, and or mitigate the hazards and vulnerabilities they had identified.

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 El Dorado 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, El Dorado 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.

At each of the below listed community meetings, disaster council meetings, LHMP planning team

Meetings

Initial training of key County staff members took place in May 2009, followed by a meeting of County staff to assign principal roles and responsibilities. Additional pre-planning meetings took place between the County OES, Planning, Building, Department of Transportation, El Dorado Irrigation, Environmental Management, local fire protection districts, and City of Placerville staff members on May 4, 2009, where the initial scheduling of events was discussed, resulting in assignments being set:

1. May 21, 2009: Initial meeting of all interested jurisdictions, agencies, special districts, and public. Invitations were mailed to all known forms of "local government" in the County, plus all known interested agencies or parties.

June 25, 2009: Additional meeting of all interested jurisdictions, agencies, special districts, and public. Invitations were mailed to all known forms of "local government" in the County, plus all known interested agencies or parties.

Subject: Presentation made on the need for a local hazard mitigation plan, outline of the requirements necessary to gain approval of such a plan, and an invitation to all local government jurisdictions in the County to participate in a multi-jurisdiction plan. Assignments were made to various agencies for submitting drafts of each type of disaster handled by that agency at the end of July.

2. June, July 2009: Provide press releases to local newspapers requesting public input on the Hazard Mitigation Plan. Also, set up a web site on the Sheriff Departments, Office of Emergency Services home page, describing the process and provided an e-mail address, and phone number for the public to give input.

3. June 18-21, 2009: A flyer was passed out from two separate information booths to El Dorado County Fair attendees requesting public input on the Hazard Mitigation Plan.

   Subject: Requesting public input on impact of local hazards such as wildfires, winter storms, earthquakes, dam failures, land slides, droughts, Seiche Waves, and terrorism events, listing concerns, and measures that should be taken to prevent or lessen the effect.

4. July 7, 8, 9, 2009: Public and open meetings for all participating jurisdictions as well as interested parties. Meeting occurred in Placerville, El Dorado Hills, and South Lake Tahoe.

   Subject: Presentation made on the need for a local hazard mitigation plan, outline of the requirements necessary to gain approval of such a plan, and an invitation to all local government jurisdictions, and public in the County to participate in a multi-jurisdiction plan.

5. A professionally created video of the General Public and open meetings was created and made available to the public via the El Dorado County Sheriff's Office of Emergency Services website. The public was encouraged to view and submit their input via email.

6. El Dorado County Board of Supervisors adopted the Multi-Jurisdictional Hazard Mitigation Plan on 12/9/09.

II. Hazard Identification and Analysis

The United States and its communities are vulnerable to a wide array of natural and man-made hazards that threaten life, property and continuation of governmental services. 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 El Dorado County. This Section 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 El Dorado County's infrastructure. 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 section also provides maps that illustrate the location and spatial extent for those hazards within El Dorado 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 section provides a treatment for all of the typical natural and man-made 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 El Dorado County, and has the potential to affect the County's infrastructure, 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**
- **Seiche Wave**
- **Earthquakes, Sinkholes and Landslides**
- **Winter Storms**
- **Volcano**
- **Drought/Extreme Heat**
- **Erosion**
- **Severe Thunderstorms and Tornadoes**
- **Avalanche**
- **Terrorism**

Wildfire

Any fire occurring in vegetation areas regardless of ignition sources. A wildfire responds to the weather, topography, and fuels in its environment. Under extreme burning conditions, the behavior of a wildfire can be so powerful and unpredictable that fire protection agencies can only wait until conditions moderate before suppression actions can be taken. Since the fire itself, weather and topography can not be mitigated that leaves us with the fuel to mitigate. Wildland fire fuel can be anything from the forest, to residential structures and fortunately they can be modified to mitigate the wildland fire hazard.

Wildfire is our greatest concern as these disaster events have impacted our county on numerous occasions, and as recently as 2007 with the Angora fire in South Lake Tahoe. The Angora fire burned 3,400 acres of forest, and destroyed 254 homes before it was contained. Our wildland fire threat is so severe we devoted an entire section of this plan to that one specific hazard.
See section titled "Wildland Fire Hazard Mitigation Plan" submitted by the El Dorado County Fire Safe Council and AEU CAL FIRE for a comprehensive discussion of this hazard.

Floods

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

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 groundcover to absorb and retain surface water runoff.

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.

The flood loss information provided below can only be considered approximate.

In the table below, the data are for water years, starting in October and ending in September. The quality of the older data is subject to some question. The more recent data are generally more reliable, but while the damage amounts for individual years are not precise, they provide reasonable indications of relative changes over time.

The damage figures in the second column are in thousands of dollars. The second column provides "unadjusted" damage amounts. That is, the damage as reported in the year it occurred, not adjusted for inflation. The third column is a Construction Cost Index, used to adjust for inflation. The next column to the right is the adjustment factor applied to the unadjusted estimates to get the column damages estimates "adjusted" to 2007 dollars. The Construction Cost Index is obtained from McGraw Hill Construction; Engineering News-Record

Table 11-1. National Flood Damage by Fiscal Year (October-September

Year	Unadjusted Damages (thousands)	CCI Index	Adjustment Factor	Adjusted Damages (Billion)
1979	$3,500,000	3003	2.65	$9.275

1980	$1,500,000	3237	2.46	$3.690
1981	$1,000,000	3535	2.25	$2.250
1982	$2,500,000	3825	2.08	$5.200
1983	$4,000,000	4066	1.96	$7.840
1984	$3,750,000	4148	1.92	$7.200
1985	$500,000	4182	1.90	$0.950
1986	$6,000,000	4295	1.85	$11.100
1987	$1,444,199	4406	1.81	$2.614
1988	$225,298	4519	1.76	$0.397
1989	$1,080,814	4615	1.73	$1.870
1990	$1,636,431	4732	1.68	$2.749
1991	$1,698,781	4835	1.65	$2.803
1992	$762,762	4985	1.60	$1.220
1993	$16,370,010	5210	1.53	$25.046
1994	$1,120,309	5408	1.47	$1.647
1995	$5,110,829	5471	1.46	$7.462
1996	$6,121,884	5620	1.42	$8.693
1997	$8,730,407	5826	1.37	$11.961
1998	$2,496,960	5920	1.35	$3.371
1999	$5,455,263	6059	1.31	$7.146
2000	$1,338,735	6221	1.28	$1.714
2001	$7,309,308	6334	1.26	$9.210
2002	$1,211,339	6538	1.22	$1.478
2003	$2,482,230	6695	1.19	$2.954
2004	$13,970,646	7115	1.12	$15.647
2005	$42,010,435 see note below	7446	1.07	$44.951
2006	3,744,636	7751	1.03	$3.857
2007	2,609,160	7966	1.00	$2.609

IMPORTANT NOTE CONCERNING WY2005 DAMAGE ESTIMATES AND HURRICANES KATRINA AND RITA:

The devastation and loss of life associated with Hurricanes Katrina and Rita are extensive and hard to quantify. Determining the total damage caused by these storms, let alone allocating the portion due to flooding is extremely difficult. The following discussion is intended to provide the process involved in creating this best available estimate of flood damages caused by these storms.

Estimates of losses caused by Katrina range from 100 billion to 150 billion, as compiled by the National Climatic Data Center (http://www.ncdc.noaa.gov/oa/reports/tech-report-200501z.pdf).

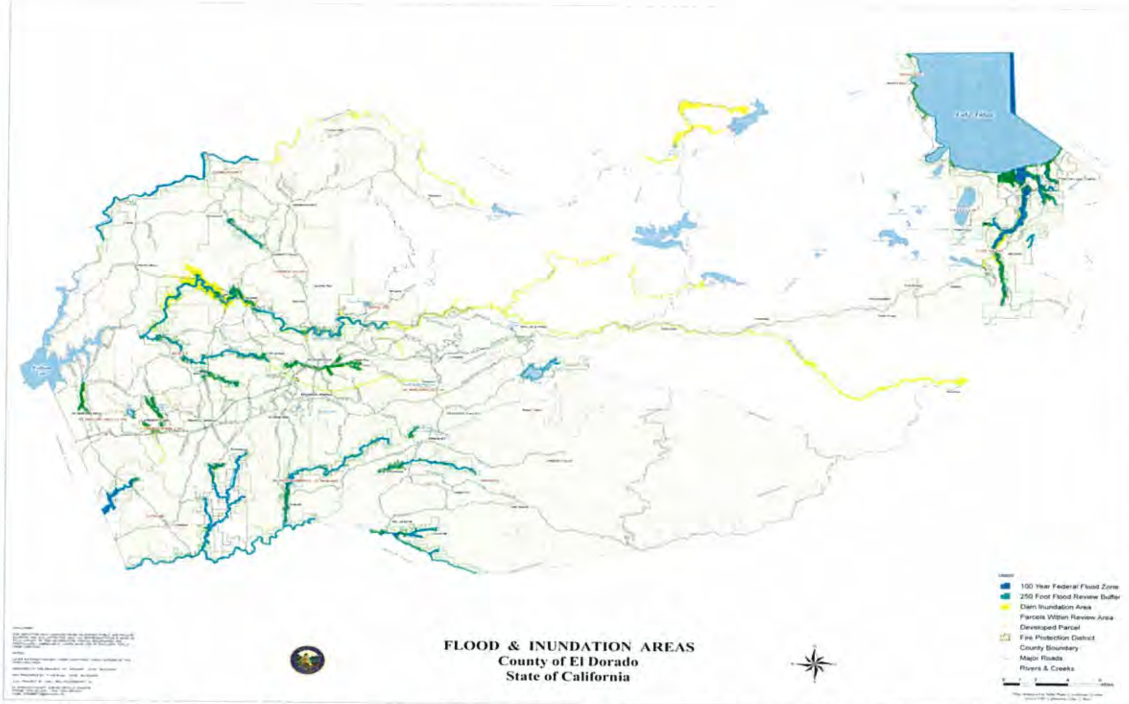
The National Hurricane Center has a lower estimate (http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf). Additionally, Dr. Roger Pielke, Jr., who has done significant research concerning the determination of flooding related losses has an assessment of the damages between 100 and 150 billion (http://sciencepolicy.colorado.edu/prometheus/archives/disasters/000563part_ii_historical.html).

Source: National Weather Service
http://www.weather.gov/oh/hic/flood_stats/Flood_loss_time_series.shtml

Flood Hazard in El Dorado County

El Dorado County's flood potential is strongly affected by the physical geography of the County. Located on the western slope of the Sierra Nevada Mountain Range and in an area of moderate seasonal rainfall, the runoff characteristics of the watersheds strongly determine the possibility of flooding. The western areas of the county are made up mostly of rolling foothills. The eastern areas of the County are at higher elevations. The City of Placerville, the County Seat, is at about 2,000 feet above sea level, while the City of South Lake Tahoe is at about 6,500 feet elevation. Some mountain peaks in El Dorado County reach in excess of 10,000 feet. The elevation range for the County is 200 to 10,881 feet above sea level. Due to the elevation of much of the watersheds of El Dorado 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 the County is owned or controlled by Federal agencies, and therefore not subject to private ownership or development. The seven watersheds that form El Dorado County are Lake Tahoe, the upper Carson River, lower American River, North & South Forks of the American River, the upper Mokelumne River and the upper Cosumnes River. Most 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, where very little floodplain has been formed. The Federal

Emergency Management Agency (FEMA) has published Flood Information Rate Maps (FIRM), which are available to local jurisdictions to indicate where modeling has shown the 100-year floodplains to be. The following graphic, Figure 11-2 indicates where the 100-year floodplains exist in El Dorado County.



Flood & Inundation Areas County of El Dorado, Revised 06-25-09 GIS project #5136

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.

In the past five years, since the previous publication of the Hazardous Mitigation Plan, specific areas in El Dorado County have been identified and/or experienced infrastructure damage including public, commercial, and residential buildings, roadways, utility delivery systems, and other infrastructure damage and associated costs due to flooding and severe winter storms. These areas include:

2005 - Approximate dollar value loss $100,000.

City of South Lake Tahoe
South Lake Tahoe Basin
Myers
Mosquito
El Dorado

Coloma

2006 - Approximate dollar value loss 1.5 million dollars

City of South Lake Tahoe
City of Placerville
Meeks Bay
El Dorado
Deer Creek
Latrobe
Georgetown
Cameron Park
Nashville
Mount Aukum
Sly Park (EID Campground)
Rancho Ponderosa
Camino Heights
Pollock Pines
Cool
Garden Valley
El Dorado Irrigation facilities and distribution systems

2007 - No flood/winter storm damage reported.

2008 - Approximate dollar value loss $525,000.

City of South Lake Tahoe
City of Placerville
South Lake Tahoe Basin
Myers
Camino
Garden Valley
Pollock Pines
Grizzly Flat
Omo Ranch
Cameron Park
Georgetown

*In addition to dollar value loss, there was loss of human life of a utility worker while engaged in restoring power to the Georgetown area as a direct result of winter storm damage in 2008.

2009 - As of the date of preparation of this update document (7/01/09), there has been no reported damage caused by Flooding and/or Winter Storms for the 2009 year.

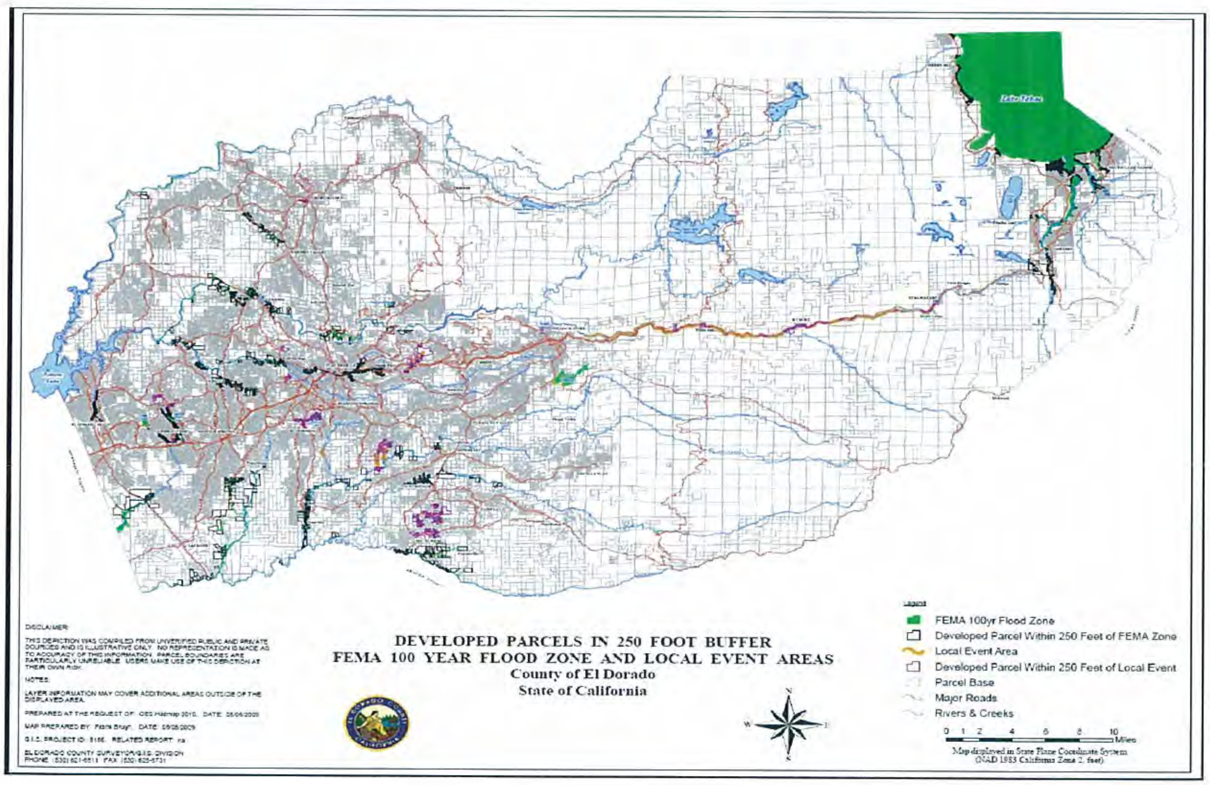
<u>Repetitive Losses-</u> The following properties experienced repetitive losses due to flooding during the listed years.

3361-3363 La Canada, Cameron Park, Ca	1995 / 1997	$8,398.25
5733 Stream wy, Somerset, Ca.	1996 / 2005	$204,472.17

The current FEMA Flood Areas Map of El Dorado County (2009) has been compared to data documented from prior flooding events in order to assess potential property damage. These additional areas, which are not currently on the FEMA Flood Areas Map, have been noted on the El Dorado County GIS map Project # 5186 map titled, "Developed Parcels In 250 Foot Buffer FEMA 100 Year Flood Zone And Local Event Areas". This data was used in conjunction with the FEMA Flood Area Map to identify El Dorado County's flood vulnerability and risk assessment. As part of El Dorado County's zoning requirements, a 250 foot buffer zone is used to assemble potential flood zones. All of the developed parcels and critical infrastructure that could be impacted by these flood zones have been identified utilizing Assessor records for value of property and experts on potential critical infrastructure. It is estimated El Dorado County's total dollar loss would be approximately $1.7 billion for these identified areas.

El Dorado County does participate in the National Flood Insurance Program and a certificate is currently on file within El Dorado County Planning Department.

The following graphic, Figure 11-2A (Developed Parcels In 250 Foot Buffer FEMA 100 Year Flood Zone & Local Event Areas, County of El Dorado, State of California, 8-06-09, GIS project #5186, El Dorado County Surveyor /G.I.S.) identifies the updated areas.



Dam/Levee Failure

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.

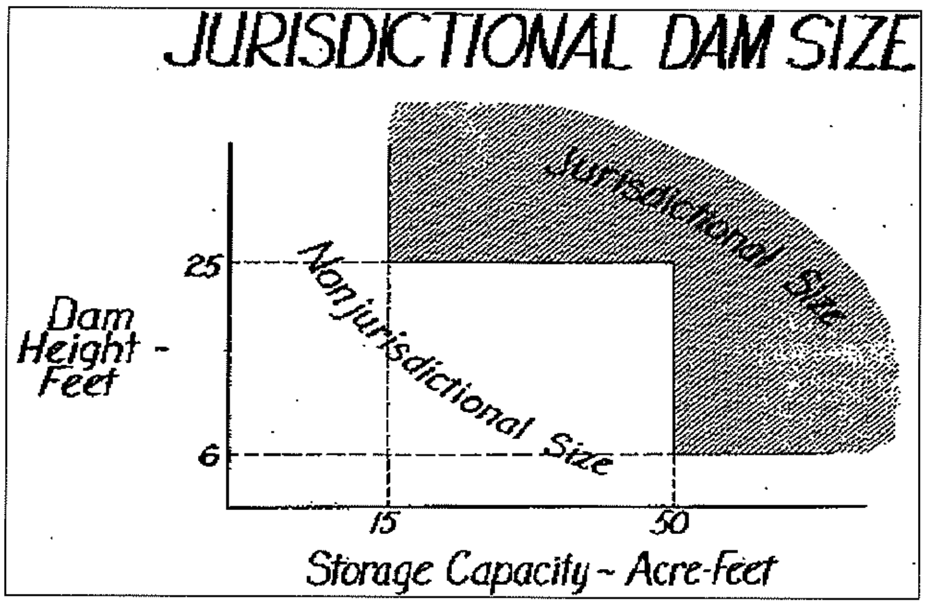
Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream 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.

Dam/Levee Failure Hazard in El Dorado County

El Dorado County has a significant number of large and small dam structures with impoundments, and one privately owned levee. Therefore, only the potential for dam failure will be considered further.

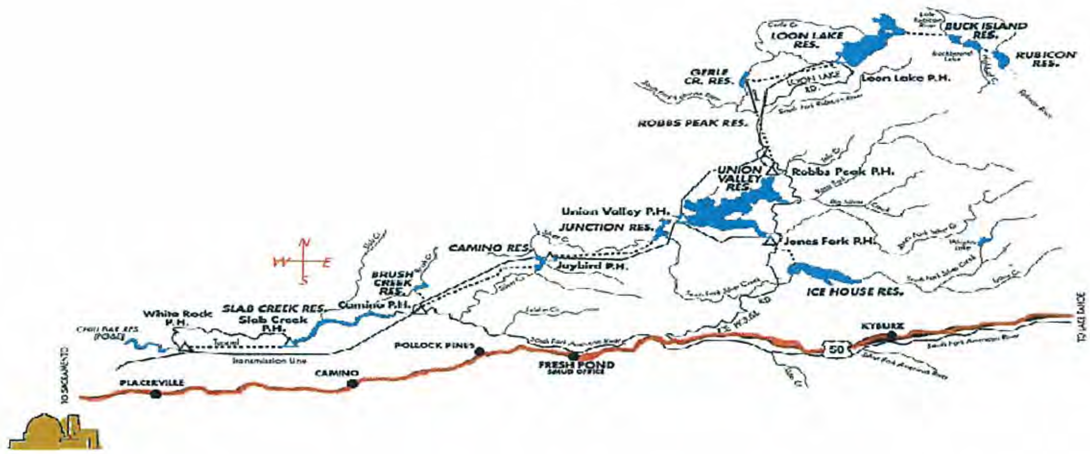
There is an historical record since the Gold Rush days of the mid 19th Century of the construction and use of dams as water reservoirs. During the Gold Rush, the water was used primary to wash placer gold deposits from the stream sediments, particularly during the summer months in the lower elevations when surface water was 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 11-3 shows the jurisdictional size:

Figure 11-3. Chart Indicating Jurisdictional Dam Size



There are 59 known dams in El Dorado 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 11-4 shows the distribution of all of the larger impoundments found in El Dorado County and many of the smaller dams as well.

Figure 11-4 Location of: Larger Impoundments in El Dorado County



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

Flood/Dam Failure and Inundation Hazard in El Dorado County

Flood hazards that may occur in El Dorado County include flooding caused by precipitation, dam failure, and seismic activities. Flooding hazards associated with the increase in development are discussed in this subsection. A flood has many implications for public safety. Hazards and damage caused by flooding includes loss of life, displacement or complete destruction of buildings, siltation, temporary loss of utilities, road and bridge damage resulting in transportation slowdowns, loss of goods and services, and the threat of waterborne diseases. Additionally, significant private and public costs are associated with flooding, particularly in urban areas.

In this subsection, the proposed policies and existing regulations are assessed for their effect on reducing impacts related to flooding and Seiches. The land use map for the General Plan were evaluated for the maximum land use density allowed within the 100-year floodplain and dam inundation areas, and the resulting potential for flood hazards area assessed in consideration with the General Plan policies and existing laws, regulations, and programs. The existing conditions, including existing laws, regulations, and programs, are discussed below.

Physical Environment

Flooding

Flood hazards can result from intense rain, snowmelt, cloudbursts, or a combination of the three, or from failure of a water impoundment structure, such as a dam. Floods from rainstorms generally occur between November and April and are characterized by high peak flows of moderate duration. Snowmelt floods combined with rain have larger volumes and last longer than rain flooding.

Flood-Prone Areas

Because of a lack of extensive low-lying areas and a great deal of upland areas, the majority of El Dorado County is not subject to flooding. The primary flood-prone areas on the west slope of the County are the following: South Fork, American River from Kyburz to Riverton and below Chili Bar Dam; Coloma Canyon Creek between Greenwood and Garden Valley; Weber Creek from Placerville to the American River, including Cold Springs, Dry; Creek, and Spring Creek tributaries; Shingle Creek from Shingle Springs to the Amador County line; Deer Creek from Cameron Park to Sacramento County line; Big Canyon Creek from El Dorado to the Cosumnes River, including the Slate, Little; Indian, and French Creek tributaries; New York Creek; Middle Fork of the Cosumnes River within the Somerset-Fairplay vicinity, and its confluence with the North Fork of the Cosumnes River; Cedar Creek from Omo Ranch to the Cosumnes River (FEMA 1996; Maurer, pers. comm., 2003)

Flood Control

Historically, the emphasis for flood management in California has been to control the flow of water. These types of flood control projects have included the construction of reservoirs in upstream areas to retain and gradually release water, the construction of levees to confine water to the channel or designated area, the improvement of channels to increase their water carrying capacity, and the establishment of bypasses or diversions.

There are no dams dedicated to flood control on the west slope or in the Lake Tahoe Basin. All existing reservoirs in El Dorado County are operated for power generation or water storage, not flood control purposes. There is only one known levee in El Dorado County (in El Dorado Hills near Carson Creek). However, this levee is privately owned and it is unknown whether this levee is certified for flood control purposes.

Dam Failure

A dam failure can occur as the result of an earthquake, as an isolated incident because of structural instability, or during heavy runoff that exceeds spillway design capacity. According to the California Department of Water Resources (DWR), El Dorado County does not have a history of major dam failure. Nine dams located within the County have been identified as having the potential of inundating habitable portions of the County in the unlikely event of dam failure. These nine dams are Echo Lake Dam (El Dorado Irrigation District [EID]), Union Valley Dam (Sacramento Municipal Utility District [SMUD]), Ice House Dam (SMUD), Chili Bar Reservoir (Pacific Gas and Electric Company [PG&E]), Stumpy Meadows Dam (Georgetown Divide Public Utility District [GDPUD]), Weber Creek Dam (EID), Slab Creek Dam (SMUD), Loon Lake Auxiliary Dam (SMUD), and Blakely Dam (EID).

In addition to these nine dams, the Caples Lake Dam (EID) and the Cameron Park Lake/Warren Hollister Dam (EID) have been identified by the County as having considerable potential to inundate inhabited areas in the unlikely event of dam failure. The maps showing the locations and inundation areas of these dams can be found at the County Office of Emergency Services.

Regulatory/Planning Environment

Federal Regulations

National Flood Insurance Act (1968)

The National Flood Insurance Act established the National Flood Insurance Program (NFIP), a Federal program administered by FEMA. The NFIP enables property owners in participating communities to purchase insurance as protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the Federal Government.

National Dam Safety Program Act (1972)

The National Dam Safety Program was established in 1972 and is administered by FEMA. The primary purpose of the program is to provide financial assistance to the states for strengthening their dam safety programs.

Dam Safety and Security Act (2002)

The Dam Safety and Security Act was enacted to assist states in improving their dam safety programs, to support increased technical training for state dam safety engineers and technicians, to provide funding for dam safety research, and to maintain the National Inventory of Dams (ASDSO 2003).

State Regulation

Dam Safety Act

The Dam Safety Act was passed to establish procedures for emergency evacuation and control of populated areas below dams. The Dam Safety Act provides for the development of inundation maps by dam owners, map approval by OES, and development of emergency procedures by local governments to evacuate and control the risk areas. Emergency regulations to implement the Dam Safety Act became effective on April 2, 2002. These regulations require owners of state jurisdictional dams to file inundation maps and studies, and they include provisions for noncompliance that may include referral of the matter to the office of the Attorney General (EDCOES 2002).

County Ordinance and Plan

Flood Damage Prevention Ordinance (1986)

The County has enacted a floodplain ordinance that is compatible with FEMA guidelines in order to regulate development within the 100-year floodplain. This ordinance is applied in conjunction with the County's Zoning Ordinance. Under the Flood Damage Prevention Ordinance, development within the 100-year floodplain may occur; however, certain engineering and zoning standards apply in order to reduce injury and loss of life, to reduce structural damage caused by flooding, and to reduce public expenditures for additional flood control structures. Development within the floodway is also prevented unless no increase in flood elevation would result from the development.

Multi-Hazard Functional Emergency Operations Plan (1993)

The County's Emergency Operations Plan contains dam failure plans for those dams that qualify for mapping. The individual dam facility plans located at the County Department of Emergency Services include a description of the dams, direction of flood waters, responsibilities and actions of individual jurisdictions, and evacuation plans. The Emergency Operations Plan also contains response plans for floods resulting from periods of high rainfall or rapid snowmelt, which can cause flooding in the 100-year floodplain.

Agencies and Organizations

Federal Agencies

Federal Emergency Management Agency

As discussed above, FEMA administers the NFIP. FEMA also prepares the Flood Insurance Rate Maps (FIRMs).

Floodplain Designation and Mapping

The boundary of the 100-year floodplain is the basic planning criterion used to demarcate unacceptable public safety hazards. The 100-year floodplain boundary defines the geographic area having a 1% chance of being flooded in any given year. All streams are subject to areas within the 100-year flow and therefore, have a 100-year floodplain. However, many minor and intermittent streams do not have current FIRMs. Outside these boundaries, the degree of flooding risk is not considered sufficient to justify the imposition of floodplain management regulations. Some level of regulation is desired to protect public health, safety, and welfare within the 100-year floodplain.

The 100-year floodplain is divided into a floodway and floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that should be kept free of development so that the 100-year flood can pass through without an obstruction that would result in substantial increase in flood heights. Development within the floodway reduces the channel's floodwater carrying capacity, increases flood heights, and increases flood hazards beyond the border of the floodway. As a minimum standard, FEMA limits any increase in flood heights within the floodway to 1.0 foot or less provided that hazardous water velocities do not result from the increase in flood height.

The area between the floodway and the boundary of the 100-year floodplain is termed the floodway fringe and encompasses the portion of the floodplain that could be used for development without increasing the surface elevation of the 100-year flood more than 1.0 foot at any point.

Different development standards may be formulated for the floodway and the floodway fringe. These standards have two functions. First, they are designed to minimize loss of life and property damage by controlling the types of land uses permitted and by prescribing certain construction methods. Second, they are intended to preserve the ability of the floodway to discharge the 100-year flood. Failure of floodplain regulations to recognize this latter function by prohibiting encroachment of the floodway would result in an increase in the geographic area of the 100-year floodplain.

National Flood Insurance Program

El Dorado County is a participant in the NFIP, and, as required, the County has implemented an ordinance for 100-year flood protection. The U.S. Army Corps of Engineers (USACE), under contract to FEMA, prepared a flood insurance study report and a series of FIRMs that depict the location of the calculated 100-year flood, flood elevations, floodways, 500-year flood boundaries, and flood insurance rate zones. The most current land use information available at the time of the FIRM preparation, such as land use designation, are typically used to determine the maximum development density potential, which is used to estimate the peak flow and model the flood elevation.

The latest FIRM for El Dorado County was completed in 1995. The County participates in the NFIP by reviewing specific development proposals to ensure that structures that may be in a 100-year floodplain are protected from flood damages and that any changes in the floodplain do not cause unacceptable increases in the elevation of the 100-year water surface.

U.S. Army Corps of Engineers

The USACE assists FEMA in providing emergency response for floods. The USACE also inspects and inventories dams throughout the United States in its National Inventory of Dams.

National Inventory of Dams

The National Inventory of Dams currently includes information on approximately 77,000 dams throughout the United States that fit the following criteria: High Hazard Potential class dam; Medium[1] Hazard Potential class dam; Low Hazard Potential class dam that exceeds 25 feet in height and 15 acre-feet of storage; and Low Hazard Potential class dam that exceeds 50 acre-feet of storage and 6 feet in height.

Currently there are 59 dams in El Dorado County that are listed in the National Inventory of Dams. Of these, nine dams in the County are classified as High Hazard Potential and 35 dams are classified Medium Hazard Potential. This does not suggest dams will fail; only that if they do they could result in inundation hazards. In addition, one dam in Amador County classified as a High Hazard Potential class dam may inundate inhabitants in El Dorado County in the unlikely event of a dam failure.

State Agency

California Department of Water Resources Division of Dam Safety

The principal goal of the DWR Division of Dam Safety is to avoid dam failure and thus prevent loss of life and destruction of property. Finnon Dam has been identified by the Division of Dam Safety as potentially susceptible to damage from a seismic event because of its hydraulic fill construction method. After the San Fernando Earthquake of 1971, all dams of this construction type were flagged for review and inspection.

Regional Agencies

American River Authority

The American River Authority was established through a Joint Powers Agreement, made and entered into on June 8, 1982, between the County, Placer County, the El Dorado County Water Agency (EDCWA), and Placer County Water Agency. A Board of Directors conducts the business of the American River Authority. The purpose of the American River Authority Joint Powers Agreement is to study all water development project opportunities on the American River between Placer County Water Agency's Middle Fork American River Project and Folsom Lake. Collectively, the efforts described above comprise what is referred to as the American River Project.

Local Organizations and Agency

El Dorado County Sheriff Office of Emergency Services

The County's Office of Emergency Services, which is managed by the County Sheriff's Office, collaborates with the County's fire districts, emergency medical services agency, hospitals, schools, and public and private agencies to prepare, update, and implement the County's Emergency Operations Plan, which includes emergency response plans for flood and dam failure events. The County Office of Emergency Services also maintains emergency plans for dams that are prepared by utility companies.

El Dorado County Department of Transportation

As a part of the County Department of Transportation's ongoing program to develop a Capital Improvement Program (CIP) for drainage infrastructure, FEMA mapping has been updated for four specific drainages in the County: Deer Creek in Cameron Park, New York Creek in El Dorado Hills, Carson Creek in the El Dorado Hills Business Park, and the El Dorado Townsite. These drainage studies help to identify potential flood-prone areas and may be used to refine FEMA maps during subsequent FIRM updates.

South Fork of the American River Watershed Group

The mission of the South Fork of the American River Watershed Group is to protect and improve the health and condition of the South Fork of the American River watershed through stewardship and education to a measurable extent. With assistance from the County and Georgetown Divide Resource Conservation District, the group will coordinate with federal, state, and local government agencies, neighboring watershed groups, local community organizations, and private individuals to develop a Watershed Management Plan and

Stewardship Strategy for the watershed (SFARWG 2002).

Cosumnes River Task Force

The primary purpose of the Cosumnes River Task Force is to develop a Coordinated Resource Management Plan that stakeholders can use as a guide to identify resource concerns, plan and implement improvements, and collaborate on common goals to improve watershed health and flood management (CRTF 2002).

STORMWATER SYSTEMS

Physical Environment

Drainage Basins

The west slope of El Dorado County contains three major watersheds, each of which drains into one of these major rivers: the Middle Fork American River, the South Fork American River, and the Cosumnes River. These watersheds are further divided into smaller drainage basins that feed the tributaries of these three major rivers. Developed drainage infrastructure exists in many of the drainage basins, particularly in the following nine drainage basins (Spiegelberg, pers. comm., 2003): Coloma Canyon between Greenwood and Garden Valley (7.5 square miles); Finnon Reservoir drainage (4 square miles); Weber Creek from the Pollock Pines area to the American River, including the Cold Springs, Dry Creek, and Spring Creek tributaries (40 square miles); Deer Creek from Cameron Park to the Sacramento County line (72 square miles); Big Canyon Creek from El Dorado to the Cosumnes River, including the Slate, Little Indian, and French Creek tributaries (36 square miles); Middle Fork of the Cosumnes River within the Somerset/Fairplay vicinity (23 square miles); Cedar Creek from Omo Ranch to the Cosumnes River (37 square miles); Jenkinson Reservoir drainage (18 square miles); New York Creek (2.6 square miles); and Allegheny Creek (1.9 square miles).

Stormwater Hazards

Flooding is the primary hazard related to stormwater runoff. Urban development generally increases the amount of impervious surfaces. When rainfall or snowmelt exceeds the ground infiltration rate (i.e., the ability of the ground to absorb water), stormwater runs off and collects in drainage facilities, which may be in the form of roadways, storm drains, and natural creeks and rivers. The net effects of additional impervious surfaces are increases in the flow rate and volume of water in the drainage channels during and after a storm event. When the volume of water exceeds the capacity of the drainage channel to convey it, flooding can result. Hazards associated with localized flooding include the overtopping of roadways, inundation of areas near the drainage channels, and structural damage. Stormwater runoff may also contribute to regional flooding.

Other problems connected with increased stormwater runoff include erosion, sedimentation, and degradation of water quality. Stormwater can become polluted by eroded soil, pesticides, paint, fertilizers, animal waste, litter, oil and other automotive fluids, and household chemicals. Increased stormwater runoff can increase erosion and facilitate the movement of pollutants and soils into bodies of water. Increased sedimentation may be a detriment to aquatic wildlife habitats, and the use of downstream water bodies for beneficial uses (e.g., recreation, irrigation, water consumption) may be impaired (EMD 2002a).

Regulatory/Planning Environment

Federal Programs

National Flood Insurance Program

El Dorado County participates in the National Flood Insurance Program (NFIP), a federal program administered by the Federal Emergency Management Agency (FEMA). Under the NFIP, the County is required to regulate for 100-year flood protection. A 100-year flood is considered a severe flood with a reasonable possibility of occurrence for purposes of land use planning, property protection, and human safety. The U.S. Army Corps of Engineers (USACE), under contract to FEMA, prepared a flood insurance study report and a series of Flood Insurance Rate Maps (FIRMs) for numerous county waterways. The study and maps depict the location of calculated 100-year flood zones, flood elevations, floodways, 500-year flood boundaries, and flood insurance rate zones. The County participates in the NFIP by reviewing specific development proposals to ensure that structures that may be in a 100-year floodplain are protected from flood damage and that any changes in the floodplain do not cause unacceptable increases in the elevation of the 100-year water surface (HDR Engineering 1995).

National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) permit program was established by the Clean Water Act of 1972 to regulate municipal and industrial discharges to surface waters of the United States. The discharge of wastewater to surface waters is prohibited unless an NPDES permit allowing that discharge has been issued. The NPDES permit program is overseen by the U.S. Environmental Protection Agency's (EPA's) stormwater program; the State of California is authorized to administer the NPDES program within California. Starting in 1990, Phase I of EPA's stormwater program required NPDES permits for stormwater runoff from all of the following (EPA 2002): "medium" and "large" municipal separate storm sewer systems (MS4s) generally serving populations of 100,000 or greater and denoted by EPA as MS4s; construction activity disturbing 5 acres of land or greater, and ten categories of industrial activity.

Phase II of the NPDES permit program was the next step in EPA's effort to protect water resources from polluted stormwater runoff. The Phase II program expands the Phase I program by requiring smaller operators of MS4s in urbanized areas and operators of small construction sites, through the use of NPDES permits, to implement programs and practices to control polluted stormwater runoff (EPA 2002). The County submitted an application for the NPDES Phase II permit and participated in the voluntary project which resulted in a Draft report of "Voluntary Domestic Well Assessment Project".
(http://www.waterboards.ca.gov/gama/docs/edc_draft120905version.pdf)

State Regulations

Subdivision Map Act (1907)

One of the powers granted to local jurisdictions by the Subdivision Map Act is the authority to impose drainage improvements or drainage fees and assessments. Specifically, local jurisdictions may require the provision of drainage facilities, proper grading and erosion control, dedication of land for drainage easements, or payment of fees needed for construction of drainage improvements. The types and applicable standards of the improvements may be specified in the local ordinance.

El Dorado County Regulation and Programs

County Grading, Erosion, and Sediment Control Ordinance

The County Grading, Erosion, and Sediment Control Ordinance (Grading Ordinance) (Chapter 15.14 of the County Code) establishes provisions for public safety and environmental protection associated with grading activities on private property. Section 15.14.090 of the Grading Ordinance, which has incorporated the recommended standards for drainage Best Management Practices (BMPs) from the High Sierra Resource Conservation and Development Council BMP guidelines handbook, prohibits grading activities that would cause flooding where it would not otherwise occur or would aggravate existing flooding conditions. The Grading Ordinance also requires all drainage facilities, aside from those in subdivisions that are regulated by the County's Subdivision Ordinance, be approved by the County Department of Transportation. Pursuant to the ordinance, the design of the drainage facilities in the County must comply with the County of El Dorado Drainage Manual, as described below.

El Dorado County Subdivision Ordinance

The County's Subdivision Ordinance (El Dorado County Code Title 16) requires the submission of drainage plans prior to the approval of tentative maps for proposed subdivision projects. The drainage plans must include an analysis of upstream, onsite, and downstream facilities and pertinent details, and details of any necessary offsite drainage facilities. The tentative map must include data on the location and size of proposed drainage structures. In addition, drainage culverts consistent with the drainage plan may be required in all existing drainage courses, including roads.

El Dorado County Department of Transportation Drainage Program

The County Department of Transportation has an ongoing drainage program with a goal of developing a Capital Improvement Program and funding mechanism for the construction of essential drainage infrastructure and to repair and/or replace inadequate drainage facilities throughout the county. The first phase of the drainage program, development of standard procedures for drainage system designs, was completed with the adoption of the *County of El Dorado Drainage Manual* in 1995.

The second phase of the drainage program involves updating FEMA mapping of four specific drainage basins in the county: Deer Creek in Cameron Park, New York Creek in El Dorado Hills, Carson Creek in the El Dorado Hills Business Park, and the El Dorado Townsite. Three of these basin studies have been completed and are discussed below. These basin studies provide area-specific analysis and identify areas where drainage improvements are required. The third phase of the drainage program is the development of funding mechanisms to address drainage problems in the study areas. With funding mechanisms in place, capital improvement and maintenance programs can be implemented.

The capital improvement program may establish methods of prioritizing existing and future drainage deficiencies and requirements with respect to potential damage, risk, and cost.

County of El Dorado Design and Improvement Standards Manual

The County's Design and Improvement Standards Manual was adopted in 1990 and provides required erosion and sediment control measures that are applicable to subdivisions, roadways, and other types of developments.

County of El Dorado Drainage Manual

The *County of El Dorado Drainage Manual* provides standard procedures for future designs of drainage improvements. The Drainage Manual supercedes the stormwater drainage system design standards in the County's *Design Improvements Standards Manual.* The Drainage Manual requires that a hydrologic and hydraulic analysis be submitted for all proposed drainage facilities. The analysis must include an introduction/background, location map/description, catchment description/delineation, hydrologic analysis, hydraulic and structural analysis, risk assessment/impacts discussion, unusual or special conditions, conclusions, and technical appendices. This analysis is usually required on projects undergoing discretionary review. However, under the Building Code and Grading Ordinance, the County also reviews ministerial development, including required drainage plans, to ensure that appropriate runoff design and controls are in place.

Drainage Basin Studies

Three regional drainage studies have been completed on the west slope. A study of the El Dorado townsite has not been completed.

Carson Creek Regional Drainage Study

The *Final Report of the Carson Creek Regional Drainage Study* (Bottorff 1996) was completed in 1996 for the 15-square-mile Carson Creek watershed, most of which is located in the southwestern portion of El Dorado County. The purpose of this drainage study is to provide a unified plan for stormwater management in the El Dorado County portion of the watershed. The study recognizes the drainage needs of individual projects, assesses the impacts of the proposed drainage improvements on the entire catchment area, and satisfies the requirements of the *County of El Dorado Drainage Manual.*

The Carson Creek Regional Drainage Study uses results from previous drainage studies within the watershed, as well as land use information and drainage improvements included in the previous studies, to develop a regional drainage model. The drainage study was based on the maximum development allowed by the 1996 General Plan, and development projects that were proposed at that time. The study assumes that the portion of the watershed in Sacramento County would remain as open space. The study concluded that runoff for the 100-year storm would result in minor downstream impacts in Sacramento County and that the increase in existing flood inundation areas would be negligible. The study recommended that future drainage improvements be designed and analyzed in context of the regional drainage model. Specific drainage improvements, such as culvert upgrades, channel improvements, and construction of a regional detention storage facility were also recommended. (Bottorff 1996.)

New York Creek Basin Drainage Study

The New York Creek Basin Drainage Study (Ensign & Buckley 1995) analyzes the watershed of New York Creek and its Governor Drive tributary. Assumptions for future land uses within the watershed were based on data from the El Dorado Hills Specific Plan and the El Dorado Hills/Salmon Falls Area Plan. The study concluded that in order to minimize the overtopping of roadways during the 100-year peak flow condition, improvements would be required at eight roadway crossings across New York Creek and the Governor Drive tributary. Even with the construction of these improvements and regular maintenance activities (e.g., channel clearing), flooding and overtopping may occur at roadway crossings. This drainage study also included cost estimates for the recommended improvements.

Cameron Park Drainage Study

The Cameron Park Drainage Study analyzed the flooding potential of a 72-square-mile area in the upper reaches of Deer Creek in order to identify needed drainage channel improvements. The option of using detention to reduce peak flow was not analyzed. The General Plan land use map available during the preparation of the drainage study in 1995 was the source of future land use data in the Cameron Park Drainage Study, the hydrologic and hydraulic analyses of which were based on the full build out of the watershed consistent with the land use designations. The study concluded that 16 roadway crossings at the build out of the 1995 draft General Plan may experience overtopping during a 100-year storm event if culvert or detention improvements were not implemented. The study included recommended culvert improvements while also recommending further studies regarding using detention to reduce the peak flow. This drainage study also included cost estimates for the recommended culvert improvements (Psomas and Associates 1995). In practice, the potential for flooding may be less than identified by the study. The drainage study was based on the draft General Plan in 1995, which was similar to the 1996 General Plan. Discretionary developments in the study area subsequent to the drainage study have constructed detention improvements as required by the County's Drainage Manual (Pesses, pers. comm., 2003). Furthermore, some of the projects in the drainage study area have been built at lower densities than the maximum allowed; thereby decreasing the potential for flooding conditions (Spiegelberg, pers. comm., 2003).

El Dorado County Special Districts

California Government Code §25210 allows for the formation of county service areas in unincorporated areas, providing an alternative method of furnishing extended governmental services and the levy of taxes to pay for the extended services. The County has established Drainage Zones of Benefit, as well as Road and Drainage Zones of Benefit, that are managed by the County's General Services Department for the purpose of generating funding for the construction of community drainage facilities.

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.

Seiche

A **Seiche** (pronounced "saysh") is a standing wave in an enclosed or partially enclosed body of water. Seiches and seiche-related phenomena have been observed on lakes, reservoirs, swimming pools, bays and seas. The key requirement for formation of a seiche is that the body of water be at least partially bounded, allowing the formation of the standing wave. The term was promoted by the Swiss hydrologist François-Alphonse Forel in 1890, who was the first to make scientific observations of the effect in Lake Geneva, Switzerland. The word originates in a Swiss French dialect word that means "to sway back and forth", which had apparently long been used in the region to describe oscillations in alpine lakes. The Great Lakes of North America have seen Sieche wave activity within the past 20 years ranging from one foot to ten feet waves with noted injuries and some deaths. Lakes in seismically active areas, such as Lake Tahoe in California/Nevada, are significantly at risk from seiches. Geological evidence indicates that the shores of Lake Tahoe may have been hit by seiches and tsunamis as much as 10 m (33 feet) high in prehistoric times, and local researchers have called for the risk to be factored into emergency plans for the region.

Risk for a Seiche wave for the area, as well as potential losses due to a Seiche Wave impact, is considered to be low relative to much of California. As indicated by the seismic activity map, Figure 111-12, the region of the state where El Dorado County is located, just east of Lake Tahoe, seldom suffers the effects of even a 2.5 magnitude earthquake. Given the fact that there are not many homes built at the current lake level or on the immediate shores of Lake Tahoe, a Seiche Wave would cause little damage to homes in the Un-incorporated areas of El Dorado County. There would be substantial damage to infrastructure such as county roads and two state highways that run through El Dorado County, Highway 50 and Highway 89.

Given this recognized area vulnerability, the State of California hosted a Functional Exercise involving a Seiche Wave (called Golden Guardian 2008) that impacted the South shore of Lake Tahoe. The exercise evaluated numerous local and state government agencies in response to such an event. The exercise details and detailed After Action report for Golden Guardian 2008 were reviewed and considered in this vulnerability assessment. The After Action report is attached as appendix. (GG08 Tahoe Region AAR_Final_032009.pdf)

Since there has not been a Seiche Wave on record in the Lake Tahoe area, it would be difficult to get an accurate estimate of damages such an event would cause. Some of the damages to infrastructure in this type of event would include repair and/or replace infrastructure such as roadways which would include manpower hours and resources to make the repairs. The size of the Seiche Wave would also dictate the amount of the debris removal cost to the County and/or State would incur.

A small (0.4-foot) wave surge was reported in Lake Tahoe during the 1966 Truckee earthquake, which had a Richter Scale magnitude of between 6.0 and 6.9.

Earthquakes, Sinkholes and Landslides

Earthquake

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 11-5 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 11-6.

Table 11-5. Richter Scale

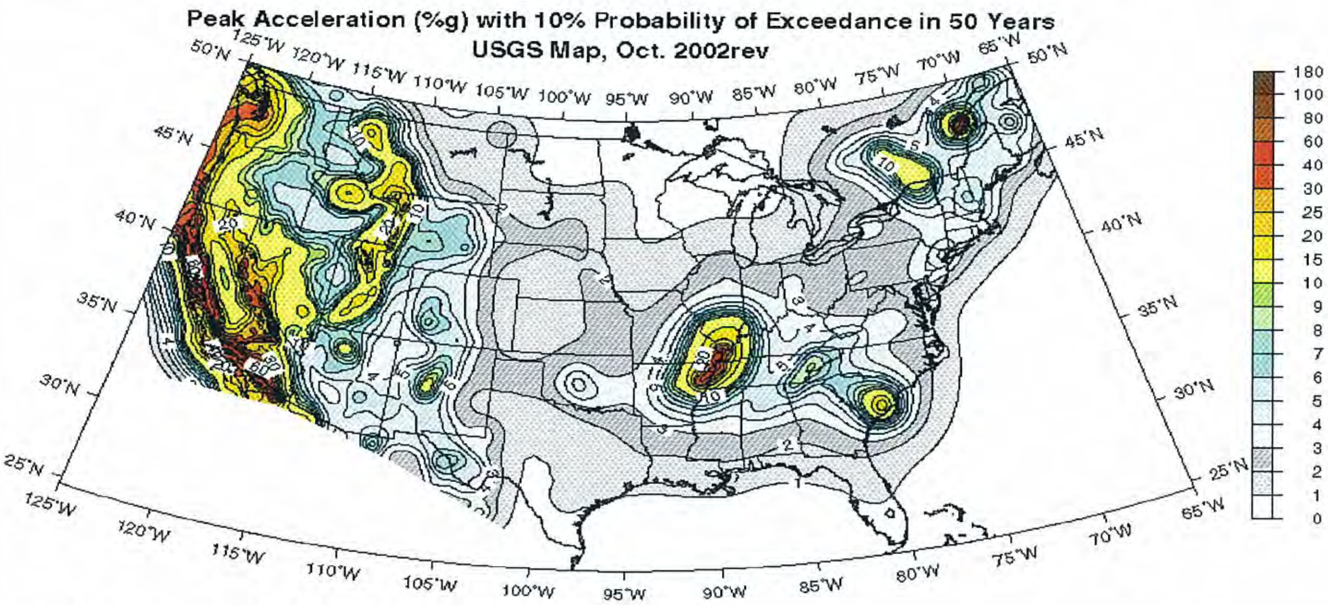
Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas 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 11-6. 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

Figure 11-7 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.

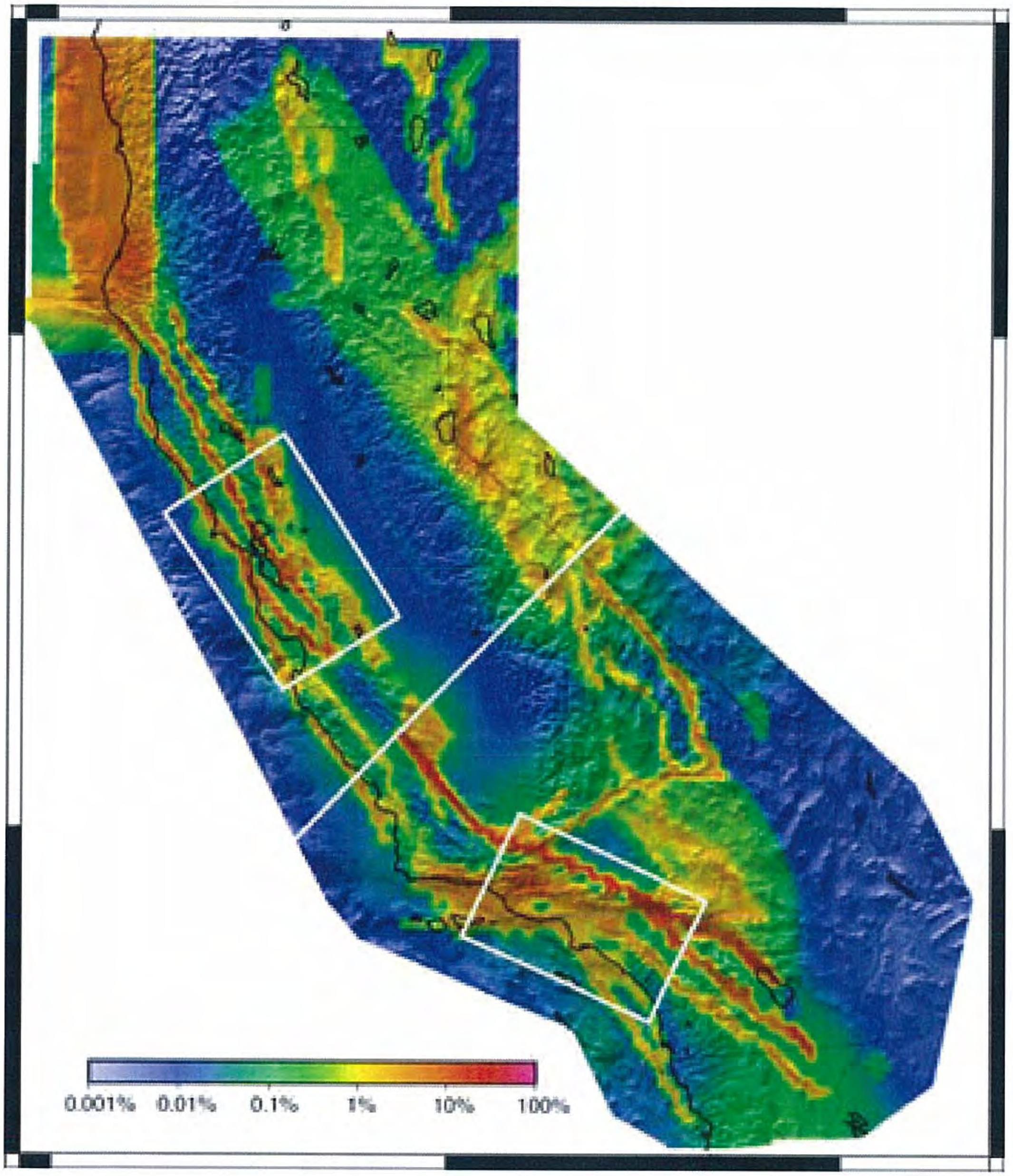
Figure II-7. Peak Acceleration with 10 Percent Probability of Exceedance in 50 Years (Nationwide)



Earthquake Hazard in El Dorado 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 11-8, El Dorado County is one of the lowest risk areas in the State.

Figure 11-8. Level of Earthquake Hazard (California)[1]



The probability of a M>6.7 earthquake in the next 30 years calculated using the UCERF

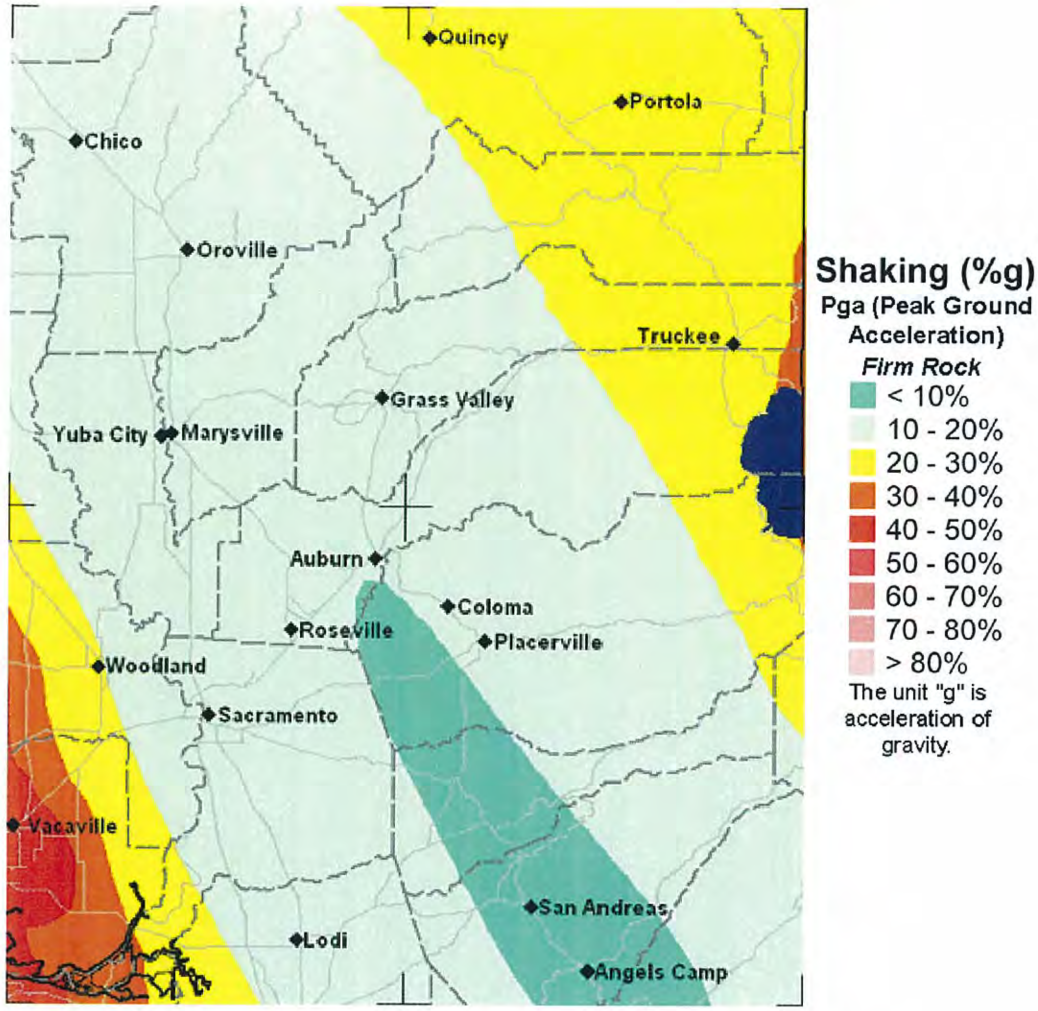


Figure 11-9 Peak Acceleration with 10 Percent Probability of Exceedance in 50 Years (El Dorado County and Vicinity)

The preceding graphic, Figure 11-9, gives a closer look at the El Dorado 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.

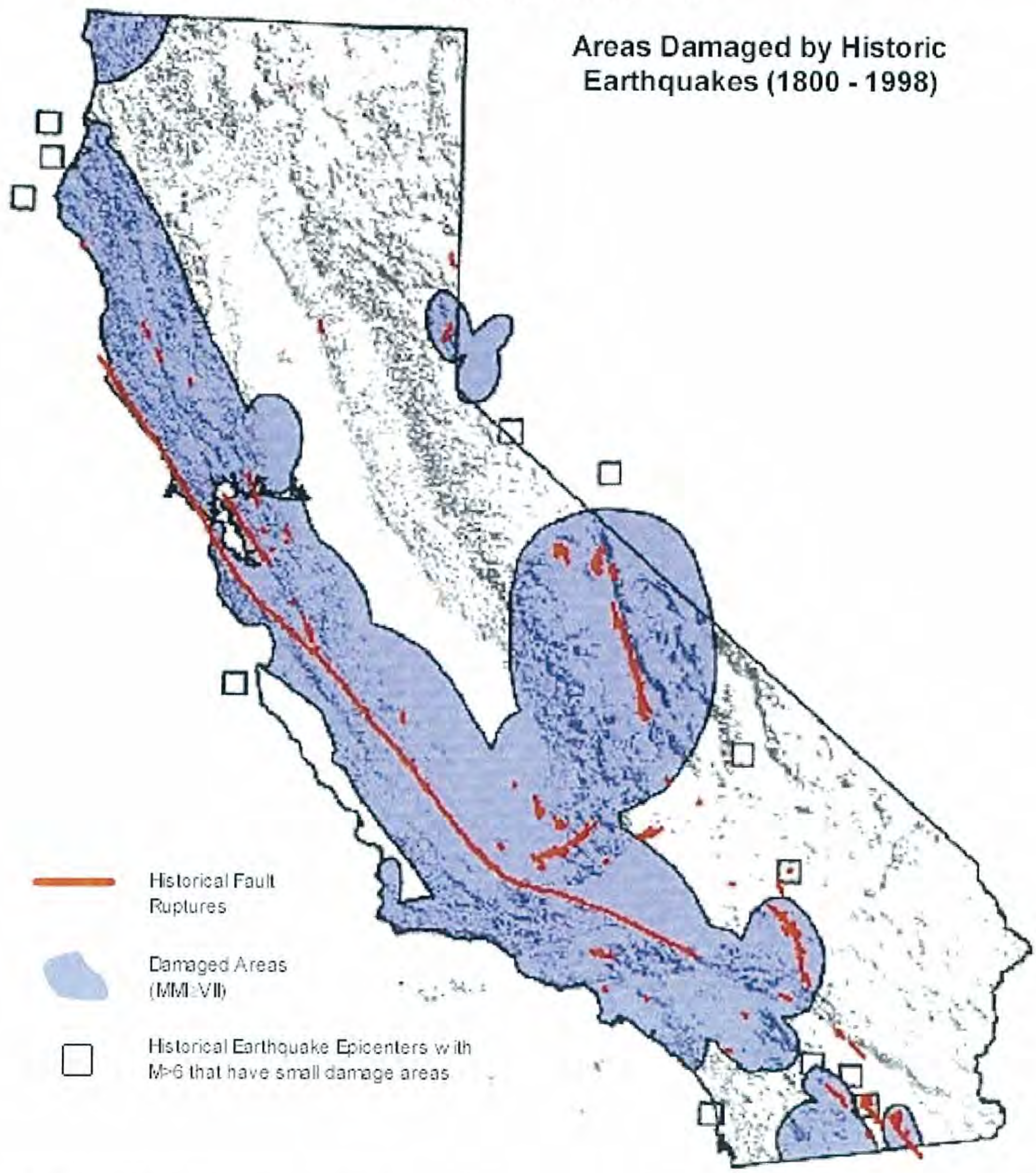
The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This state law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. Surface fault ruptures locations are known, and therefore improvements in these areas can be easily restricted.

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 El Dorado County, due to its location being relatively distant from any known faults that meet the criteria of the mapping program. There is one fault zone on land under the County's jurisdiction, the Rescue Lineament Bear Mountain fault zone. This fault zone cuts across the western end of the County trending north to south. However, there has been no appreciable movement in this fault and no record of damages sustained.

The following graphics (Figure 11-10 and Figure 11-11) demonstrate 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. El Dorado County lies within the portion of the State that has no record of damaging shaking events during that period.

Figure 11-10. Number of Times Areas of the State has Experienced Significantly Damaging Earthquakes



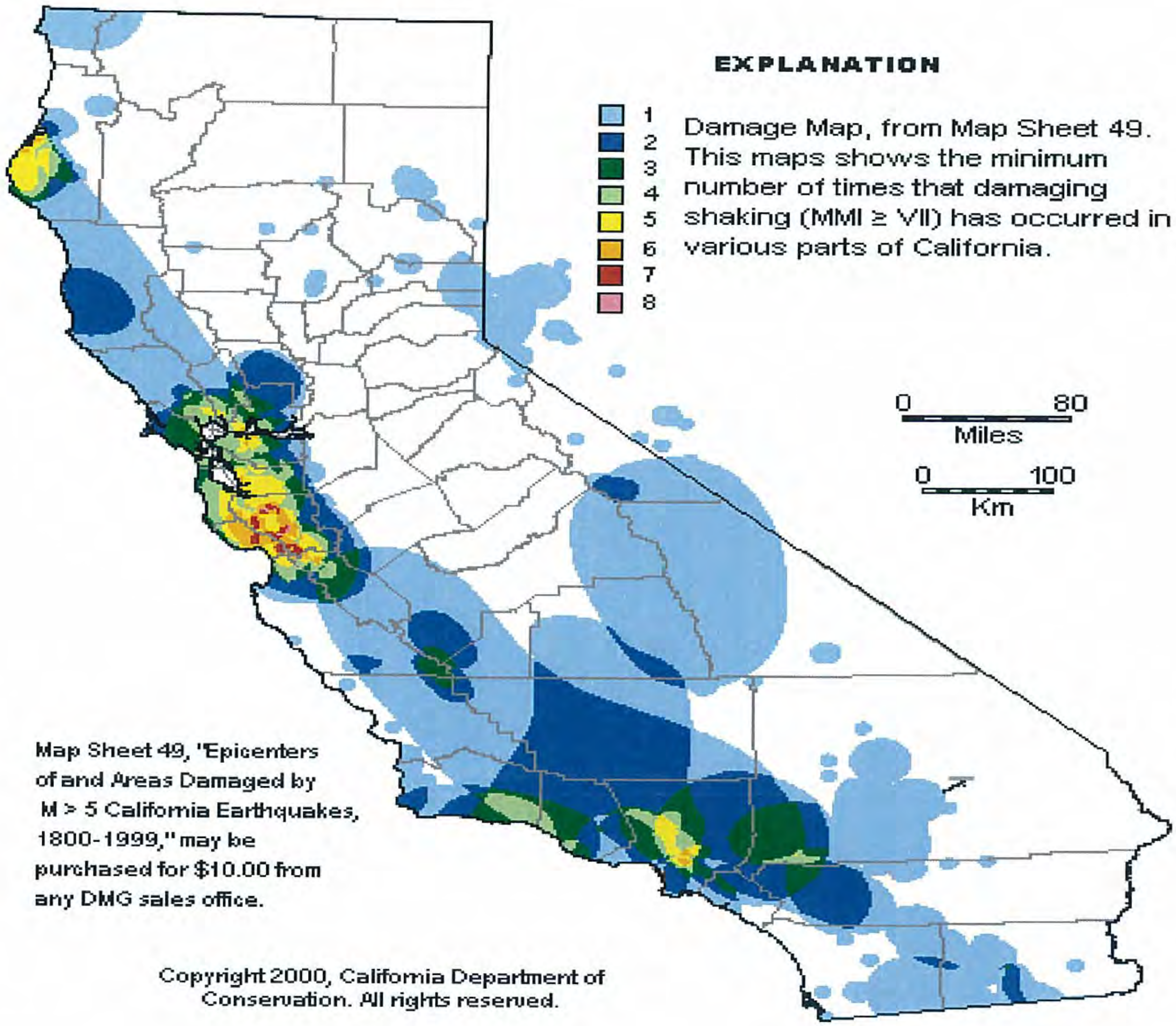


Figure 11-11 (Above) Epicenters of and Areas Damaged by M>5 California Earthquakes, 1800-1999

Sinkholes

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.

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

Sinkhole Hazard in El Dorado County

Sinkholes in El Dorado 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.

There is some geologic expression of carbonate bedrock and formation of solution holes or caverns in El Dorado County. 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 these parts of the County, 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 area affected by underground mining is the Mother Lode area and smaller gold ore deposits have been mined in several other smaller areas of the County.

Landslides

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, changes in groundwater levels, and deforestation caused by wildland fires.

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 accompany 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.

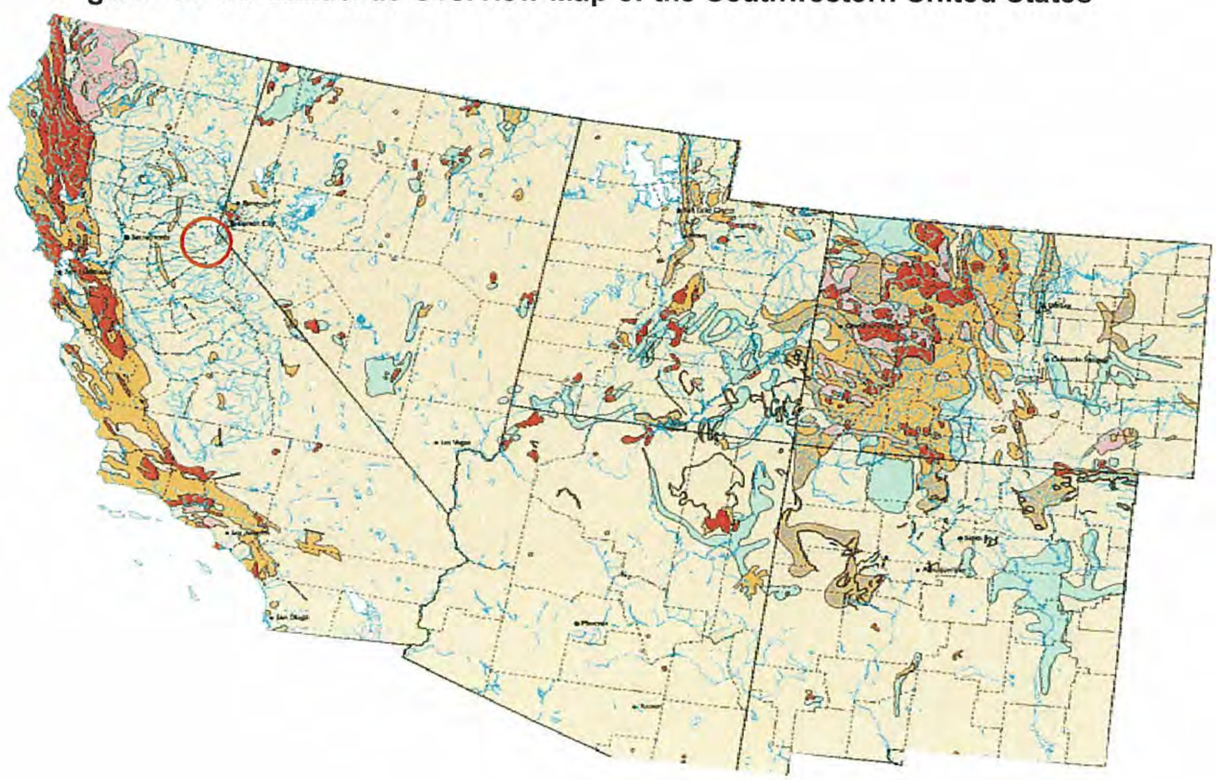
Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow resulting from the 1980 eruptions of Mount St. Helens, Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of 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 11-12 identifies 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. The red circle on the image was added to identify the location of El Dorado County on the relatively small-scale map.

Figure 11-12. 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.

Landslide Hazard in El Dorado County

The topography of El Dorado County displays a wide range of landforms ranging from vertical cliffs to gently undulating foothills. 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 El Dorado County Geohazards Maps indicate general areas of the developable properties that has 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 El Dorado 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 along the Highway 50 Corridor in the vicinity between Riverton and Strawberry. Slope failure of the steep slopes along the American River have littered the adjacent slopes with boulders and other debris. Typically limited to the slopes along the upper American River, development in this area should be done only after carefully considering appropriate setbacks from the break point where the topography dramatically changes. It is important to note that slope failure along Highway 50, as evidenced in January of 1997 even though within the boundaries of El Dorado County fell under Caltrans jurisdiction.

Downslope development on relatively flat land at the base of steep cliffs should occur only after the potential for rockfall is evaluated. Surface mapping of rock exposures along with observation of conditions in the local area of a project assists 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 features 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 El Dorado 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 Figure 11-12), where the geologic conditions are much more prone to landslide and general instability.

Winter Storms

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.

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.

Winter Storm Hazard in El Dorado County

El Dorado 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. 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 occurs in winter and early spring. A summertime monsoon flow of tropical moisture can bring thunderstorms to the high elevations in the extreme east and northeast of the County, but seldom brings any significant rainfall to the lower elevations.

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 fell trees that block roadways. Snowfall and felled trees are more likely to cause significant damage in the higher elevations of El Dorado County, but localized flooding from intense rainfall can occur anywhere.

Due to the strong correlation of winter storms and flooding all of the prior incidents that caused reportable damage were documented in the earlier section of "Floods"

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.

Volcano

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.

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, ash, steam, and other gases they release can have an impact on much larger areas.

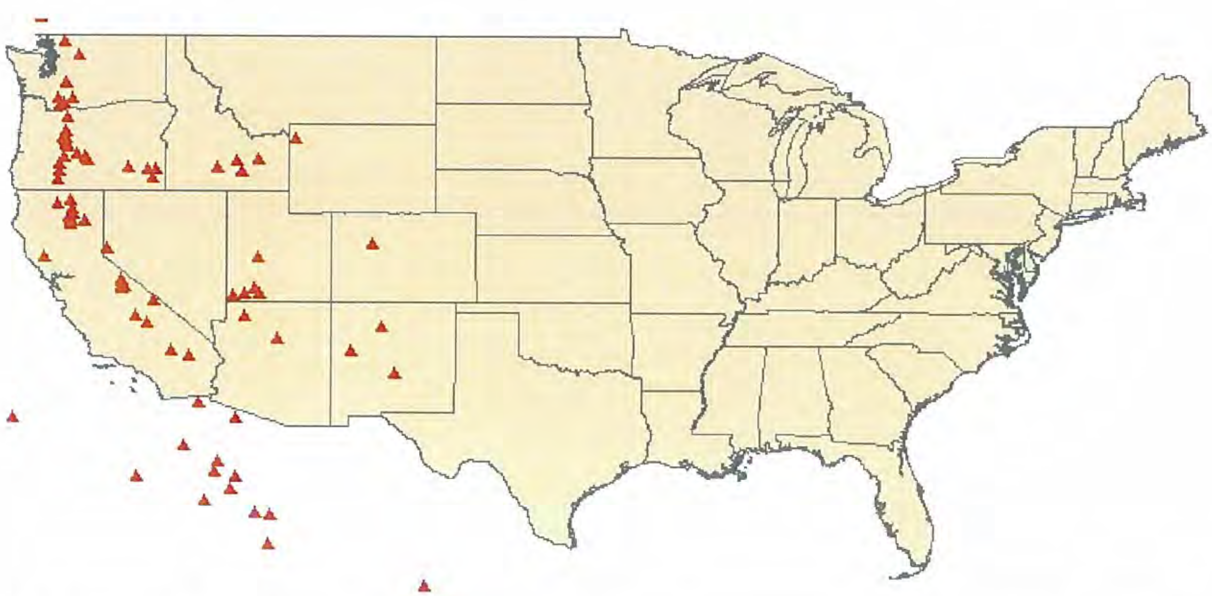
Lahar is the mudflow of debris and water caused by a volcano. It is also known as debris flow or volcanic mudflow. Lahar is most often triggered by rainfall washing down the debris from the slopes of volcanoes. However, lahar flows can also be triggered by rapidly melting snow and ice, debris avalanches 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 debris. Volcanic ash pollutes the air, can contaminate water supplies, cause electrical storms, collapse roofs, and may 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 eruption in 1980 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 11-13). The danger area around a volcano covers approximately a 20-mile radius. Some danger may exist 100 miles or more from a volcano.

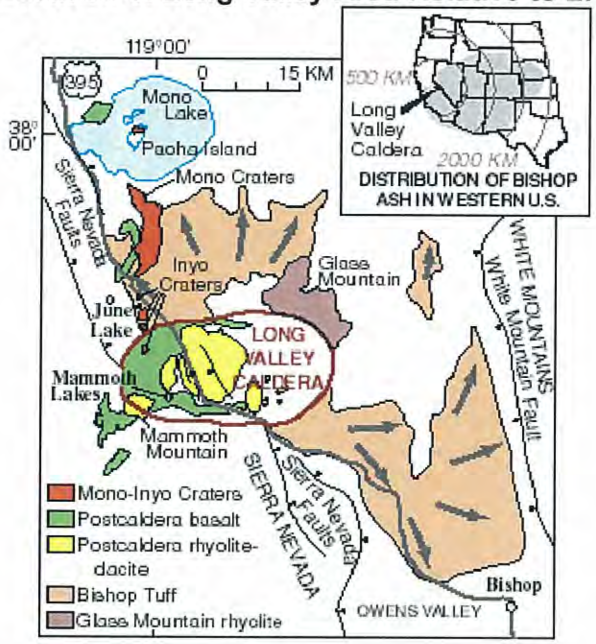
Figure 11-13. Known Volcano Locations in the United States



Volcano Hazard in El Dorado County

The volcano hazard of El Dorado County is presented by the relative proximity to the Long Valley Volcanic Field. As shown in Figure 11-14 the extreme northwest corner of the Long Valley area reaches the most extreme southeastern corner of El Dorado County.

Figure 11-14. Location of Long Valley Area Relative to El Dorado 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. 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. This reduces the risk of a significant ash event from affecting El Dorado County.

Drought/Extreme Heat

Over the past 150 years, conditions of drought/extreme heat in El Dorado County have caused significant crop loss. Various apple orchards and wineries have been impacted by these adverse weather conditions. A recent El Dorado County Crop Report states the following on the impact of the weather on agriculture.

The El Dorado County gross crop value for 2008 was $35.4 million which is an overall decrease of 33.5% from the 2007 values. The decline in total value was mainly due to weather related damage caused by low springtime temperatures and a dramatic decrease in timber harvesting. Specifically, timber values saw a precipitous 67.6% decrease from the prior year while many of the other crops experienced lower harvests of higher quality fruits.

Historically, El Dorado County has been included in disaster proclamations for drought in 2008, and 2009. The County Agriculture Department is currently determining the cost of the crop losses in the recent years.

We are currently operating under a disaster declaration from the U.S. Small Business Administration for contiguous counties for agricultural losses caused by drought that occurred January 1, 2004, and continuing. Further analysis, and mitigation measures are currently under development. Updates to this plan, will include a complete analysis of this hazard at a future date.

Erosion

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.

Erosion Hazard in El Dorado County

The soils in El Dorado 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. These 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 roadways are tested for shrink/swell potential and the test results considered in the 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. Concurrent testing, in conformance with the recommendations of the Uniform Building Code and the project engineer can ensure a grading project 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 in El Dorado County in excess of 30% are considered as having a high potential for erosion.

The vast majority of development in El Dorado County is not in proximity to cliff-like areas, 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 El Dorado County.

Severe Thunderstorms and Tornadoes

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.

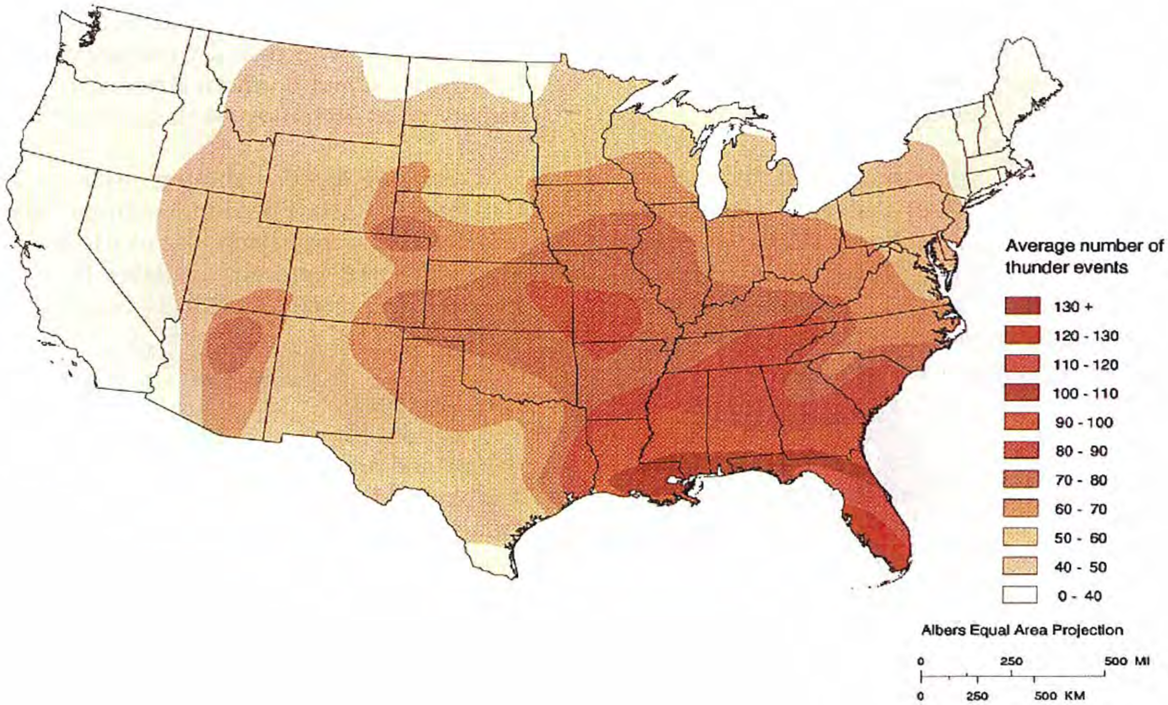
Multiple cloud-to-ground and cloud-to-cloud lightning strikes observed during a nighttime thunderstorm.

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 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 11-15.

Figure 11-15. Annual Average Number of Thunder Events



A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground.

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.

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.

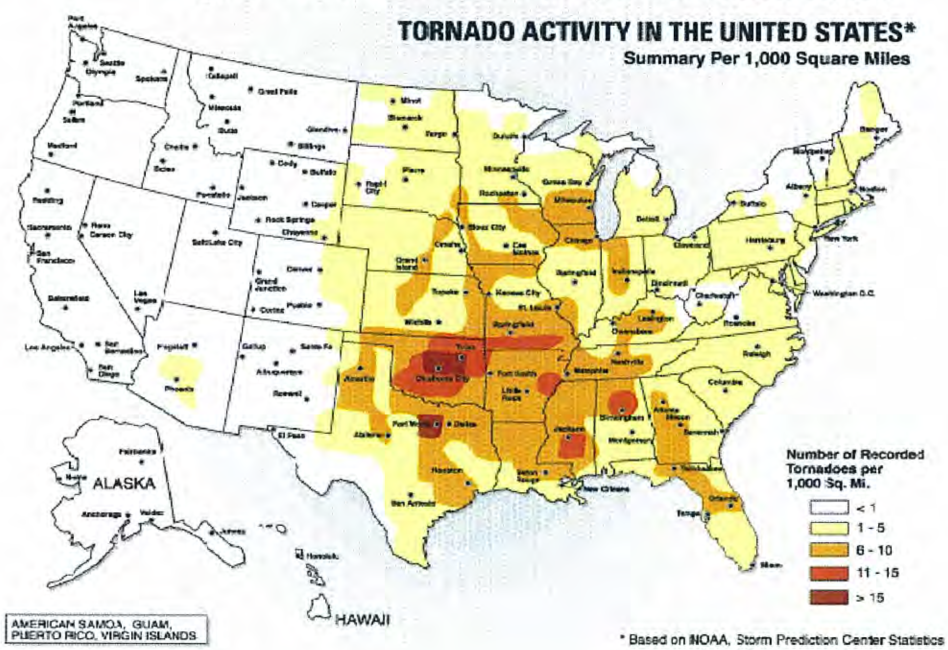
Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (National Oceanographic and Atmospheric Administration, 2002). They are more likely to occur during the spring and early summer months of March through June and can occur at any 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 11-16. shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

Figure 11-16. Tornado Activity in the United States



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 11-17 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 11-17. Wind Zones in the United States

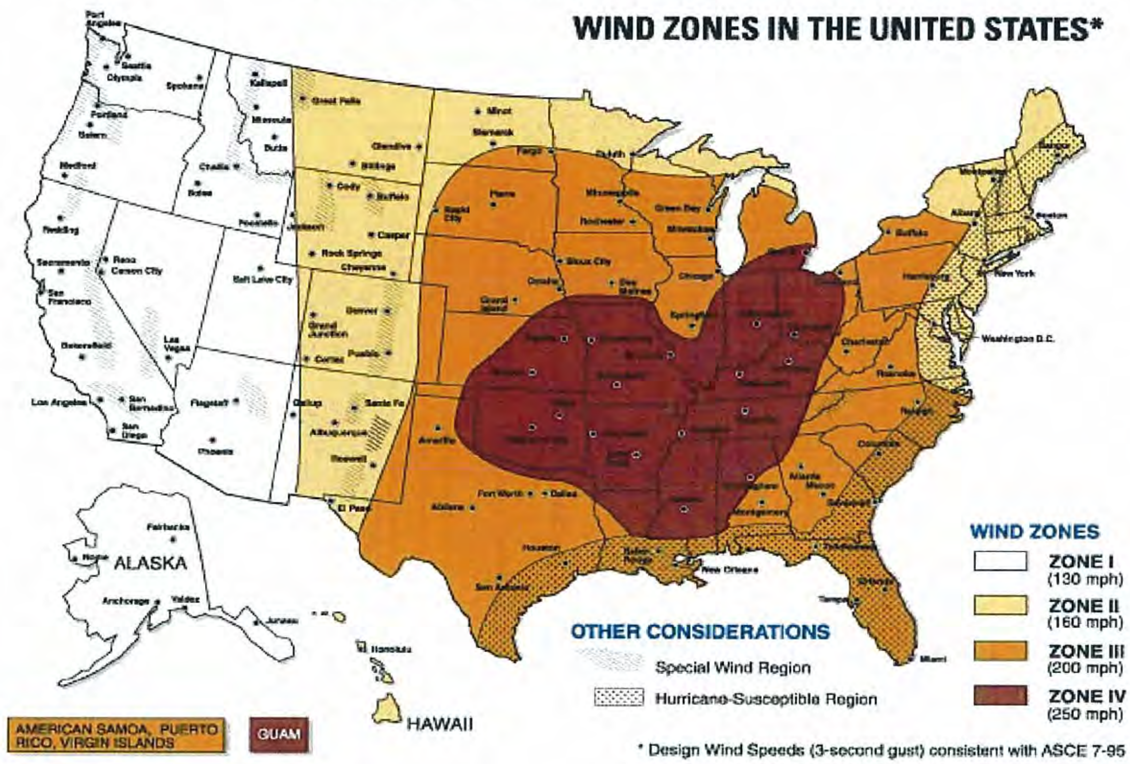


Figure I.2 **Wind zones in the United States**

Source: Federal Emergency Management Agency

Thunderstorm/Tornado Hazard in El Dorado County

As shown by the graphics in the section above, El Dorado County is not located in an area of these types of extreme meteorological events. With these types of wind and storm events associated with summer or fall warm air masses, El Dorado 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 are localized flooding as a result of thunderstorms or similar intense rainfall events. Because there is otherwise no history of damage from thunderstorms or tornadoes, there will be no further discussions related to these in this document.

Hurricanes and Tropical Storms

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

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.

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.

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/Tropical Storm Hazard in El Dorado County

Due to the nature of most hurricanes and tropical storms being a phenomenon of the southeastern/southern area of the United States, El Dorado County has never experienced major problems related to these hazards. 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.

Avalanche

General Avalanche Hazard from National Perspective

An avalanche is a rapid flow of snow down a slope, from either natural triggers or human activity. Typically occurring in mountainous terrain, an avalanche can mix air and water with the descending snow. Powerful avalanches have the capability to entrain ice, rocks, trees, and other material on the slope; however avalanches are always initiated in snow, are primarily composed of flowing snow, and are distinct from mudslides, rock slides, rock avalanches, and serac collapses from an icefall. In mountainous terrain avalanches are among the most serious objective hazards to life and property, with their destructive capability resulting from their potential to carry an enormous mass of snow rapidly over large distances.

In the United States, 514 avalanche fatalities have been reported in 15 states from 1950 to 1997. Each year, avalanches claim more than 150 lives worldwide, a number that has been increasing over the past few decades. Thousands more are caught in avalanches, partly buried or injured. One of the major reasons for increasing avalanche fatalities is the boom in mountain industries and recreation. Skiing, hiking and other winter sports draw millions of people to the mountains. To support these activities, more roads, buildings, and towns are forced into avalanche prone areas.

Although avalanches can occur on any slope given the right conditions, in the United States certain times of the year and certain locations are naturally more dangerous than others. Wintertime, particularly from December to April, is when most avalanches will "run" (slide down a slope). However, avalanche fatalities have been recorded for every month of the year.

A large avalanche in North America might release 300,000 cubic yards of snow, the equivalent of 20 football fields filled 10 feet deep with snow. Slab avalanches are the most common and most deadly avalanches, where layers of a snowpack fail and slide down the slope. Since 1950, 235 people in the U.S. have been killed in slab avalanches.

Several factors may affect the likelihood of an avalanche, including weather, temperature, slope steepness, slope orientation (whether the slope is facing north or south), wind direction, terrain, vegetation and general snowpack conditions. Different combinations of these factors can create low, moderate or extreme avalanche conditions.

Avalanches are most likely to run either during or immediately after a storm where there has been significant snowfall. The 24 hours following a heavy snowstorm are the most critical. The extra weight of new snow alone can cause a slab to break off and fall down the slope. Snowfall amounts of one foot or more (frequent in mountainous areas) create the most hazardous situations, producing avalanches that are often large enough to block highways and cause major destruction. Snow amounts of six to twelve inches pose some threat, particularly to skiers and recreationists. Snow amounts less than six inches seldom produce avalanches.

Perhaps the most significant factor (but not the only one) is how the snowpack has developed over the season. Only the surface and maybe the top few layers of snow are visible, but layers of snow several feet deep may ultimately determine whether the slope will fail.

Snowpack conditions are extremely important because many layers of snow build up over the winter season. Each layer is built up under different weather conditions and will bond differently to the subsequent layers. Snowflakes, or snow crystals, within the snowpack eventually become more rounded due to melting/re-freezing and settlement. This metamorphism allows them to compress and generally form stronger bonds.

Between snows, the temperature may rise and melt the exposed surface layers, which when they re-freeze create a smoother, less stable surface for the next snowfall. Failure is much more likely to occur during or after the next few snowfalls. Rain between snows creates a slicker surface as well, and can weaken the bonds between snow layers.

Most avalanches occur on slopes between 30 and 45 degrees, but can occur on any slope angles given the right conditions. Very wet snow will be well lubricated with water, meaning it might avalanche on a slope of only 10 to 25 degrees

Avalanche Hazard in El Dorado County

Typically limited to the steeper slopes of the Sierra Nevada Mountains, the majority of the land in this "avalanche zone" is owned by the Federal Government. Private ownership development, when allowed, is done only after carefully considering appropriate setbacks from the known avalanche starting zones, tracks and runout zones. Generally the roadways running through this "avalanche zone" are also privately owned and therefore not a significant hazard for El Dorado County.

The above discussion concerning areas with potential avalanche hazard is limited to certain areas along the Eastern edge of the County in the higher elevations. There have been reported incidents of avalanches 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 small portions of privately owned and potentially developable land and therefore roads of El Dorado County can include areas where avalanche could occur, it is not common to most areas.

Avalanche control along the mountain passes of Highway 50, the main east-west roadway through El Dorado County, is a 24-hour a day, seven-day a week job for Caltrans from November, when the first snow normally falls, until Spring. Caltrans monitors slope conditions determining when any particular slope is ripe for an avalanche. By triggering smaller, controlled avalanches, Caltrans reduces the potential for a large wall of snow from cascading down onto the highway, trapping motorists and causing injuries or deaths. These controlled "mini" avalanches are triggered by a projectile fired into the suspect slope from a LoCAT, a compressed air launcher, sending the unstable snow down the slope where Caltrans teams wait to clear the highway.

Terrorism

Terrorism is the calculated use of unlawful violence or threat of unlawful violence to inculcate fear; intended to coerce or to intimidate governments or societies in the pursuit of goals that are generally political, religious, or ideological. (FBI definition)

- Domestic terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico without foreign direction committed against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.
- International terrorism involves violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or any state, or that would be a criminal violation if committed within the jurisdiction of the United States or any state. These acts appear to be intended to intimidate or coerce a civilian population, influence the policy of a government by intimidation or coercion, or affect the conduct of a government by assassination or kidnapping. International terrorist acts occur outside the United States or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to coerce or intimidate, or the locale in which their perpetrators operate or seek asylum.

Terrorist events in the United States 2002-2005

In keeping with a longstanding trend, domestic extremists carried out the majority of terrorist incidents during this period. Twenty three of the 24 recorded terrorist incidents were perpetrated by domestic terrorists. With the exception of a white supremacist's firebombing of a synagogue in Oklahoma City, Oklahoma, all of the domestic terrorist incidents were committed by special interest extremists active in the animal rights and environmental movements. The acts committed by these extremists typically targeted materials and facilities rather than persons. The sole international terrorist incident in the United States recorded for this period involved an attack at the El Al ticket counter at Los Angeles International Airport, which claimed the lives of two victims.
Source-http://www.fbi.gov/publications/terror/terrorism2002_2005.htm#page_7

Terrorist events in El Dorado County

Possible Earth Liberation Front (ELF) action at Tahoe Ski Resort
On Tuesday, August 25, 2001 Authorities were called to investigate Heavenly Valley Ski Resort's new gondola in South Lake Tahoe after a 2x16-inch stick was found wired to a steel cable. Safety sensors that had been wired to the gondola cable were broken, and the letters ELF were formed with wire at the base of one of the support towers.

United States Forest Service Genetics Lab in Camino
In January 2006 three suspects were arrested by FBI agents for plotting to blow up the Forest Services Institute of Forest Genetics in Camino.

Two El Dorado County men arrested in December of 1999 by FBI.
Two anti- government militia members from El Dorado County were arrested by the FBI while planning to blow up a 24 million gallon liquefied propane storage facility located in Elk Grove.

III. Community Vulnerability Assessment

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

- **Wildfire**
- **Floods**
- **Dam Inundation**
- **Seiche**
- **Earthquakes, Sinkholes and Landslides**
- **Winter/Seasonal Storms**
- **Erosion**
- **Avalanche**

The above hazards were chosen from the previous sections due to the higher level of risk for these hazards compared to others and the impact these hazards may have on the county's infrastructure. 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, information was gathered from the public, and various U.S. and local website databases, County files, current County hazard mitigation plans, the County General Plan and local newspaper archives. This information was then analyzed for the potential hazards that exist, our vulnerability, and what can be done to prevent, and or mitigate the threats that exist.

It should be noted that the determinations presented in this section with regard to vulnerability were developed using best available data, and the results are 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 GIS-based Risk Assessment Methodology

The general steps used in the GIS-based assessment 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.

- Primary data layers include past disaster losses involving OES, Cal EMA and FEMA, and various geo-referenced point locations and line files. For floods and winter storms risk was assessed by using the GIS data and calculating the total structural value of all of the infrastructure, roadways and transportation related structures estimated to be at risk. The structural values were estimated for a typical mile of roadway in El Dorado County from a combination of files and current construction cost tables. The losses were determined by applying that data to the estimated number of miles lost during a flood, or other event and annualized.

- A similar process to that described above for floods was followed to address the hazard of dam failure and subsequent inundation and landslides. The area of potential inundation was determined using the inundation maps the State of California requires owners or operators of larger dams to prepare. The maps were submitted to the Office of Emergency Services (OES) and forwarded to the County Emergency Services Coordinator. Those maps were combined into one and overlaid with the transportation system structures to determine structures within the inundation zones (Figure 111-10 on page 13 of this section). The risk of inundation damages was then calculated similarly the process outlined for flood events.

- For volcano, erosion hazards, sinkholes and avalanches, meaningful historical data (meaning data which would have included roadway damages and other essential indicators) was virtually non-existent, and therefore annualized potential losses for these hazards are 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 111-1 provides the criteria associated with each label.

Table 111-1. 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 infrastructure affected
Moderate	2	Between 10 and 50% of area infrastructure affected

Small	1	Less than 10% of area infrastructure affected
Potential Impact		
Catastrophic	4	High number of deaths/injuries possible. More than 50% of infrastructure, roadways and transportation facilities 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 infrastructure, roadways and transportation facilities in affected area damaged or destroyed. Complete shutdown of facilities for more than one week.
Limited	2	Minor injuries only. More than 10% of infrastructure, roadways and transportation facilities in affected area damaged or destroyed. Complete shutdown of facilities for more than one day.
Minor	1	Very few injuries, if any. Only minor infrastructure, roadway and transportation facility 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 El Dorado County Vulnerability

El Dorado 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 Placerville. It is located in the bend of eastern California. It is just 30 miles east of Sacramento, California's State Capitol and 40 miles west of Carson City, Nevada's State Capitol.

El Dorado County encompasses 1,805 square miles, located on the western slope of the mountain range known as the Sierra Nevada and is bordered to the east by the State of Nevada, to the north by Placer County, to the west by Sacramento County and to the south by Amador and Alpine Counties. The western areas of the county are made up of mostly rolling foothills. Eastern areas of the County are at higher elevations. The City of Placerville, the County seat, is about 2,000 feet above sea level. Portions of Lake Tahoe (the largest alpine lake in North America at 12 miles wide, 22 miles long and having 72 miles of shoreline) and approximately one million acres of national forest land make up the easterly section of El Dorado County.

El Dorado County has one U.S. route (U.S. Highway 50) and four other State Routes (State Routes 49, 89, 153, and 193). U.S. Highway 50 is the primary transportation facility in El Dorado County, providing connections to Sacramento County and the State of Nevada. It accesses nearly all of the recreation areas and tourist attractions for visitors to the County. U.S. Highway 50 is also the major commute route to employment locations in the greater Sacramento area and the major shipping route for goods movement by truck. It connects the County to Sacramento to the west, where it connects with Interstate 5, connecting to all other areas north and south, and to Interstate 80, which connects to San Francisco. To the east, the highway connects to Carson City and Reno, Nevada and areas east. The western half of its length in El Dorado County is four-lane freeway, except for a short distance in the

City of Placerville. The eastern half winds over the Sierra Nevada and becomes a city street in South Lake Tahoe, the County's largest city.

Other highways in El Dorado County include State Highway 49, the historical Mother Lode Highway of 49'er fame, which travels north connecting Placerville to Auburn, Grass Valley, and Interstate 80 traveling east. Highway 49 also connects Placerville south to the California Gold Country, and also provides an alternate connection to Interstate 5 traveling south.

State Highway 193 in El Dorado County connects the populated foothills north of Placerville to Highway 49 between Placerville and Auburn.

State Highway 89 connects South Lake Tahoe south to U.S. Highway 395 south to Los Angeles, and north along the western shore of Lake Tahoe toward Truckee and Interstate 80.

State Route 153 is a one-half mile long road that provides access from State Route 49 to the Marshall Monument in Coloma, and does not handle regional traffic.

TOPOGRAPHY AND LAND FORMS

Landforms within the County range from gently rolling foothills in the west to steep, jagged mountainous terrain in the east and along the canyons of the Carson, American, Mokelulumne and Cosumnes Rivers, which flow through the County. These landforms were derived from the uplifting of the Sierra Nevada Range from the Pacific Ocean, which once covered El Dorado 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. El Dorado County is within the Sierra Nevada Geomorphic Province. Elevations range from 200 feet, in the western valleys between the foothills, to 10,881 feet at some mountain peaks in the Sierra Nevada Mountain Range.

The County's three major rivers, the South and Middle Forks of the American, and the Cosumnes occupy deep canyons that drain west into the Sacramento Valley. Slopes along these river canyons are extremely steep with gradients of 60% to 100% and with banks rising as much as 1,000 to 2,000 feet above the riverbeds. Slopes on the broad areas between these 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 rolling grassy hills with metamorphic rocks. 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.

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 Loon Lake, Union Valley, Ice House, and Brush Creek. 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.

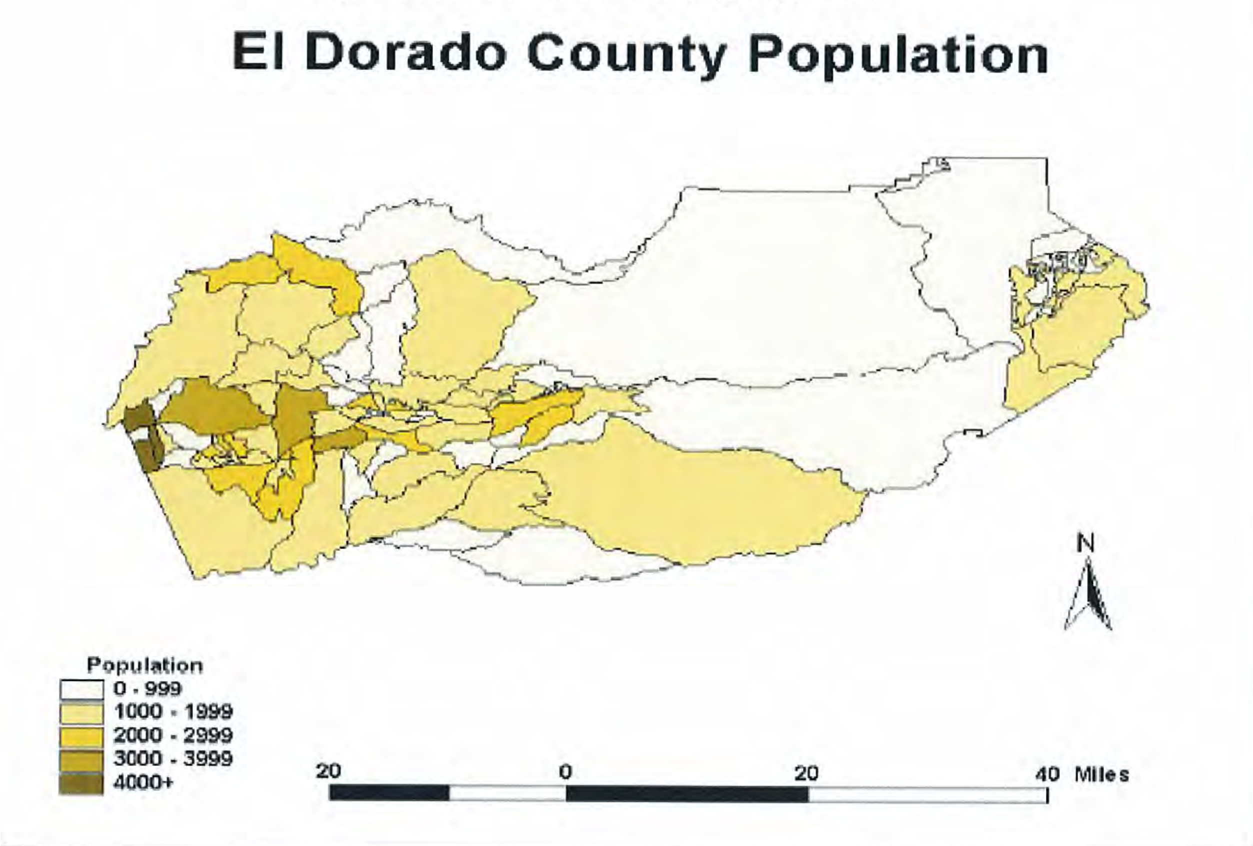
There is one fault zone on land under the County's jurisdiction, the Rescue Lineament-Bear Mountain fault zone. This fault zone cuts across the western end of the County trending north to south. However, there has been no appreciable movement in this fault and no record of damages sustained from events stemming from this fault. The next closest fault to El Dorado County is the North Tahoe Fault, which lies northeast of the County's border, beneath the surface of Lake Tahoe, trending east to west. Both of these faults' likelihood of occurrence rate is 0% placing them in the "unlikely" category in the Criteria for Qualitative Assessment.

The transportation infrastructure development capacity of El Dorado County is constrained by its geology, landform, and soils. These factors are used to determine the existence of steep slopes, fault zones, and soils unsuitable for road or transportation facility foundations.

DEMOGRAPHICS

According to the U.S. Census Bureau, the estimated population of El Dorado County on July 1, 2008 was 176.075. The population of El Dorado County has seen rapid growth within the last decade. Since 2003, the population has increased 5 percent, exhibiting a total growth rate of over 30% percent, or 42,000 people, with roughly 98 people per square mile, a 27% increase since 1991. Over 78% of the population lives in unincorporated areas outside of the city limits as shown in Figure 111-2. Keeping in mind that the more densely populated the area, the higher the demand for roadways and access to public transportation, resulting in a concentration of transportation infrastructures in these areas.

Figure 111-2 El Dorado County Population



DEVELOPMENT TRENDS

Since the early 1980's, El Dorado County has been included in the Sacramento Metropolitan Statistical area. Major residential communities (El Dorado Hills, Cameron Park, and Shingle Springs) in the western part of the county serve as suburban areas to the booming Sacramento metropolitan region. The unique environment and high quality of life in El Dorado County provide the "get away" lifestyle desired by employees and leaders of the region's new and expanding businesses.

El Dorado County's quality of life and proximity to Sacramento have resulted in rapid growth over the past 20 years. Total population nearly doubled between the 1970 and 1980 census years, then nearly doubled again by the 1990 census. Population growth of approximately 3.5% annually is projected into the 21st century.

Studies show that 78.2% of population increases since 1980 is due to the overall growth of the Sacramento Region with the majority of the growth in El Dorado County occurring in the El Dorado Hills/Cameron Park area. As transportation services and housing opportunities increase, this trend is expected to continue.

The General Plan directs 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 storms or earthquakes cannot be avoided totally with planning growth in specific areas, due to the pervasive nature of those hazards within El Dorado 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

El Dorado County features a large geographic area consisting of approximately 1,144,480 acres, stretching from 30 miles east of Sacramento in the west to the Nevada state line in the east. The County is located on the western slope of the Sierra Nevada mountain range. Of the 1,155,000 total acres, approximately 534,000 acres are National Forest or other lands under Federal jurisdiction (see Figure 111-3). An additional 27,181 acres are owned by other public agencies including 9,751 acres which are State Lands (see Figure 111-4) with the remaining acreage held by other local agencies. The remaining 583,299 acres are primarily privately held and subject to typical residential, commercial, or industrial development which would therefore require transportation infrastructure for continued development. The County's transportation system is primarily focused around the roadway network. Most in-county travel is in automobiles because low-density development patterns have limited the viability of facilities or services related to transit, bicycles, and pedestrians. For purposes of this plan, those are the properties that are considered "developable" and therefore would require development of transportation and infrastructure to match the projected growth.

Figure 111-3. Location of Public Held Lands in El Dorado County

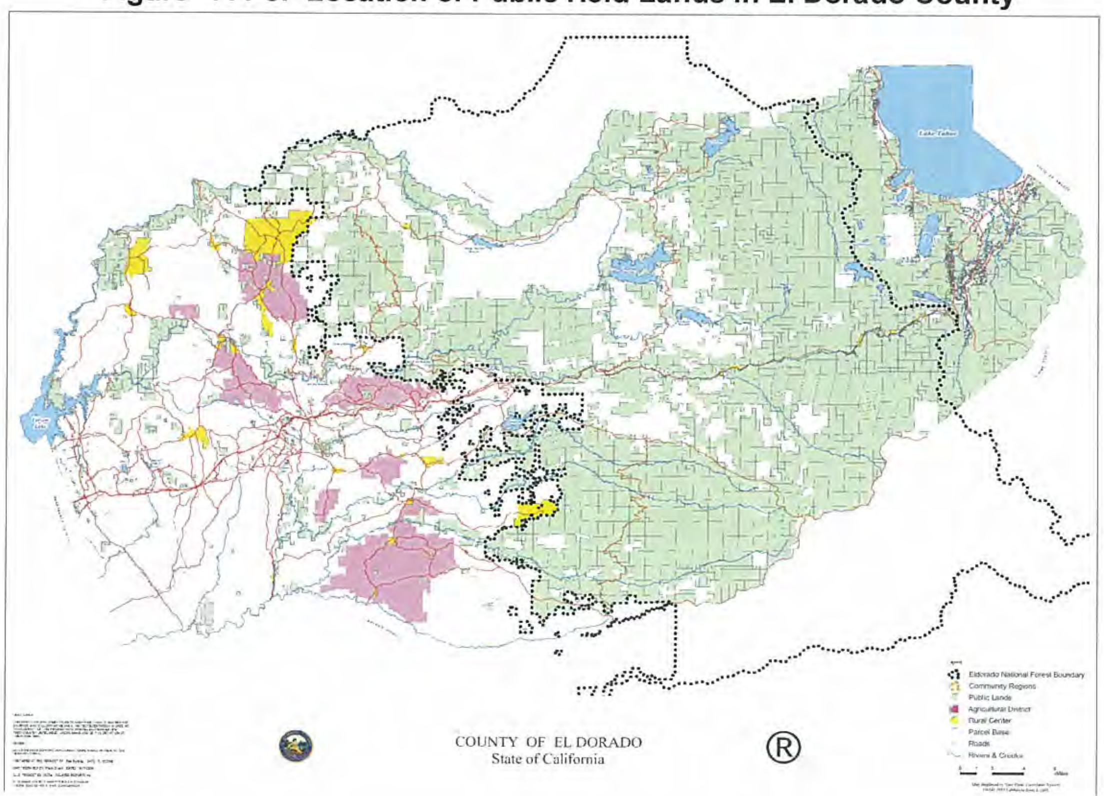
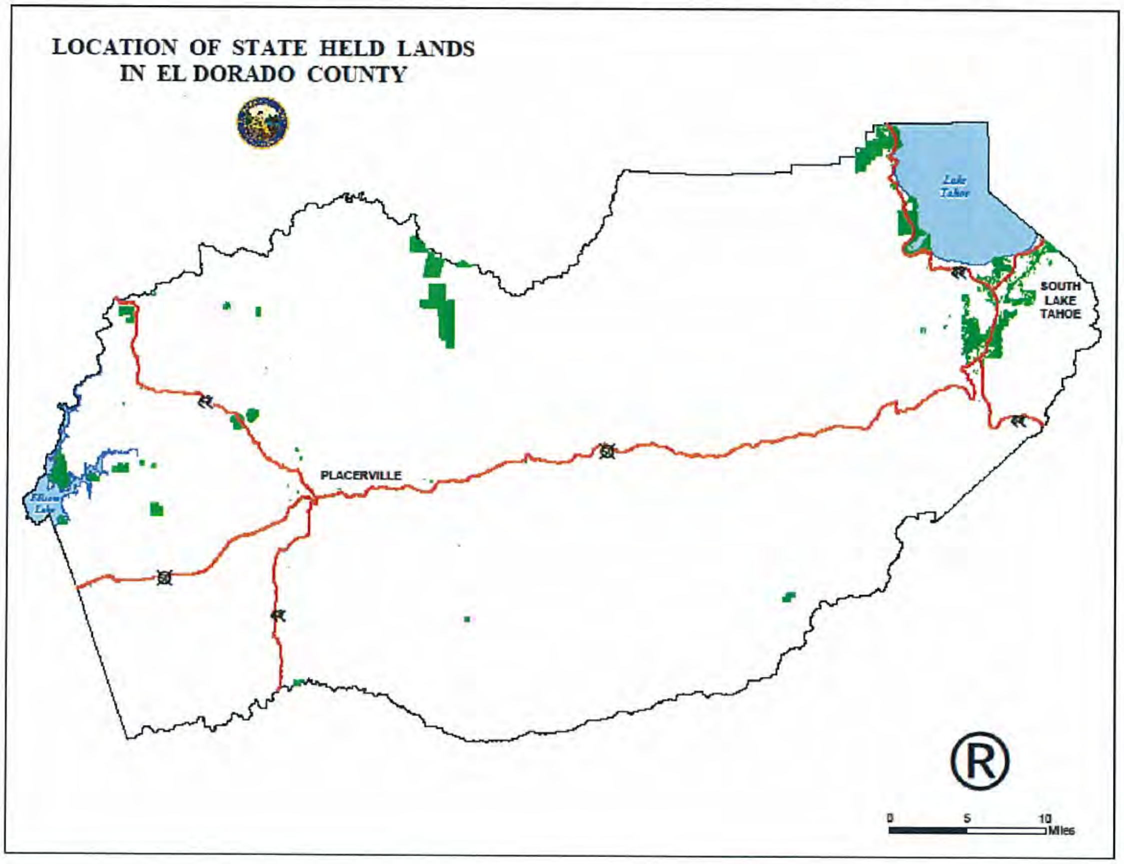


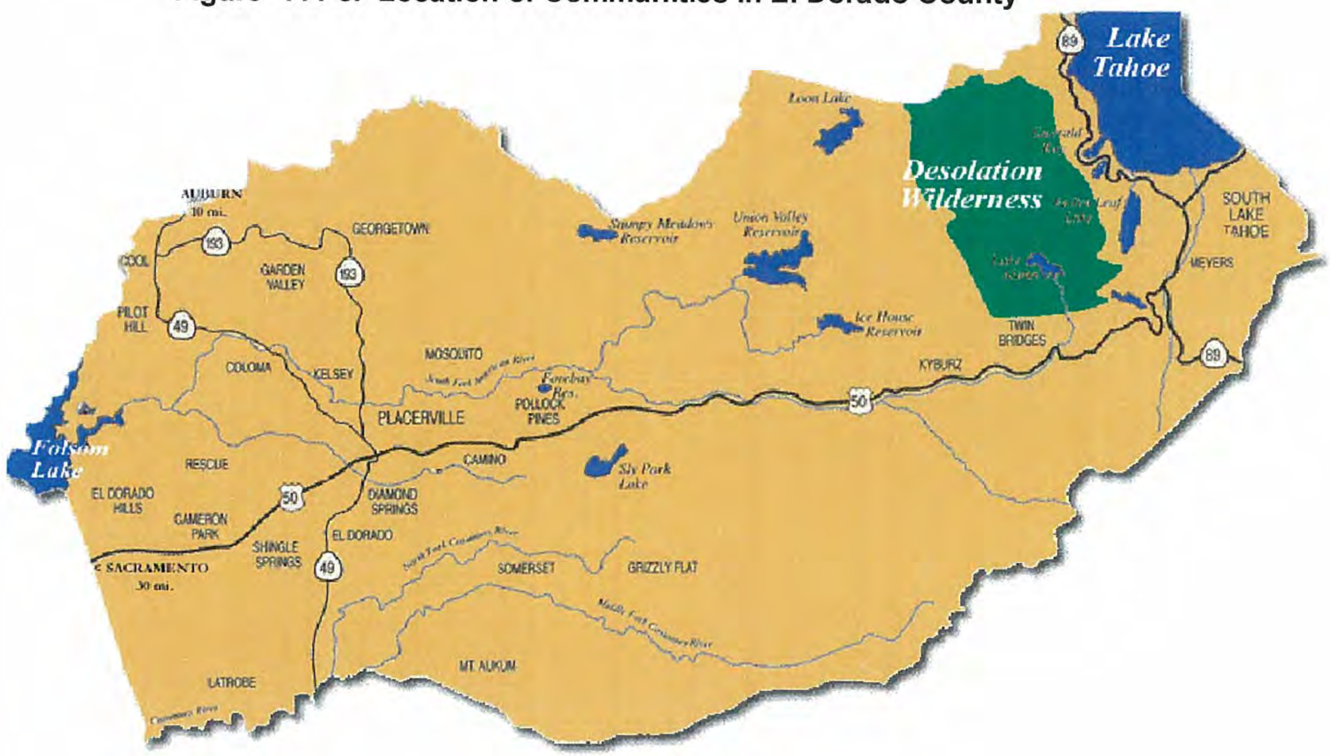
Figure 111-4. Location of State Held Lands in El Dorado County



COMMUNITY ORIENTATION

The following graphic, Figure 111-5, shows the general orientation of communities within El Dorado 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 in large part reflects that history. A more complete discussion of the historic settlement of El Dorado County is found in the following section "Historical Resources." All of the various communities are connected by and therefore reliant upon County roadways for commute purposes. According to the 2000 Census, almost 90 percent of all trips from home to work by County residents were made by automobile.

Figure 111-5. Location of Communities in El Dorado County

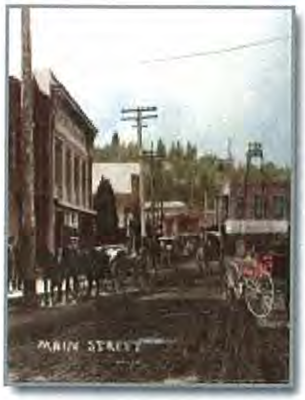


HISTORIC RESOURCES

According to history books, the Miwok & Maidu Indian tribes split the southwestern portion of what is now El Dorado County. The Maidu tribe had vast territories to the north, their 74 villages stretched roughly from the Nevada state line, over the mountains and down into the foothills of El Dorado County, while the Miwok went south with a small band along the Pacific coast, west of El Dorado County. The County's indigenous peoples, the Central Sierra Maidu 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 lumber, railroad, and transportation development past. .

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 list shows some of the areas in El Dorado County that contain a significant number of historic structures, most occupied and used for residences, businesses and offices. Access to all of these historic sites is dependent upon the transportation infrastructure of El Dorado County.

Partial Graphic Listing of Historic Sites in El Dorado County



Placerville, California c. 1900

Placerville, the County Seat, is a charming California "gold rush" town named after the placer gold deposits found in its riverbeds and hills in the late 1840's.

Gold Discovery Site, Coloma
Sutter's Mill

Actual site of the gold discovery in California on January 24, 1848.

Historic Strawberry Lodge

Along the banks of the cascading American River on Highway 50, this historic lodge, dating back to 1858, was once a stop for the Pony Express.

The Tallac Historic Site "Valhalla"

The Tallac Historic Site, often referred to as "Valhalla," includes 74 acres of secluded woods and over a quarter of a mile of south shoreline on Lake Tahoe between Emerald Bay and Camp Richardson. It is listed on the National Register of Historic Places. Far from the crowds and gambling, the Tallac Historic Site is home to the archeological remains of the Tallac Resort and three large summer estates built by wealthy San Franciscans in the late 1800's and early 1900's. The Tallac Resort includes three estates, all of which are open to the public.

Pearson, the Ice Merchant

John McFarland Pearson was an early Placerville businessman who emigrated from Scotland in 1852. He got his start as an ice merchant cutting ice from mountain lakes and the American River near what is known today as Riverton and Ice House Road. Pearson would haul ice into town by horse and wagon, and then sell the ice blocks to the town's people.

In 1859, Pearson built the Pearson Soda Works building at 594 Main St. where it still stands today.

The building has several interesting features; like a 135-foot abandoned mining tunnel carved into the hill behind the building that served as a cooler. It also has iron doors that help support part of the upper floor, and a water driven elevator that once transported the heavy cases of soda from the bottling room to the storage areas.

The threat from hazards to the transportation structures and systems that provide the public access to these cultural resources is relatively easy to define and quantify, however, the loss of revenue, were the public to be unable, due to transportation system failure, to visit these historic sites, would be difficult to define, and probably impossible to quantify. Since the transportation infrastructure is vital to the tourism industry. This particularly applies to historic transportation structures, such as "No Hands Bridge" (Figure 111-6), which can be damaged or destroyed by natural hazards, in particular earthquakes, landslides or floods. The historic structures were constructed long before modern codes that require seismic reinforcement. A major earthquake could cause substantial loss of these types of structures throughout the County. As the historic structures are, for practical purposes, irreplaceable then rebuilding after such a disaster would result in new structures that would not have the same character and the same value as the historic resources.

"Mountain Quarry Bridge", "Railroad Bridge", and finally the name, "No Hands Bridge," which it is known by today, was initially built by the Pacific Portland Cement Company to accommodate trains servicing an upstream rock quarry. It was the first concrete bridge of its kind in North America.

"No Hands" Bridge (Figure 111-6)

The bridge was completed on March 23, 1912, by 600 men working on the Placer County side and 200 more on the El Dorado side for $300,000. At the time of its construction, the bridge was the longest concrete arch bridge in the world.

High Potential Loss to Transportation Infrastructures and Critical Facilities

El Dorado County has inventoried high potential loss transportation infrastructures within the County along with critical facilities such as transportation maintenance sites and public transit facilities. 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 111-7 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 111-7. High Potential Loss Transportation Infrastructure and Critical Facilities

Type	Total Number in Inventory
Regional Roadway System – Miles of Roadway	1075
Bridges	93
Box Culverts	141
Public & Commercial Bus Transportation Systems	1
Airports – County owned/maintained	2
Park-and-Ride Facilities	14
Transportation Facilities & Maintenance Yards	7

Critical Transportation Related Facilities

The El Dorado County Department of Transportation's 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 seven main Transportation facilities and yards house the principal assets of the County Transportation Department for road maintenance, and are used for a variety of storage, repair, crew functions and administrative services. 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 most significant bridges and larger culverts are considered critical, all of which are susceptible to damage from hazards such as winter/seasonal storms, flooding, and earthquakes.

Still another group of critical transportation facilities are the areas airports and bus stations. Not only the facilities themselves but the roadways giving access to them would be critical for the residents of El Dorado County during any disaster event.

Wildfire

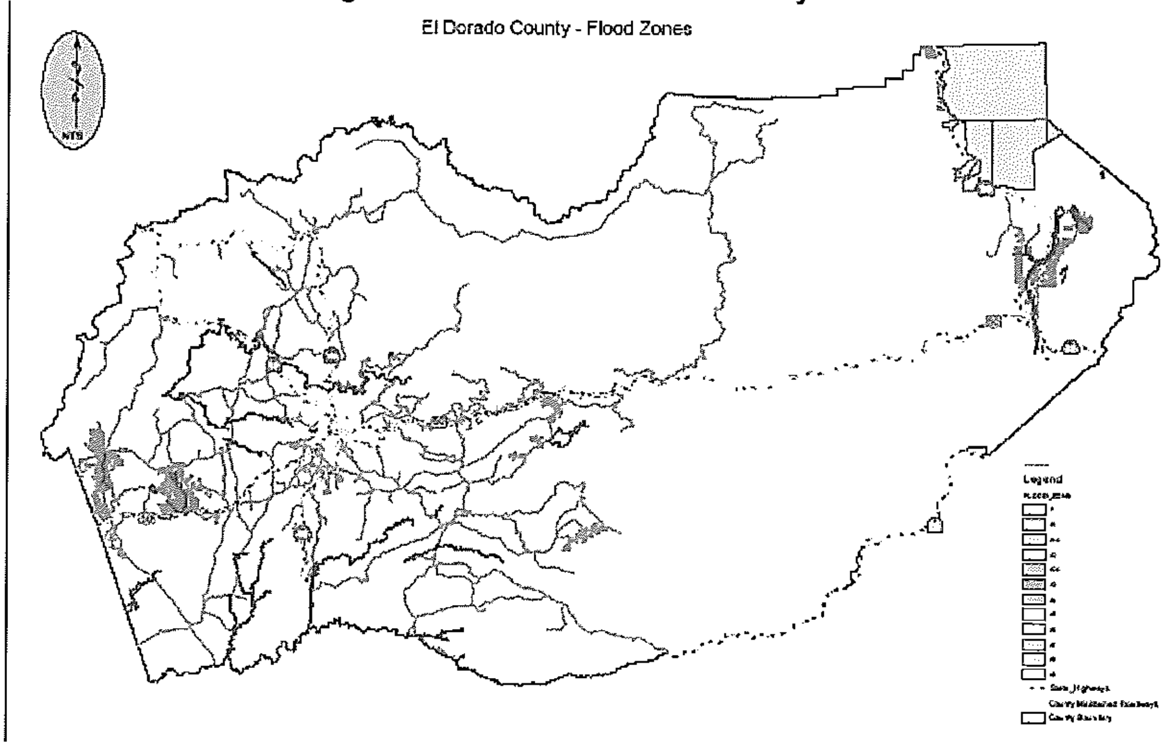
The threat of wildfires to the counties infrastructure along with the likelihood of occurrence is such a high risk that an entire section was devoted to this hazard.

See section titled "Wildland Fire Hazard Mitigation Plan" submitted by the El Dorado County Fire Safe Council and AEU CAL FIRE for a comprehensive assessment of this hazard.

Flood

The vulnerability assessment for flooding in El Dorado 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). Figure 111-8 shows a graphic representation of the GIS files identifying flood zones on a countywide scale.

Figure 111-8. Flood Zones 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 being outside of the 100-year flood zone. However, it is very likely that some of these areas, if analysis were done to clearly define the 100-year floodplain, would be vulnerable 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.

Flood/Dam Failure Inundation

The General Plan would have a significant impact if development would: place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or FIRM or other flood hazard delineation map; place within a 100-year flood hazard area structures that would impede or redirect floodflows; expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or result in inundation by Seiche or mudflow.

Impacts related to mudflows are addressed in Section IV of this Plan. Because the potential for seismic activities on the west slope of the county is low and development standards are required for buildings within the 100-year floodplain, Seiches are not expected to inundate any new development adjacent to lakes and reservoirs. As such, Seiches are not analyzed further in this subsection.

Risk of Exposure to Flood Hazards within the 100-Year Floodplain.

New development, including housing, could occur in the designated 100-year floodplain. The County's Flood Damage Prevention Ordinance contains development standards applicable to all development within the 100-year floodplain that protects development and occupants from flood hazards and prohibits redirection or obstruction of flood flow. The potential for exposure of people and property to flood hazards is low and new development in the 100-year floodway would not impede or redirect flood flows.

The land use map designates land uses within the FEMA 100-year floodplain. For purposes of this analysis, the General Plan land use designations have been categorized based on the maximum intensity of land use allowed by each of the General Plan land use maps, as shown below:

< **High intensity:** high-density residential, medium-density residential, low-density residential (i.e., lot sizes ranging from 5 to 10 acres), multifamily residential, industrial, commercial, research and development, public facilities, and the adopted plan.

< **Medium intensity:** tourist recreational, rural land, rural residential (i.e. lot sizes ranging from 10 to 40 acres), and agricultural land.

< **Low intensity:** natural resources and open space. In general, these are areas expected to continue to function largely as undeveloped open space areas.

Within the 100-year floodplain, the risk of exposure to flood conditions would be the greatest in areas designated as high-intensity land uses, because the highest amount of development and thus the greatest number of people would be exposed to flood hazards. Medium-intensity land uses would result in the exposure of less development and fewer occupants to flood hazards; thus the risk is reduced correspondingly. Very few structures and occupants would be expected in the low-intensity land uses areas; thus the risk is the least in these areas. The Table below shows the acreage in each category.

Designated Land Use Intensity Within the 100-Year Floodplain
General Plan Acreages of Various Intensity Land Uses
1996 General Plan

High	Medium	Low	Total
2,026	2,202	3,875	8,103

The acreage reflected under each of the land use intensity categories contains both developed and undeveloped lands. Development in the 100-year floodplain may be subject to property damage and occupants to injury or death caused by flood conditions during an 100-year flood event. Also, if critical emergency response facilities, such as hospitals, are constructed within the floodplain, the ability of the County to respond to emergencies during a flood event may be compromised.

Flood hazards may be averted by requiring new development to incorporate design measures that would protect structures and occupants from flood-related damage. Such hazards may also be averted by prohibiting certain types of development within the 100-year floodplain. The County's Flood Damage Prevention Ordinance has incorporated various requirements into the County Zoning Ordinance that are applicable to development within the floodplain. Building permits, which are required for both discretionary and ministerial development, are reviewed for consistency with the Flood Damage Prevention Ordinance before construction or development begins within the FEMA-designated 100-year floodplain (FEMA Flood Hazard Zones A and A1-30).

Developments within the floodplain are required to comply with development standards designed to minimize onsite flood damage. Within the floodplain, new construction and substantial improvements to existing structures require that the lowest floor be elevated above the 100-year flood elevation. New nonresidential buildings must either meet these requirements or provide an alternative method of flood-proofing that is certified by a registered architect or engineer and approved by the County Building Department. In all areas within the 100-year floodplain, compliance with specialized standards of construction are required, including anchoring of all new construction and substantial improvements, the use of materials and equipment resistant to flood damage, and the use of methods and practices that minimize flood damage (e.g. watertight doors, reinforcement of walls, anchoring of structures, and accessory items).

The Flood Damage Prevention Ordinance places even stricter standards on development within the floodway. Rivers and streams where FEMA has prepared detailed engineering studies may be designated as floodways. For most waterways, the floodway is where the water is likely to be deepest and fastest. It is the area of the floodplain that should be reserved (kept free of obstructions) to allow floodwaters to move downstream. Placing fill or buildings in a floodway may block the flow of water and increase flood heights (FEMA 2003). The ordinance requires engineering studies to demonstrate that any proposed structures or substantial improvements to existing structures would not increase the flood elevation before such structures or improvements may be permitted within the floodway

AT-RISK STRUCTURES

A GIS analysis was accomplished by comparing the FEMA FIRM mapping locations with the El Dorado County's Department of Transportation maps indicating location of roads, bridges, culverts and facilities and other related data. The datasets were compared in order to ascertain the total number of transportation structures that at least partially within the floodplain, and the number that are identified as being within the floodplain. An "annualized" estimate was created by multiplying the number of structures estimated to be within the 100-year floodplain by the typical value of a structure, 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 flood damage to transportation structures.

This same process was used to identify developed properties that may be impacted by flooding. Flood GIS data was compared with Assessor data files to identify the number of structures within a 250 ft buffer zone of the 100-year floodplain. There were a total of 1547 parcels identified within the buffer zone with a total value of $492,863,915.

The results of this analysis are presented in Table 111-9, which follows:

Table 111-9 Overview of At-Risk Transportation Structures in El Dorado County (100-Year Floodplain)

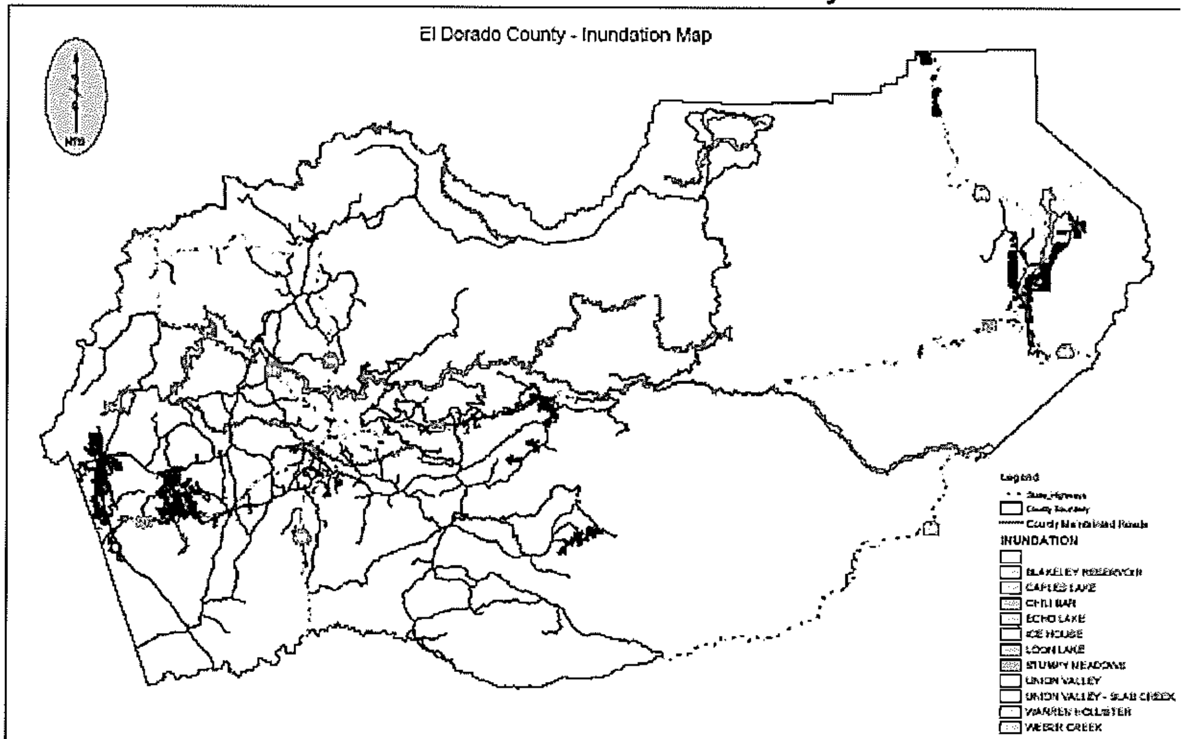
Total Number of Roadway miles with some portion within the 100 year floodplain	7.27
Total Number of Bridges within the 100 year floodplain	7
Total Number of Transportation Maintenance Facilities/Yards within the 100-year floodplain	0
Total value of potentially affected structures	$805,123.46
Annualized Loss Estimate	$8,051.23

Dam Failure/Inundation

The vulnerability assessment for dam failure in El Dorado 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 El Dorado 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 compared to the Transportation and Circulation maps derived from the Department of Transportation's files, to determine which inundation areas actually affected transportation infrastructure, or which could be developed requiring new transportation infrastructure (areas owned by government agencies such as the El Dorado National Forest or one of the reservoir-owning irrigation districts were not counted). Those dams with inundation areas that affected no County maintained transportation structures were not analyzed any further. Figure 111-10 reflects the dams and their inundation zones considered to have the potential to affect El Dorado County transportation systems.

Figure 111-10. Dams and Their Inundation Areas That Affect Transportation Infrastructures in El Dorado County



The process was similar to that carried out for FEMA flood zones in the section of this document concerning flooding. All of the developable transportation areas that fell within the inundation zones were counted, along with those containing transportation structures at the present time within the actual inundation zone. An estimate of 75% was used to predict the total number of structures at risk to inundation from any of the dams based on the probability that 75% of all transportation structures 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 111-11 shows the results:

Table 111-11. Results of Potential Dam Inundation Analysis

Total Transportation Dept structures that fall within a Dam Inundation Area	75% of Structures that are Potentially Affected	Value of Structures at Risk of Dam Failure Inundation	Annualized Risk based on 1/10,000 Threat of Dam Failure
41	**30**	**$ 4,644,597.26**	**$ 464.45**

Seiche

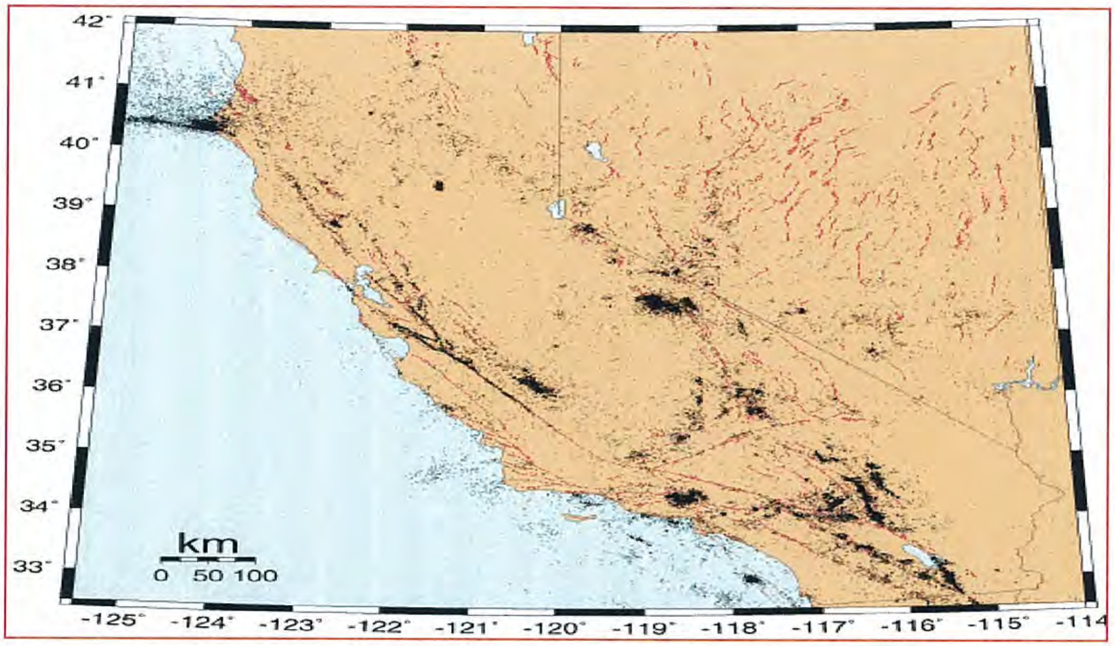
The risk for a Seiche wave for the area is considered to be unlikely, with a less than 1% per year chance of occurring. In the event of a Seiche wave the area affected, depending on the severity would be limited to infrastructure within the Tahoe Basin area.

Earthquakes, Landslides and Sinkholes

EARTHQUAKES

The 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. As indicated by the seismic activity map, Figure 111-12, the region of the state where El Dorado County is located, just east of Lake Tahoe, seldom suffers the effects of even a 2.5 magnitude earthquake. Earthquakes of that magnitude do little to no damage to transportation structures.

Figure 111-12 Recorded seismicity in California 1969 - 2000, Magnitude 2.5 and larger.



The above attempts to quantify the annual risk vulnerability to earthquakes but does not take into account the possible impacts to historic transportation structures that are particularly vulnerable. Although rare, if the County were to endure a seismic event of the larger variety, it might very well damage or destroy historic transportation structures. Having been built prior to modern code requirements, those structures are generally lacking the reinforcement and other provisions included in the structural design of modern transportation, leaving them more vulnerable to earthquake hazards. It is not practical to attempt an estimate for those structures, as they cannot be replaced.

SINKHOLES

There are no known incidences where structural 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 El Dorado County.

Subsidence as a result of previous underground mining activity could prove to be consequential in portions of El Dorado 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 roadways. However, portions of the City of Placerville are underlain by mine workings, and the threat could be more significant in that location.

Without an historical record of 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.

LANDSLIDES

As discussed in the Hazard Identification and Analysis Section II, there have been rare occurrences of landsliding or general instability in El Dorado County. Most of these have been in the higher elevations, along the South Fork of the American River, on the Highway 50 corridor, in eastern El Dorado County. Comprehensive mapping of these isolated areas that may have experienced landslides or are prone to experience landslides in the future has yet to be completed.

However, on January 24, 1997, after a long period of heavy rains, tons of earth gave way down a steep Sierra Nevada canyon slope and slid onto U.S. Highway 50. The since named Mill Creek landslide closed U.S. Highway 50 and briefly dammed (5 hours) the nearby South Fork of the American River, about 25 miles east of Placerville in El Dorado County. Highway 50, although a major transportation route through El Dorado County, is a State maintained highway. Therefore, the financial burden for cleanup, debris removal and road repairs of approximately $4.5 million dollars, fell to Caltrans. The indirect costs to the area residents along with the Tahoe Basin which relied heavily on tourists is estimated at being more than 1 million dollars a day, for the month period that the road was closed.

Many other large landslides along this corridor of the South Fork of the American River have moved in the geologic past, and some may impact Highway 50 in the future. Although most slides in this canyon are dormant during dry times, they typically become active during or following extended periods of rain or snow melt due to increased ground-water pressures. These elevated pressures, in turn, reduce the overall strength of the slope and induce down slope movement. Many landslides along the corridor move slowly, traveling perhaps only a few inches over many days. Occasionally, however, a landslide will move rapidly, traveling hundreds of fee in a matter of minutes, as did the Mill Creek landslide. Another occurrence upriver in 1983 closed the highway for 75 days, again however, with Highway 50 being State maintained, other than the economic losses from the highway closure; El Dorado County suffered no substantial loss.

Prior to the installation of monitors, landslide movement patterns and associated hydrologic conditions along Highway 50 were not systematically measured. During the wet winter of 1996, U.S. Forest Service geologists observed ground cracking in the hill slope that would later become the Mill Creek landslide. These field observations, however, were not sufficient to indicate that sudden and rapid movement would occur the following year.

Soon after the Mill Creek landslide, the USGS installed a real-time monitoring system at the nearby active Cleveland Corral Landslide. A real-time monitoring system provides near-continuous measurements on the hydrologic conditions and ground movement of the landslide. Data collected at such a continuous rate and in real-time will greatly increase the understanding of dynamic landslide activity and behavior in the Highway 50 corridor. The data will enable geologists to detect changes in landslide movement, monitor the rainfall and ground water conditions, and hopefully anticipate possible catastrophic movement at the Cleveland Corral landslide site.

The El Dorado 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.

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 lay across roadways, causing snarls in 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 roads 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 occur in Cameron Park along the main drainage and street crossings, along various sections of Latrobe Road near Deer Creek, and Pleasant Valley Road east of Gold Oak School. In addition, various locations in the County are occasionally subject to shallow flooding of streets which require sand-bagging to protect those facilities. 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. The 1997 heavy winter storms affecting the watershed regions of the Cosumnes and American Rivers resulted in the flooding of many communities in El Dorado County. This resulted in major infrastructure damages particularly damages to roadways, culverts and bridges.

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 as they were during the winter storms that triggered major floods along the South Fork of the American and the Cosumnes Rivers.

A summary of transportation infrastructure damages from the 1997 winter storm related floods is as follows:

Debris Removal from Roads, Bridges & Culverts	$ 58,684
Placing of Signs & Barricades, Closing Bridges & Roads	10,278
Road & Embankment Repairs/Replacements	416,373
Road & Culvert Repairs/Replacements	163,605
Road, Shoulder & Guard Rail Repairs/Replacements	75,452
Road Repairs/Replacements (washout/erosion)	227,803
Road & Bridge Repairs/Replacements	1,152,433
Dept of Transportation Water Retention Pond Repairs	2,890
Total Approximate Costs	$2,107,518

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 American and Consumes Rivers, as happened during the 1997 winter storm floods. However, other parts of the County infrastructure network affected by winter storms, not directly in these watersheds, are more common and difficult to predict due to the unknown location of future storm cell 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 $2 million in damages. Although the sample period is very short, the annualized cost is estimated at $400,000. Potential losses may be further inflated by additional factors not represented in this estimate, such as removal of snow from roadways.

A qualitative facet of vulnerability in El Dorado County is the broad manner in which severe seasonal storms, particularly snowfall, causes general disruption. Normal mobility is lost, as 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.

Erosion

As described in the Hazard Identification and Analysis Section, 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 so 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 El Dorado 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 El Dorado 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. With the exception of erosion caused by the 1997 Winter Storm Floods detailed earlier in the Winter Storm section of this document, the overall vulnerability of erosion as a hazard to the County is either negligible or currently undefined.

Avalanche

Avalanches can occur on any slope given the right conditions, however, certain times of the year and certain locations are more prone to avalanche than others. December to April is when most avalanches occur. This is the time when the snowfall amounts are highest in the mountain areas of El Dorado County.

Climbers, backcountry skiers, and snowmobilers are by far the most likely to be involved in avalanches. One of the major reasons for increasing avalanche fatalities is the boom in mountain industries and recreation. Skiing, hiking and other winter sports draw millions of people to the mountains. To support these activities, more roads are forced into avalanche prone areas. Most of the properties where these activities take place are either in Federal, State or privately owned lands. The overall vulnerability of avalanche as a hazard to the County is either negligible or currently undefined.

Conclusions on Hazard Risk

As explained in "Methodologies Used," a hybrid approach was employed to reconcile findings from both a quantitative assessment and a qualitative assessment (based on a scoring and ranking system scored by general consensus of the Local Hazard Mitigation Planning Committee). Table 111-13 summarizes the annualized expected losses for each hazard, which are a culmination of the quantitative assessment. The top hazard identified through this process is winter storms.

Table 111-13. Summary of Potential Annualized Losses (From Quantitative Assessment)

Hazard	Estimated Annualized Losses
Wildland Fire	Significant
Floods	8,051.23
Dam Failure	464.45
Earthquakes, Sinkholes and Landslides	Negligible
Winter Storms	421,503.60
Erosion	Negligible
Avalanche	Negligible

Based upon the qualitative approach defined in detail under Methodologies Used, the risk from natural hazards in El Dorado 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 111-14). The dominant hazard identified through this process is the wildfire hazard followed by the winter or seasonal storm hazard.

Table III-14. Hazard Risk Ratings (From Qualitative Assessment)

Hazard	Likelihood	Spatial Extent	Potential Impact	HAZARD RATING
Wildland Fire	3	2	3	**8**
Floods	2	2	3	**7**
Dam Failure	0	1	4	**5**
Seiche	0	1	2	**3**
Earthquakes, Sinkholes and Landslides	1	2	1	**4**
Winter / Seasonal Storms	3	3	2	**8**
Erosion	1	2	1	**4**
Avalanche	2	1	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 111-15). The hazards identified with the highest risk through this process are the wildland fire, winter/seasonal storm and resulting floods. The next highest is dam failure, which is categorized as high, in that while it is highly unlikely to occur, the results would be catastrophic. The remaining four moderate risk hazards identified are, earthquakes / sinkholes, landslides, erosion, Seiche, and avalanche.

Table III-15. Estimated Risk Levels for El Dorado County (Combination of Qualitative and Qualitative Assessments)

HIGH RISK HAZARDS	Wildland Fire, Winter / Seasonal Storms; & resulting Floods;
MODERATE RISK HAZARDS	Dam Failure Earthquakes, Sinkholes, and Landslides; Erosion, Avalanche
LOW RISK HAZARDS	None Identified

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.

In conclusion, while El Dorado County's infrastructure is susceptible to a wide range of natural hazards to varying degrees, the hazard of Wildland Fire, Winter/Seasonal Storms and the resulting floods, is 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* section of this Plan.

IV. Hazard Mitigation Goals and Policies

INTRODUCTION:

A **Local Hazard Mitigation Plan (LHMP)** is a local government plan that is designed to reduce or eliminate risks to people and property from natural and man-made hazards. Mitigation strategies are supported by state government and federal programs, in line with the Disaster Mitigation Act.

The need for hazard mitigation has become more recognized over the past few years due to the large number of natural hazards which have occurred in the U.S and the increase in the costs to achieve post disaster recovery. Money spent prior to a hazardous event to reduce the impacts of a disaster can result in substantial savings in life and property following the event. The benefits of implementing a mitigation program usually far outweigh the costs. Because of this, the Federal Emergency Management Agency (FEMA) and the states have developed national and state Mitigation strategies and funding is becoming increasingly more available to support hazard mitigation efforts.

The advantages of developing a local LHMP program are numerous and include:

1. Guidance in developing pre and post mitigation plans;
2. Identifying priority projects and programs for funding; and
3. Increasing the likelihood of State and Federal funding for pre- and post-hazard mitigation projects.

PLANNING and PRIORITIZATION PROCESS:

The data used to build our mitigation strategies and priorities was acquired through several sources and they include:

1. Collecting data from previous disaster events that have occurred here and in similar jurisdictions;
2. Actively engaging community members, and public agency representatives at scheduled-publicized meetings to identify and prioritize the hazards that exist, and what can, and should be done to eliminate, and or minimize these hazards; and
3. An analysis of mitigation strategies that have proven to be cost effective in eliminating, and or mitigating the affects of disaster events.
4. Participation in our regularly scheduled multi-agency/disciplinary Disaster Council meetings where this subject has been an ongoing matter for discussion.
5. Participation in the Bi-State Governor's Commission on the Angora Fire in South Lake Tahoe.
6. Creation of a Multi-agency-disciplinary LHMP Planning Team.

Following a thorough hazard, risk and vulnerability analysis by all who have participated in this effort, mitigation strategies were then developed to eliminate, and/or mitigate the dangers that exist to life and property. When participants (Community members, first responders, Disaster Council, LHMP Planning Team) were asked to identify and rate in priority the hazards they had identified, there was a very clear consensus that wildfire was number one

(1), with flooding number two (2), threats from avalanche and rock slides being number three (3), and acts of terrorism number four (4). The prioritization of mitigation actions followed this list of priorities. There was little interest from those involved in the plan update to address in the Mitigation Action Plan those hazards that have a low frequency of occurrence, low or high impact potential.

Wildland fires have impacted our county on numerous occasions, and as recently as 2007 with the Angora fire in South Lake Tahoe. The Angora fire burned 3,400 acres of forest, and destroyed 254 homes before it was contained. In the aftermath of the fire, the governors of California and Nevada called for a bi-state commission to review why this fire was so devastating, and to consider the "lessons Learned" in future development, vegetation management and fire mitigation work. The California – Nevada Tahoe Basin Fire Commission report (with mitigation actions) can be found at: http://resources.ca.gov/TahoeFireCommission/. We can reasonably predict based on past wildland fire activity and the conditions that exist today, and into the future, a major and highly destructive wildland fire will once again occur. Our wildland fire threat is so severe we devoted an entire section of this plan to that one specific hazard.

Hazards relating to flooding and mitigation are also seen as needing priority attention for prevention and mitigation action. When we have significantly heavy rainfall, and or rainfall combined with significant snowmelt, water will tend to go over the banks of rivers, creeks and streams. What can compound flooding is when vegetation and debris has been allowed to build up in the channels and that in turn adds to water running over banks. A culverts that is too small for drainage will also cause water to flow out and damage nearby structures and infrastructure.

To mitigate the potential for wildland fires and other identified hazards, the County and several of its political sub-divisions have successfully applied for, and been awarded FEMA mitigation grant funds. These funds have been used to mitigate our wildland fire threat by reducing fuel loads, creating fuel breaks, and defensible space around homes. Flooding hazards have been reduced by enlarging culverts, and clearing streams, creeks, and drainages of debris and excess vegetation. Prior lessons learned and mitigations strategies have been included in the County's General Plan (Adopted 2004).

The Angora Fire has underscored the need for a comprehensive review of fire prevention and fuels management practices in the Lake Tahoe Basin, and on July 5, 2007, Nevada Governor Jim Gibbons publicly invited California Governor Arnold Schwarzenegger to join him in establishing a joint fire commission to review fuels management of forests in the Tahoe Basin as well as the policies and procedures of the various agencies that govern fuels management within the Basin. (The Emergency California-Nevada Tahoe Basin Fire Commission Report, May 2008)

The California-Nevada Tahoe Basin Fire Commission's report includes 48 findings and 90 recommendations. They are organized into six categories that address both, short- and long-term needs, policy changes, education, funding, governmental structures, and environmental practices related to Lake Tahoe's vulnerability to wildfire.

IV. Hazard Mitigation Goals and Policies

The Commission's challenge from the Governors was to take a treasured jewel, two states, and a diverse community, strongly held beliefs, the work of many regulatory agencies, and the input of a concerned public to create a set of recommendations to reduce the risk of wildfire to Lake Tahoe. The Commission's report recommends some change from past practices.

The information developed as a result of this planning effort for all of the hazards identified will be considered for adoption in other planning mechanisms such as the County's General Plan and Zoning Ordinances.

Although no new hazards and vulnerabilities have been identified since the development of our 2004 LHMP, we have refined some goals and mitigation strategies. The current fiscal crisis has had an impact on staffing levels, grant funding opportunities and the amounts of those grants. Lack of staff and funding will no doubt have a negative impact on our ability to carry out some mitigation strategies. One positive aspect is that the cost of some vegetation management and fuel reduction work has been reduced in some cases by thirty percent (30%). You will see in our mitigation strategies our first efforts are with what can be accomplished with paid and volunteer staff. Staff time is more reliable when considering the potential costs of starting and completing a project. Other mitigation strategies are projects we would like to accomplish if grant funds are awarded.

ADMINISTRATION

This plan is a multi-jurisdictional plan that includes the participation of many public and private agencies. Participating agencies have discussed the formation of joint powers authority (JPA), and or Firesafe Council to apply for and administer mitigation grant funds. Since wildland fires are a number one priority concern for all of the participants involved in this plan, a JPA may be the best means by which to collectively address the hazard across jurisdictional lines, and enhance our opportunities to successfully be awarded grant funding. The JPA, and or Firesafe Council would also manage the grant and the work to be done.

Some jurisdictions may elect to apply for grants and implement – manage their projects on their own. This may be more effective and efficient when the mitigation project focuses on a particular type of mitigation for a specific hazard in a geographic area. Our wildland fire hazard poses an extreme and imminent danger to life and property and mitigating actions must be taken immediately. The wildland fire section (Tab H) identifies with specifics the projects (location, type of mitigation, cost-benefit analysis) that we hope to fund with grant monies as there are no General Funds available now or in the near future.

There are 566,000 acres in El Dorado County where CAL FIRE has the primary responsibility for wildland fire protection, we refer to these lands as State Responsibility Area (SRA), and the remaining acres are the responsibility of the US Forest Service or Local Government. Federal lands are not covered by this Hazard Mitigation Plan. The SRA lands are broken into three Fire Hazard Severity Zones; Moderate, High and Very High. There are over 311,000 acres (40,000 parcels) in the Very High Severity Zone. The value of structures in the Very High Severity Zone is over 3.8 billion dollars (average value per acres is $12,257.00). The average cost to do fuel reduction projects in the Very High Severity Zone is $1,000/acre, obviously the cost to mitigate and prevent large damaging fires is much less than the value. This does not include the value of the water or other resources that are destroyed during a devastating wildlife.

In the Annex section of this plan you will find documentation from participating jurisdictions on the mitigation projects they intend on applying for with FEMA. Again, all have voiced that there is no General Fund monies for mitigation work other than what can be accomplished through employees on straight-time conducting outreach education programs to the public, and their work in enforcing building codes, zoning ordinances, and other regulatory actions that help prevent, and/or mitigate disaster events. Grant funding is an essential element to accomplish many of the other mitigation projects we hope to accomplish.

Several agencies will seek grant funds to enlarge culverts and remove debris from rivers, creeks and streams that pose a hazard for flooding. Enlarging culverts are a one-time enhancement that will aid in preventing, and/or mitigating floods. The cost of culvert enlargement can be as little as $2,000 dollars and in turn protect several million dollars worth of structures, household contents, and prevent damage to infrastructure. Vegetation and debris clearing from rivers, creeks and streams is equally inexpensive given the protection it can provide from flooding. The only issue is that there will have to be on-going debris and vegetation clearing. Both efforts are seen as high priority projects.

Avalanche and rock slides pose a threat to our roadways and water delivery systems. Agencies will be taking mitigative action to minimize and/or eliminate these potential hazards by acquiring grants funds to stabilize slopes and protect infrastructure with various kinds of barriers. Some water delivery systems are located in environments where they are at greater risk of being damaged and/or destroyed by a wildland fire.

Protection of critical facilities from terrorist attack was of significant concern for public safety agencies and utility companies. They see their facilities and infrastructure for water storage and conveyance, power transmission as being very vulnerable to attack. Protecting water purity is also a priority concern. These agencies will be pursuing grant funds for training of staff in terrorism awareness and response – recovery operations. Additional grants will be sought to harden their facilities and infrastructure for detection and prevention of intrusion. A terrorist attack on critical facilities, infrastructure, and water quality could result in great loss of life, and millions of dollars in property damage and lost business revenue. The costs associated with training employees ($25,000) and hardening of facilities with improved fences, locking devices and detection devices ($500,000) is minimal given the potential loss in life, property and revenues (business trade and taxes) that can occur.

IMPLEMENTATION

This section provides the County and the participants in this multi-hazard mitigation plan with the basis for action. Based on the findings of the *Risk and vulnerability Assessment* and goals, and actions that follow are intended to guide both the day-to-day operations and the long-term approach to be taken to reduce the impacts of hazards. In order to achieve these aims, the following section has been separated into the following components:

- **Goals, Objectives and Activities**
- **Mitigation Goals**
- **Benefit-Cost Analysis and Effectiveness of Mitigation Measures**
- **Identification and Analysis of Mitigation Measures**
- **Identification of Mitigation Techniques**
- **El Dorado County General Plan – Safety Element (Policies, Goals, Objectives and Implementation plans**
- **Community and Participating Agency Contributions to the LHMP**
- **Mitigation Action Plans**

The plan is designed to be both comprehensive and strategic in nature. That is, the plan provides a comprehensive review of hazards and identifies far-reaching policies and projects intended to not only reduce the future impacts of hazards, but also assist LHMP participants in achieving compatible economic, environmental and social goals. In addition, the plan is strategic, in that all policies and projects are linked to responsible agencies for their implementation.

The crucial basis for action in this plan can be found in the *Mitigation Action Plan* (MAP), which lists in priority the specific actions to be taken, their benefit-cost analysis, those responsible for their implementation, potential funding sources that may be used, and an estimated target date for completion. Each action will be listed with this accompanying information. This approach provides those in charge of the plan's implementation important planning and monitoring tools. The collection of actions also serves as an easily understood menu of policies and projects for decision makers. At the present time, the MA will be addressing the higher priority hazards that have a higher frequency of occurrence and high potential for impact on populations, property, economic and social concerns.

GOALS, OBJECTIVES AND ACTIVITIES

The purpose of this section is to describe the general goals and objectives of the LHMP. In order to be effective, these goals and objectives must be achievable. Before adopting these goals, objectives and especially the mitigation measures (actions), consideration was given to the Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLEE) criterion. By establishing achievable goals and objectives the various groups involved in the LHMP update planning process can see that their efforts are making a difference and involvement in other mitigation efforts can be achieved.

As local plans are submitted for review and approval, the risk assessment outlined in this plan will be updated accordingly. As part of that process, the goals and objectives outlined in this plan will also be reviewed and updated as needed to reflect the current situation in the county.

Every mitigation project that is considered and undertaken should, at the very minimum, have as its final result the potential to reduce the affects of a future disaster event.

Planning Approach

In order to guide the actions of those charged with implementation, the Plan follows a traditional planning approach. First, the goals are designed to meet the intent of the Plan. Next, mitigation actions are identified and tied to established goals and priorities. Each step is intended to provide a clearly defined set of policies and projects based on a rational framework for action. The components of the planning framework are explained in greater detail below:

Goals:	Goals represent broad statements that are achieved through the implementation of more specific, action-oriented policies or projects. Goals provide the framework for achieving the intent of the Plan.
Proposed Hazard Mitigation Policies:	Policies are defined here as an ongoing course of action agreed to by members of the LHMP Planning Team. If appropriate, potential funding sources are listed.
Proposed Hazard Mitigation Projects:	Projects are defined as actions taken to address defined vulnerabilities to populations, new and existing buildings and infrastructure. Potential funding sources are listed for each project.
Mitigation Action Plan:	The MAP is a prioritized list of action strategies (policies and projects), each of which includes a categorization of the mitigation technique, the hazards addressed, the individual or organization responsible for implementation, an estimated timeline for completion, and a series of potential funding sources.

MITIGATION GOALS

The Mitigation Goals and action steps identified in the Mitigation Action Plan were developed from the information received from our community meetings, Disaster Council meetings, subject matter experts, research, participating agencies, and Planning Team.

Goal #1 Implement policies and projects designed to reduce or eliminate the impacts of hazards on people and property.

Goal #2 **Collect and utilize data, including conducting necessary studies and analyses, in order to provide the information needed to improve policymaking and the identification of appropriate mitigation projects.**

Goal #3 **Improve planning processes in order to reduce the impact of hazards on people and property.**

Goal #4 **Enhance compliance capabilities in order to reduce the impacts of hazards on people and property.**

Goal #5 **Enhance the use of natural resource protection measures as a means to reduce the impacts of hazards on people and property.**

Goal #6 **Obtain additional resources necessary to reduce the impact of hazards on people, property and economic sustainability.**

Goal #7 **Provide structure and enhancement of training, education and outreach efforts describing the potential effects of hazards and the means to increase resiliency.**

Goal #8 **Continue to participate in the National Flood Insurance Program (NFIP).**

Goal #9 **Continue to provide National Incident Management System (NIMS) training to all first responders.**

BENEFIT-COST ANALYSIS AND EFFECTIVENESS OF MITIGATION MEASURES

A key criterion for mitigation projects to be eligible for funding is that they must be cost-effective. If the project benefits are higher than the project costs, then the project is cost-effective.

In order to ensure a consistent approach in determining the cost-effectiveness of all mitigation projects, participating agencies will use the FEMA Benefit Cost Analysis (BCA) module and process. Since this is also the method used by FEMA to determine the cost-effectiveness of a project, it is only reasonable that we use the same method. The benefit cost analysis (BCA) is an assessment of the mitigation project application data to determine whether the cost of investing federal/state/local funds in a hazard mitigation project is justified by the prevented or reduced damages from future disasters. With limited project data and streamlined benefit-cost methods, a cost-effectiveness determination can usually be made quickly and accurately.

It is understood that a positive benefit cost ratio (greater than one) does not necessarily guarantee that a hazard mitigation project will be approved. However, by applying project specific information to the benefit cost analysis module we can get a good initial look at the mitigation potentials associated with that project. The results of this analysis can also help communities evaluate current and future mitigation projects and adjust their overall mitigation strategy accordingly.

The following information serves to summarize the three-step process of determining a mitigation project's cost-effectiveness. This process is used for determining the cost-effectiveness of all mitigation project applications regardless of the type of mitigation measure.

It is important to understand that benefit cost analysis is basically the same for each type of hazard mitigation project. The only differences are the types of data that are used in the calculations, depending on whether the project is for wildland fires, floods, hurricanes, tornados, earthquakes etc.

1. Cost-effectiveness is determined by comparing the project cost to the value of damages prevented after the mitigation measure. Given an example where the project cost is $1,000 and the value of damages prevented after the mitigation measure is $2,000.

2. Because the dollar-value of benefits exceeds the cost of funding the project, the project is cost-effective. This relationship is depicted numerically by dividing the benefits by the costs, resulting in a benefit cost ratio (BCR). The BCR is simply a way of stating whether benefits exceed projects costs, and by how much.

3. To derive the BCR, divide the benefits by the cost ($2,000/ $1,000). If the result is 1.0 or greater, then the project is cost-effective. In this instance, the BCR is 2.0, which exceeds the 1.0 level.

4. On the other hand, if the cost of the project is $2,000 and the benefits are only $1,000, the project would have a BCR of 0.50 ($1,000/ $2,000) and would not be cost-effective.

While the example mentioned above may be a simple one, the process and the benefit cost analysis calculations associated with it are basically the same for all mitigation projects.

IDENTIFICATION OF MITIGATION TECHNIQUES

Prevention

Prevention activities are intended to keep hazard-related problems from getting worse. They are particularly effective in limiting a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of prevention activities include:

- Planning and zoning;
- Hazard mapping;

- Building codes;
- Studies / data collection and analysis;
- Fuel load reductions
- Open space preservation;
- Floodplain regulations;
- Stormwater management;
- Drainage system maintenance;
- Capital improvements programming; and
- Riverine setbacks.

Property Protection

Property protection measures are intended to enable structures to better withstand hazard events, remove structures from hazardous locations, or provide insurance to cover potential losses. Examples include:

- Acquisition;
- Relocation;
- Building elevation;
- Critical facilities protection or "hardening";
- Retrofitting (i.e., wind proofing, flood proofing, seismic design standards, etc.);
- Insurance; and
- Safe room construction.

Natural Resource Protection

Natural resource protection activities reduce the impact of hazards by preserving or restoring the function of environmental systems. In some cases, natural systems may include high hazard areas such as floodplains, steep sloped areas or barrier islands. Thus, natural resource protection measures can serve the dual purpose of protecting lives and property while enhancing environmental goals such as improved water quality or recreational opportunities. Parks, recreation or conservation agencies and organizations often implement natural resource protection measures. Examples include:

- Floodplain protection;
- Riparian buffers;
- Fire resistant landscaping;
- Best management practices
- Fuel breaks;
- Erosion and sediment control;
- Wetland preservation and restoration;
- Habitat preservation; and

- Slope stabilization.

Structural Projects

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

- Reservoirs;
- Levees / dikes / floodwalls;
- Diversions / Detention / Retention;
- Beach nourishment;
- Channel modification; and
- Storm sewer construction.

Emergency Services

Although not typically considered a "mitigation technique," emergency services can significantly reduce injuries and loss of life associated with hazards. These actions are typically taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems;
- Search and rescue;
- Evacuation planning and management; and
- Flood "fighting" techniques.

Public Information and Awareness

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

- Outreach and education;
- Speaker series, demonstration events;
- Real estate disclosure; and
- Training.

EL DORADO COUNTY GENERAL PLAN – Safety Element (Policies, Goals, Objectives and Implementation Measures)

GENERAL

IV. Hazard Mitigation Goals and Policies

GOAL 6.1: COORDINATION

A coordinated approach to hazard and disaster response planning.

OBJECTIVE 6.1.1: EL DORADO COUNTY OPERATIONAL AREA MULTI-HAZARD EMERGENCY OPERATIONS FUNCTIONAL PLAN

The El Dorado County Operational Area Multi-Hazard Emergency Operations Functional Plan shall serve as the implementation program for this Goal.

Policy 6.1.1.1 The El Dorado County Operational Area Multi-Hazard Emergency Operations Functional Plan shall serve as the implementation program for the coordination of hazard planning and disaster response efforts within the County. The County will ensure that the El Dorado County Operational Area Multi-Hazard Emergency Operations Functional Plan is updated on a regular basis to keep pace with the growing population.

IMPLEMENTATION
MEASURE HS-A

Responsibility: Maintain emergency response procedures and programs, including agreements with other local, state, and federal agencies, to provide coordinated disaster response and programs to inform the public of emergency preparedness and response procedures. [Policy 6.1.1.1] Responsibility:	Sheriff's Department (Office of Emergency Services), County Administrative Officer, Department of Transportation, Environmental Management, and General Services Department
Time Frame: Immediate and on-going.	Ongoing review and updating of the Operational Area Multi-Hazard Functional Emergency Operations Plan.

FIRE SAFETY

GOAL 6.2: FIRE HAZARDS

Minimize fire hazards and risks in both wildland and developed areas.

OBJECTIVE 6.2.1: DEFENSIBLE SPACE

All new development and structures shall meet "defensible space" requirements and adhere to fire code building requirements to minimize wildland fire hazards.

Policy 6.2.1.1 Implement Fire Safe ordinance to attain and maintain defensible space through conditioning of tentative maps and in new development at the final map and/or building permit stage.

Policy 6.2.1.2 Coordinate with the local Fire Safe Councils, California Department of Forestry and Fire Protection, and federal and state agencies having land use jurisdiction in El Dorado County in the development of a countywide fuels management strategy.

OBJECTIVE 6.2.2: LIMITATIONS TO DEVELOPMENT

Regulate development in areas of high and very high fire hazard as designated by the California Department of Forestry and Fire Prevention Fire Hazard Severity Zone Maps.

Policy 6.2.2.1 Fire Hazard Severity Zone Maps shall be consulted in the review of all projects so that standards and mitigation measures appropriate to each hazard classification can be applied. Land use densities and intensities shall be determined by mitigation measures in areas designated as high or very high fire hazard.

Policy 6.2.2.2 The County shall preclude development in areas of high and very high wildland fire hazard or in areas identified as "urban wildland interface communities within the vicinity of Federal lands that are a high risk for wildfire," as listed in the Federal Register of August 17, 2001, unless such development can be adequately protected from wildland fire hazard, as demonstrated in a Fire Safe Plan prepared by a Registered Professional Forester (RPF) and approved by the local Fire Protection District and/or California Department of Forestry and Fire Protection.

OBJECTIVE 6.2.3: ADEQUATE FIRE PROTECTION

Application of uniform fire protection standards to development projects by fire districts.

Policy 6.2.3.1 As a requirement for approving new development, the County must find, based on information provided by the applicant and the responsible fire protection district that, concurrent with development, adequate emergency water flow, fire access, and fire fighting personnel and equipment will be available in accordance with applicable State and local fire district standards.

Policy 6.2.3.2 As a requirement of new development, the applicant must demonstrate that adequate access exists, or can be provided to ensure that emergency vehicles can access the site and private vehicles can evacuate the area.

Policy 6.2.3.3 Day care centers shall be subject to conformance with all applicable sections of Title 19 of the Fire Code.

Policy 6.2.3.4 All new development and public works projects shall be consistent with applicable State Wildland Fire Standards and other relevant State and federal fire requirements.

OBJECTIVE 6.2.4: AREA-WIDE FUEL MANAGEMENT PROGRAM

Reduce fire hazard through cooperative fuel management activities.

Policy 6.2.4.1 Discretionary development within high and very high fire hazard areas shall be conditioned to designate fuel break zones that comply with fire safe requirements to benefit the new and, where possible, existing development.

Policy 6.2.4.2 The County shall cooperate with the California Department of Forestry and Fire Protection and local fire protection districts to identify opportunities for fuel breaks in zones of high and very high fire hazard either prior to or as a component of project review.

OBJECTIVE 6.2.5: FIRE PREVENTION EDUCATION

Inform and educate homeowners regarding fire safety and prevention.

Policy 6.2.5.1 The County shall cooperate with the U.S. Forest Service, California Department of Forestry and Fire Protection, and local fire districts in fire prevention education programs.

MEASURE HS-B

Work with the local Fire Safe Councils, fire protection districts, U.S. Forest Service, and California Department of Forestry and Fire Protection to develop and implement a countywide Wildfire Safety Plan. The Wildfire Safety Plan shall focus on, but not be limited to, the following:

- Public wildfire safety education;
- Basic fire protection standards for different areas of the county;
- Appropriate mitigation for development in areas having high and very high fuel hazards;
- Opportunities for fire fuel reduction;
- Implementation of fire safe standards;
- Coordination with fire protection districts
- Fuels management standards to apply to new development adjacent to forested areas and within greenbelts; and
- Appropriate standards for open space and greenbelts.

[Policies 6.2.1.1, 6.2.4.2, and 6.2.5.1]

Responsibility:	Planning Department, Department of Transportation, and Building Department

Time Frame:	Develop draft plan within six months of General Plan adoption.

GEOLOGIC AND SEISMIC HAZARDS

ASBESTOS

Asbestos is of special concern in El Dorado County because it occurs naturally in surface deposits of several types of ultramafic materials (materials that contain magnesium and iron and a very small amount of silica). Asbestos emissions can result from the sale or use of asbestos-containing materials, road surfacing with such materials, grading activities, and surface mining.

The El Dorado County Air Quality Management District (AQMD) is responsible for implementing and enforcing asbestos-related regulations and programs. This includes implementation of Title 17, Sections 93105 and 93106 of the California Code of Regulations (Asbestos Airborne Toxic Control Measure-Asbestos-Containing Serpentine) and the County's Naturally Occurring Asbestos and Dust Protection Ordinance. Regulated activities include construction or digging on a site containing naturally occurring asbestos in rock or soils and the sale and use of serpentine material or rock containing asbestos materials for surfacing. Asbestos-related measures presented in this General Plan are focused on supporting the actions of the AQMD.

GOAL 6.3: GEOLOGIC AND SEISMIC HAZARDS: Minimize the threat to life and property from seismic and geologic hazards.

OBJECTIVE 6.3.1: BUILDING AND SITE STANDARDS
Adopt and enforce development regulations, including building and site standards, to protect against seismic and geologic hazards.

Policy 6.3.1.1 The County shall require that all discretionary projects and all projects requiring a grading permit, or a building permit that would result in earth disturbance, that are located in areas likely to contain naturally occurring asbestos (based on mapping developed by the California Department of Conservation [DOC]) have a California-registered geologist knowledgeable about asbestos-containing formations inspect the project area for the presence of asbestos using appropriate test methods. The County shall amend the Erosion and Sediment Control Ordinance to include a section that addresses the reduction of thresholds to an appropriate level for grading permits in areas likely to contain naturally occurring asbestos (based on mapping developed by the DOC). The Department of Transportation and the County Air Quality Management District shall consider the requirement of posting a warning sign at the work site in areas likely to contain naturally occurring asbestos based on the mapping developed by the DOC.

Policy 6.3.1.2 The County shall establish a mandatory disclosure program, where potential buyers and sellers of real property in all areas likely to contain naturally occurring asbestos (based on mapping developed by the California Department of Conservation [DOC]) are provided information regarding the potential presence of asbestos subject to sale. Information shall include potential for exposure from access roads and from disturbance activities (e.g., landscaping).

Policy 6.3.1.3 The County Environmental Management Department shall report annually to the Board of Supervisors regarding new information on asbestos and design an information outreach program.

OBJECTIVE 6.3.2: COUNTY-WIDE SEISMIC HAZARDS

Continue to evaluate seismic related hazards such as liquefaction, landslides, and avalanche, particularly in the Tahoe Basin.

Policy 6.3.2.1 The County shall maintain updated geologic, seismic and avalanche hazard maps, and other hazard inventory information in cooperation with the State Office of Emergency Services, California Department of Conservation--Division of Mines and Geology, U.S. Forest Service, Caltrans, Tahoe Regional Planning Agency, and other agencies as this information is made available. This information shall be incorporated into the El Dorado County Operational Area Multi-Hazard Functional Emergency Operations Plans.

Policy 6.3.2.2 Future subdivision in the area around Fallen Leaf Lake shall be precluded.

Policy 6.3.2.3 An avalanche overlay zone shall be established and applied to all residential areas subject to avalanche. All new structures located within avalanche susceptible areas shall be designed to withstand the expected forces of such an event.

Policy 6.3.2.4 *intentionally blank*

Policy 6.3.2.5 Applications for development of habitable structures shall be reviewed for potential hazards associated with steep or unstable slopes, areas susceptible to high erosion, and avalanche risk. Geotechnical studies shall be required when development may be subject to geological hazards. If hazards are identified, applicants shall be required to mitigate or avoid identified hazards as a condition of approval. If no mitigation is feasible, the project will not be approved.

MEASURE HS-C

Develop a program to collect, maintain, and update geological, seismic, avalanche, and other geological hazard information. [Policy 6.3.2.1]

Responsibility:	Planning Department and Sheriff's Department (Office of Emergency Services)
Time Frame:	Develop program within five years of General Plan adoption.

MEASURE HS-D

Develop and adopt standards to protect against seismic and geologic hazards. [Objective 6.3.1]

Responsibility:	Planning Department, Building Department, and Department of Transportation
Time Frame:	Develop standards within five years of General Plan adoption.

. **MEASURE HS-E**

The County shall adopt a Naturally Occurring Asbestos Disclosure Ordinance that includes the provisions in the policy described in Policy 6.3.1.2.

Responsibility:	Environmental Management
Time Frame:	Present ordinance to Board of Supervisors within three years of General Plan adoption.

. **MEASURE HS-F**

Develop a program to track asbestos-related information as it pertains to El Dorado County. [Policy 6.3.1.3]

Responsibility:	Environmental Management
Time Frame:	Develop program within one year of General Plan adoption. Report results to the Board of Supervisors annually.

MEASURE HS-G

Adopt California Building Code revisions. [Policy 6.3.2.4]

Responsibility:	Building Department

Time Frame:	Adopt revisions as UBC changes are promulgated (ongoing).

FLOOD HAZARDS

GOAL 6.4: FLOOD HAZARDS

Protect the residents of El Dorado County from flood hazards.

OBJECTIVE 6.4.1: DEVELOPMENT REGULATIONS

Minimize loss of life and property by regulating development in areas subject to flooding in accordance with Federal Emergency Management Agency (FEMA) guidelines, California law, and the El Dorado County Flood Damage Prevention Ordinance.

Policy 6.4.1.1 The County shall continue participation in the National Flood Insurance Program and application of flood plain zoning regulations.

Policy 6.4.1.2 The County shall identify and delineate flood prone study areas discovered during the completion of the master drainage studies or plans.

Policy 6.4.1.3 No new critical or high occupancy structures (e.g., schools, hospitals) shall be located in the 100-year floodplain of any river, stream, or other body of water.

Policy 6.4.1.4 Creation of new parcels which lie entirely within the 100-year floodplain as identified on the most current version of the flood insurance rate maps provided by FEMA or dam failure inundation areas as delineated in dam failure emergency response plans maintained by the County shall be prohibited.

Policy 6.4.1.5 New parcels which are partially within the 100-year floodplain or dam failure inundation areas as delineated in dam failure emergency response plans maintained by the County must have sufficient land available outside the FEMA or County designated 100-year floodplain or the dam inundation areas for construction of dwelling units, accessory structures, and septic systems. Discretionary applications shall be required to determine the location of the designated 100-year floodplain and identified dam failure inundation areas on the subject property.

MEASURE HS-G

Adopt California Building Code revisions. [Policy 6.3.2.4]

Responsibility:	Building Department
Time Frame:	Adopt revisions as UBC changes are promulgated (ongoing).

MEASURE HS-H

Continue to participate in the Federal Flood Insurance Program, maintain flood hazard maps and other relevant floodplain data made available by other sources, and revise or update this information as new information becomes available. In its review of applications for building permits, discretionary project applications, and capital improvement proposals, the County shall determine whether the proposed project is within the 100-year floodplain based on these data. [Policies 6.4.1.1, 6.4.1.2, and 6.4.1.3]

Responsibility:	Planning Department, Building Department, Department of Transportation, and General Services Department
Time Frame:	Ongoing

OBJECTIVE 6.4.2: DAM FAILURE INUNDATION

Protect life and property of County residents below dams.

Policy 6.4.2.1 Apply a zoning overlay for areas located within dam failure inundation zones as identified by the State Department of Water Resources Division of Safety of Dams.

Policy 6.4.2.2 No new critical or high occupancy structures (e.g., schools, hospitals) should be located within the inundation area resulting from failure of dams identified by the State Department of Water Resources Division of Safety of Dams.

HAZARDOUS MATERIALS

GOAL 6.6: MANAGEMENT OF HAZARDOUS MATERIALS

Recognize and reduce the threats to public health and the environment posed by the use, storage, manufacture, transport, release, and disposal of hazardous materials.

OBJECTIVE 6.6.1: REGULATION OF HAZARDOUS MATERIALS

Regulate the use, storage, manufacture, transport and disposal of hazardous materials in accordance with State and Federal regulations.

Policy 6.6.1.1	The Hazardous Waste Management Plan shall serve as the implementation program for management of hazardous waste in order to protect the health, safety, property of residents and visitors, and to minimize environmental degradation while maintaining economic viability.
Policy 6.6.1.2	Prior to the approval of any subdivision of land or issuing of a permit involving ground disturbance, a site investigation, performed by a Registered Environmental Assessor or other person experienced in identifying potential hazardous wastes, shall be submitted to the County for any subdivision or parcel that is located on a known or suspected contaminated site included in a list on file with the Environmental Management Department as provided by the State of California and federal agencies. If contamination is found to exist by the site investigations, it shall be corrected and remediated in compliance with applicable laws, regulations, and standards prior to the issuance of a new land use entitlement or building permit.
Policy 6.6.1.3	Provision must be made for disposal of aviation generated petroleum, oils, lubricants, and solvents at the County airports.

MEASURE HS-N

Collect and maintain information on sites known, or suspected to be contaminated by hazardous materials. The information shall include current data from the California Department of Toxic Substances Control's Hazardous Waste and Substance Sites List compiled pursuant to Section 65962.5 of the Government Code. [Policy 6.6.1.2]

Responsibility:	Environmental Management and Planning Department
Time Frame:	Ongoing

MEASURE HS-O

Develop, implement, and update, as necessary, a plan for the storage, transport, and disposal of hazardous materials used at County-operated facilities. [Policy 6.6.1.3]

Responsibility:	Department of Transportation and General Services Department
Time Frame:	Develop plan within five years of General Plan adoption.

IV. Hazard Mitigation Goals and Policies

COMMUNITY and PARTICIPATION AGENCY CONTRIBUTIONS:

Community members and participating agencies have provided great insight on the hazards that concern them, and what should be done to eliminate, and or mitigate the threats that exist. The following list contains the mitigation goals, objectives and strategies in priority to be implemented:

Goal #1:
Wildland fires are prevented because community members are informed and practicing safe fire prevention practices.

Objective:
Public outreach programs are educating the public about the dangers wildfires pose, and what they can do to prevent them from occurring.

Strategies:

a. Implement public outreach firesafe education programs
b. Establish, and or maintain Community Emergency response Teams (CERT) to conduct firesafe inspections – assist with community fuel reductions programs
c. Promote the reporting of unsafe activities that may lead to the start of a fire
d. Evacuation warning systems are being acquired
e. Evacuation planning and public education is being done

Goal #2:
The dangers of wildland fire have been greatly mitigated.

Objective #2a:
Work is being cone to reduce fuel loads and create a buffer zone around endangered communities. In addition, homes are being built with fire retardant material, and older homes are being retro-fitted with these new materials.

Strategies:

a. Grant applications are being applied for to fund fire mitigations projects
b. Fuel loads and ladder fuel projects are being conducted
c. Defensible space work and enforcement is taking place
f. Fuel breaks are being created around wildland/urban interface communities
g. Fire stations are being built, and or retro-fitted with fire retardant materials
h. Fire fighting water storage capability is being established – enhanced n remote areas of the county

Objective #2b:
The directions and recommendations received from the California – Nevada Tahoe Basin Fire Commission is implemented.

Strategies #2b:

IV. Hazard Mitigation Goals and Policies

a. Refer the California – Nevada Tahoe Basin Fire Commission for further details. The web site is: http://resources.ca.gov/TahoeFireCommission/.

Goal #3:

Streams, creeks and drainages are able convey winter storm - heavy rainfall and sudden snowmelt without going over their banks. Damage to structures and critical infrastructure is prevented, and or greatly minimized.

Objective:

Stream, creeks and drainages are well maintained, and under sized culverts have been enlarged to handle heavy rainfall and sudden snowmelt events.

Strategies:

a. Regular maintenance and clearing of debris and excess vegetation from streams, creeks, and drainages is being done
b. Culverts and drainages failing to retain flowing water are being enlarged to handle the needed capacity
c. Sandbags are ready for quick deployment during severe weather events that will bring heavy precipitation
d. Continue to enforce County General Plan Objectives 7.3.1 Water Resource Protection to protect watersheds, riparian zones and aquifers, 2.2.5 Future Rezoning, and 5.4.1 Drainage and Flood Management Program.

Goal #4:

Land – mudslides hazards that have the potential damage and/or destroy structures and infrastructure. The hazards along the Highway 50 – American River Canyon area have been well map, and various activities have taken place to increase hillside stability. Warning sensors have been deployed for early notification of potential land-mudslide activity. The El Dorado Irrigation District has identified areas where avalanche and rock slides may impact water delivery systems.

Objective:

Grant funds are being used for activities that map hazards, increase slope stability, and warn the public of a potential avalanche, rock and mud slides.

Strategies:

a. Grant applications are made to fund hazard prevention and mitigation projects
b. LIDAR and other technologies are used to map land-mudslide hazards
c. Seeding and other projects are undertaken to increase slope stability
d. Residents in the area are educated on the warning signs of land-mudslide dangers

Goal #5

New and older structures are able to withstand high wind events.

Objective 5a:
New buildings are being constructed in compliance with current building codes and stronger materials.

Strategies 5a:
a. Enforce building codes
b. Encourage the use of stronger building materials

Objective 5b:
Older buildings are being retro-fitted with new safety designs and stronger materials.

Strategies 5b:
a. Seek grant funds for older home retro-fitting
b. Require retro-fitting to new standards when substantial remodel, and or use is to take place

Goal #6:
New construction is being built to current earthquake standards for our region.

Objective #6a:
New homes are in compliance with building codes.

Strategies #6a:
a. County to enforce building codes
b. Continue to enforce County General Plan Objective 6.3.1 Building and Site Standards to implement protections for seismic and geologic hazards.
c. Encourage builders to construct homes above current codes

Objective #6b:
Older homes are being retro-fitted to meet new earthquake standards.

Strategies #6b:
a. Grant applications are made to fund older home retro-fits
b. Grant funds are used to help residents secure home interior items such as cabinets and wall hangings

Goal #7:
Critical infrastructure has the capacity to prevent, mitigate, respond, and recover from a terrorist attack.

Objective #7a:
The security of our critical infrastructure has been enhanced with new technologies and defenses to prevent, and or mitigate a terrorist attack.

Strategies #7a:

a. Grant applications have been made to harden infrastructure
b. Fences, gates, locking mechanisms, lighting, and access restrictions have been installed
c. Technologies have been implemented for the early detection of intruders and foreign substances in water supplies

Objective #7b:
Employees operating critical infrastructure are well trained and prepared to respond and recover from a terrorist attack.

Strategies #7b:

a. Grant applications have been applied for to fund employee training and purchase equipment
b. Employees have received training on terrorism awareness, response and recovery

Goal #8:
This consists of other recommendations such as seeking grant funds for the purchase of radio interoperability, fire station construction, and training of personnel in emergency response and recovery operations

Goal #9:
Reduce avalanche, rock- mudslide hazards.

Objective #9:
People and motorists are made aware of avalanche and rock-mudslide dangers. Grant funds are sought to reduce and/or eliminate these hazards.

Strategies #9:

a. Outreach and public education
b. Monitoring of avalanche rock-mudslide hazards
c. Seek grant funds for mitigation projects

Goal #10:
Reduce erosion hazards.

Objective #10:
Hillsides are stablilized.

Strategies #10:

a. Outreach and public education
b. Seeding of hillsides for improved stability.
c. Enforce building and zoning codes by the County.

Goal #11:

Address Seiche wave concerns. This is new concern and much additional work needs to be done to address prevention, mitigation, response and recovery.

Objective #11:
Research is conducted to assemble plans that address this hazard.

Strategies #11:

a. County OES to research existing studies on Seiche wave activity for the Tahoe Basin.
b. Assemble multi-agency planning team.
c. Apply for FEMA grants for research that needs to be conducted.

Goal #12:
Reduce Dam/Levee Failure.

Objective #12:
The integrity of dams and levees is maintained.

Strategies #12:

a. County, State and Federal agencies enforce Dam/Levee construction and maintenance regulations.
b. Conduct exercise drills for public alert and warning.
c. Assemble evacuation routes.
d. Enforce the County's General Plan Objective 6.4.2 Dam Inundation for hazard prevention, identification and mitigation.
e. Identify vulnerable population and be able to warn them with reverse 911 technology.

MITIGATION ACTION PLAN (MAP): This section contains the actions to be taken to mitigate our priority hazards. These hazards have a high level of occurrence and a high level of impact on populations, new and existing structures. They were established through the work of community members, participating agencies Disaster Council and LHMP update Planning Team. For a more detailed list of current and planned wildland fire mitigation projects see El dorado County Wildland Fire Hazard Mitigation Plan. Hazards with a lower level of occurrence and impact, and low level of occurrence and high potential impact will be addressed for mitigation through the safety section of the County's General Plan, building codes and be included in public education outreach programs.

HAZARD: All Hazards
PRIORITY: High
ACTION: One
STRATEGY: Continue to incorporate local hazard mitigation planning into the Safety Element of the County's General Plan and the creation and enforcement of federal, state and local laws, regulations, ordinances and building codes..

ESTIMATED COST: Staff time for Sheriff- OES, Planning Commission, Board of Supervisors, City Councils, and Board of Directors of Special Districts.
POTENTIAL FUNDING SOURCES: County, City, Special District Budgets, and to a some extent Emergency Management Performance Grants.
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, public/private partners in public safety.
ESTIMATED COMPLETION TIME: On-going planning and enforcement efforts.
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of the planning and enforcement actions taken.
EFFECT on EXISTING STRUCTURES: Force property owners to take the necessary action to come in compliance with federal, state and local ordinances to safeguard life and property.
EFFECT on NEW CONSTRUCTION: New construction to be in compliance with federal, state and local ordinances to safeguard life and property.
EFFECT on ECONOMY: Can strengthen a business's ability to withstand and recover from disaster events.
COST-BENEFIT EFFECTIVENESS: The cost of creating laws and their subsequent enforcement with existing staff can be minimal compared to what can be saved when disaster strikes. Private and public enterprises who build structures and infrastructure to withstand foreseeable potential disaster events may see lower insurance costs and the creation of a sense of sustainability for future investment and development.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: The County's General Plan sets the foundation for recognizing disaster potential and establishing through regulations, ordinances and building codes a strategy for protecting populations, new and existing development and economic sustainability.

HAZARD: Wildland Fire
PRIORITY: High
ACTION: Two
STRATEGY: Public education delivered through local media and news agencies. Focus is on defensible space, planting fire resistant vegetation, and having a family plan for evacuation, care and shelter.
ESTIMATED COST: Staff time (minimal)
POTENTIAL FUNDING SOURCES: Emergency Management Performance Grant
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, community service districts, FireSafe Councils
ESTIMATED COMPLETION TIME: On-going efforts as opportunities present for access to media releases.
EFFECT on POPULATION: Potentially lifesaving if people follow the information they receive.
EFFECT on EXISTING STRUCTURES: Can encourage property owners to establish 100 foot defensible space that can save their homes and property.
EFFECT on NEW CONSTRUCTION: Information new home owners can bring to protect their home.

EFFECT on ECONOMY: Can create business for companies who clear defensible space around structures.
COST-BENEFIT EFFECTIVENESS: This is can be accomplished with very little staff time with a media release to local news agencies and tv stations. The greatest impact can be achieved during yearly campaigns for increased firesafe awareness. What is prevented from public outreach programs is difficult to establish; however, the potential savings could be very high. For example, had the people who started the Angora Fire properly extinguished their warming fire and the vegetation fuel in the area been properly reduced with home defensible space, we could never have suffered hundreds of millions of dollars in property damage, loss in economic revenue, timber losses, ecological damage, and the expense of fire suppression.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: Public education on being firewise should be an on-going strategy and included in all mitigation efforts.

HAZARD: Wildland Fire
PRIORITY: High
ACTION: Three
STRATEGY: Utilize Community Emergency Response Teams (CERT) to conduct defensible space inspections and attend public gatherings to educate the public on fire prevention, home safety, evacuation, care and shelter.
ESTIMATED COST: Employed staff time and volunteer CERT members
POTENTIAL FUNDING SOURCES: Emergency Management Performance Grant
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, and CERT teams.
ESTIMATED COMPLETION TIME: On-going efforts to inspect home sites and attend public gatherings.
EFFECT on POPULATION: Potentially lifesaving if people follow the information they receive.
EFFECT on EXISTING STRUCTURES: Can encourage property owners to establish 100 foot defensible space that can save their homes and property and come in compliance with SB1369. Consider how they will evacuate, care and shelter until the emergency has passed.
EFFECT on NEW CONSTRUCTION: Information new home owners can bring to protect their life and property.
EFFECT on ECONOMY: Can create business for companies who clear defensible space around structures. Can reduce property damage loss – keep businesses open.
COST-BENEFIT EFFECTIVENESS: The cost of one staff member to coordinate CERT Team training and assignments: $10,000, hazard prevention handouts: $10,000 per year, CERT team member equipment: $500 for a total of $20,500 dollars. See Action One for addition benefits.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: Public education on being firewise should be an on-going strategy and included in all mitigation efforts.

HAZARD: Wildland Fire
PRIORITY: High
ACTION: Four
STRATEGY: Continue to update Community Wildfire Prevention Plans (CWPP) for both the Tahoe Basin and West Slope of the County.
ESTIMATED COST: Staff time for Firesafe Counsels, Sheriff-OES, Planning Commission, Board of Supervisors, City Councils, and Board of Directors of Special Districts. Consultants may cost XXXXXXXXXXXXXXXXX
POTENTIAL FUNDING SOURCES: National Fire Plan, Healthy Forests Initiative, WUI Grant, local financing, private foundations, grants from state bond acts, Sierra Conservancy and Title III funds, and Emergency Management Performance Grants.
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, public/private partners in public safety.
ESTIMATED COMPLETION TIME: On-going planning efforts.
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of the planning actions taken.
EFFECT on EXISTING STRUCTURES: Vegetation management projects identified in the CWPP will result in ongoing fuels/vegetation reduction and management on public and private lands with existing structures; implementation and enforcement of defensible space requirements on properties with existing structures.
EFFECT on NEW CONSTRUCTION: New construction to be in compliance with federal, state and local ordinances to safeguard life and property. Identify and implement by code regulations the use of fire resistant materials. May encourage new development where the fire threat has been diminished and/or eliminated.
EFFECT on ECONOMY: Can reduce the economic losses due to wildfires. The potential economic losses include loss of life and property, closure of businesses, increased unemployment, and loss of tourism.
COST-BENEFIT EFFECTIVENESS: The CWPP will establish a methodology and prioritization for mitigation projects and their subsequent management to achieve maximum cost effectiveness and efficiency.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and as a guide for the implementation of fuel reduction projects.
DISCUSSION: None.

HAZARD: Wildland Fire
PRIORITY: High
ACTION: Five
STRATEGY: Continue the Chipper program.
ESTIMATED COST: El Dorado County Firesafe Council staff time and chipper vendor contract at approximately $160,000 per year.
POTENTIAL FUNDING SOURCES: FEMA and Emergency Management Performance Grant
RESPONSIBLE AGENCY(s): El Dorado County Firesafe Council

ESTIMATED COMPLETION TIME: On-going program as long as funding exists. Vendor contracts terms will be in compliance with grant requirements.
EFFECT on POPULATION: Potentially lifesaving if people establish 100 plus feet of defensible space around their homes and businesses.
EFFECT on EXISTING STRUCTURES: Can encourage property owners to establish 100 foot defensible space that can save their homes and property.
EFFECT on NEW CONSTRUCTION: Same as above.
EFFECT on ECONOMY: Will create a business opportunity for the vendor operating the chipper program. Creating a defensible space around homes and businesses can protect lives and property and the loss of tourism, business trade and tax revenue. The loss of 254 homes to the Angora fire significantly impacted the property tax revenues the Lake Valley Fire Protection District receives.
COST-BENEFIT EFFECTIVENESS: At a cost of approximately $160,000 dollars per year, the chipper program costs less than $4 dollars per acre. On average, the chipper program will produce 350,000 cubic yards of vegetation. This is a tremendous nebenfit when you consider suppression costs can run between $2000 and $4,000 per acre and the loss of one home can run approximately $250,000 on the west slope and $400,000 dollars in the Tahoe Basin. The chipper program has proven to be a very successful program that encourages property owners to take personal responsibility for maintaining a defensible space around their homes and businesses. Chipping the vegetation also diminishes burning which pollutes the air.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: None.

HAZARD: Wildland Fire
PRIORITY: High
ACTION: Six
STRATEGY: Implement various fuel load reduction measures.
ESTIMATED COST: Staff time from the El Dorado County and Tahoe Basin Firesafe Councils, Cal Fire and local Fire Protection Districts and vendor contract costs to complete the project. Vendor costs will vary greatly depending on the scope of the work to be performed. The average per acre cost for fuel reduction on the west slope of the county is between $1000 and $1,500 dollars. The cost in the Lake Tahoe basin will generally be higher at approximately $3,000 per acre due to rugged terrain and the ecological sensitivity of the area.
POTENTIAL FUNDING SOURCES: FEMA Hazard Mitigation Grants, Emergency Management Performance Grant, National Fire Plan, Healthy Forests Initiative, CalFed and EQUIP.
RESPONSIBLE AGENCY(s): El Dorado County and Tahoe Basin Firesafe Councils.
ESTIMATED COMPLETION TIME: On-going program as long as funding exists. Grant funded projects will be completed on-time as required.
EFFECT on POPULATION: Potentially lifesaving if various fuel mitigation measures are taken such as establishing fuel breaks, thinning, pruning, prescribed burns, mastication and etc.

IV. Hazard Mitigation Goals and Policies

EFFECT on EXISTING STRUCTURES: Protect homes and business from the fire reaching their structure and perhaps slow the rate of the fire's progression for a more rapid extinguishment.

EFFECT on NEW CONSTRUCTION: May encourage investment and development where the threat of a devastating wildfire has been diminished and/or eliminated.

EFFECT on ECONOMY: Will create business opportunities for vendors conducting the mitigation operation – create jobs. Create defensible space around communities, homes and businesses - protect lives and property and the loss of tourism, business trade and tax revenue. The loss of 254 homes to the Angora fire significantly impacted the property tax revenues the Lake Valley Fire District receives.

COST-BENEFIT EFFECTIVENESS: On average, it costs between $1,000 and $1,500 per acre to mitigate fuel loads. Even at $1,500 per acre rate, this cost is far less than the $2,000 per acre fire suppression cost, and the loss of one or more homes. The average value of a home on the west slope of the county is $250,000 and in the Lake Tahoe basin it is $400,000 dollars. There is also a loss in timber and agriculture, damage to the environment, and loss in business and tax revenue.

STRATEGY COMPARISON: Each mitigation project will have to be evaluated to determine what is minimally needed to achieve the desired result. Some projects may involve only a fuel break at a cost of $100 per acre to bring about a desired safer environment. Some projects may require a multitude of measures to reduce the wildfire threat. A CWPP plan will be an essential element in all activities to insure maximum effort and efficiency is attained.

DISCUSSION: The spread sheet on the following page has been assembled to provide an overview of the various mitigations actions that can be taken, the nature of the work, where best applied and not applied, approximate costs per acre, if other treatments are recommended, and the pros and cons of the work.

IV. Hazard Mitigation Goals and Policies

Methods	Objectives	Slope	Riparian Zone	Near Home	Other Treatment Required?	Contract Cost/Acre	
Manual/Mechanical							
Thinning	vertical or horizontal fuel separation	all	maybe*	OK	usually	$230-850	Pros & Cons
Slashbuster: Thinning	vertical or horizontal fuel separation	< 35%*	no**	no**	maybe	$200-500	Pros & Cons
Pruning	limb up trees to reduce ladder fuels	all	yes	OK	usually	$50-250	Pros & Cons
Slashing	remove a veg type or size	all	maybe*	yes	usually	$230-850	Pros & Cons
Slashbuster: Slashing	remove one veg type or size	< 35%*	no**	no**	maybe	$200-500	Pros & Cons
Lopping & Scattering	modify downed wood concentration	all	OK	yes	maybe	$25-45	Pros & Cons
Fuel Pullback	reduce fuel around protected items	all	yes	OK	usually	$1.50-2.00/tree	Pros & Cons
Crushing - dozer	reduce depth of fuel bed to slow fire behavior	< 35%	no	no	usually	$50-68/hr	Pros & Cons
Slashbuster: Chipping	reduce amount of downed wood	< 35%*	no**	no**	maybe	$575-1600	Pros & Cons
Hand Piling	pile dead and small material	all	maybe*	no	usually	$250-1300	Pros & Cons
Burn Hand piles	consume piled slash	all	no**	yes	usually	$25-140	Pros & Cons
Machine Piling	pile small fuel to reduce spread of fire	< 35%	no	no	usually	$200-400	Pros & Cons
Machine Pile - Burn	consume piled slash	all	no**	yes	usually	$25-140	Pros & Cons
Raking	reduce material under protected items	all	yes	OK	usually	$40-120	Pros & Cons
Prescribed Fire							
Underburn - Broadcast burn	reduce/kill small diameter & ground vegetation	all	no**	no	usually	$60-400	Pros & Cons
Fireline Construction	create 1-3 ft. ground fuel break	all*	no**	OK	usually	$50/hr	Pros & Cons
Other							
Grazing	reduce small ground fuel by grazing animals	< 60%	no**	yes	usually	varies by job: fencing, water, access, etc.	Pros & Cons
Lomakatsi Natural Treatments	analysis of area prior to treatment, considering all of the ecosystem before and after treatments	all	yes	yes	no	$500-1600	Pros & Cons

*Beyond the first 50 ft., either side of a stream or river
**See ' Living in a Biocracy ' guidelines of the Fire Plan; there is not a simple yes or no.

Methods	Pros	Pros	Cons	Cons	Cons
Manual/Mechanical					
Thinning	attractive, park-like	low risk	labor intensive	small diameter only	slash left to treat
Slashbuster: Thinning	cost-effective	perform multiple tasks at one time; no slash	for use on gentle slope only	can disturb soils	can damage leave trees/spread noxious
Pruning	attractive landscape	effective	very labor intensive	creates slash	
Slashing	easy to describe		labor intensive	could end up a clear-cut	
Slashbuster: Slashing	cost effective	perform multiple tasks at one time; no slash	for use on gentle slope only	can disturb soils; spread noxious weeds	can damage leave trees
Lopping & Scattering	low cost	few impacts on lands	labor intensive	not all fuel removed	small diameter only
Fuel Pullback	low cost	effective	labor intensive	larger slash = many cuts	
Crushing - dozer	easy & inexpensive	possibly reduces fire intensity	does not prevent fires	possible soil compaction	not for use on large or green material
Slashbuster: Chipping	cost-effective	perform multiple tasks at one time; no slash	for use on gentle slope only	can disturb soils; spread noxious weeds	can damage leave trees
Hand Piling	easy to do	few impacts on lands	slow work	time consuming	
Burn Hand piles	easy to implement		labor intensive	leaves big black spots on ground	
Machine Piling	fast	inexpensive	possible soil compaction	topsoil can be moved; spread noxious weeds	not attactive

HAZARD: Flood
PRIORITY: High
ACTION: 7
STRATEGY: Continue to participate in the National Flood Insurance Program (NFIP).
ESTIMATED COST: County, City, Special District staff time. Insurance costs are paid by the property owners.
POTENTIAL FUNDING SOURCES: County and City budgets and private property owners.
RESPONSIBLE AGENCY(s): County, Cities, Special Districts, and private property owners.
ESTIMATED COMPLETION TIME: On-going.
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of what is learned from participation in the NFIP and the subsequent planning and actions taken.
EFFECT on EXISTING STRUCTURES: The program enables property owners in participating communities to purchase insurance protection from the government against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.
EFFECT on NEW CONSTRUCTION: New construction to be in compliance with federal, state and local ordinances and NFIP and General Plan and building code standards. New construction will be able to apply for the NFIP coverage.
EFFECT on ECONOMY: Can strengthen a community's ability to recover from flood disaster events. May attract new economic development where studies have been performed to determine flood prone areas. Insurance is available if there is a risk, and actions can be taken to mitigate flood damage potential.
COST-BENEFIT EFFECTIVENESS: The cost of participation in the NFIP is minimal when compared to the losses associated with flooding and the damages to structures and infrastructure. This is especially true if structures and infrastructures are located in flood prone areas.
STRATEGY COMPARISON: Participate in the NFIP and adopt and enforce floodplain management ordinances to reduce future flood risks to new construction in Special Flood Hazard Areas (SFHA), the federal government will make flood insurance available within the community as a financial protection against flood losses. The SFHAs and other risk premium zones applicable to each participating community are depicted on Flood Insurance Rate Maps (FIRMs). The Mitigation Division within the Federal Emergency Management Agency manages the NFIP and oversees the floodplain management and mapping components of the Program.
DISCUSSION: The County is committed to its participation in the NFIP and is so stated in the Safety Element of the County's General Plan.

HAZARD: Flood
PRIORITY: High
ACTION: 8
STRATEGY: Continue to incorporate into local hazard mitigation planning and the County's General Plan enforcement of Objective 7.3.1Water Resource Protection to protect

watersheds, riparian zones and aquifers, Objective 2.2.5 Future Rezoning, and Objective 5.4.1 Drainage and Flood Management Program.
ESTIMATED COST: Staff time for Sheriff- OES, Planning Commission, Board of Supervisors, City Councils, and Board of Directors of Special Districts.
POTENTIAL FUNDING SOURCES: County, City, and Special District Budgets.
RESPONSIBLE AGENCY(s): County, Sheriff's OES, cities, and community service districts, public/private partners in water resource protection.
ESTIMATED COMPLETION TIME: On-going planning and enforcement efforts.
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of the planning and enforcement actions taken.
EFFECT on EXISTING STRUCTURES: Reduce and/or eliminate the impacts of flooding on existing structures to safeguard life and property.
EFFECT on NEW CONSTRUCTION: Reduce and/or eliminate the impacts of flooding on new construction to safeguard life and property.
EFFECT on ECONOMY: Can strengthen a business's ability to withstand and recover from disaster events.
COST-BENEFIT EFFECTIVENESS: The cost of creating laws and their subsequent enforcement with existing staff can be minimal compared to what can be saved when disaster strikes. Private and public enterprises who build structures and infrastructure outside of flood prone areas may see lower insurance costs and the creation of a sense of sustainability for future investment and development.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy. Costs related to existing staff time are more reliable for plan funding and completion than the uncertainty associated with grant awards.
DISCUSSION: The County's General Plan sets the foundation for recognizing disaster potential and establishing through regulations, ordinances and building codes a strategy for protecting populations, new and existing development and economic sustainability.

HAZARD: Flooding – Culvert Upgrades/Replacements
PRIORITY: High
ACTION: 9
STRATEGY: Incorporate hazard mitigation planning into the County maintenance and operations project planning.
ESTIMATED COST: Labor, equipment and material for a culvert replacement - $25,000.00. Replacement and emergency mitigation after a flood event that washes out a roadway could cost an estimated $200,000 (based on previous disaster response).
POTENTIAL FUNDING SOURCES: FEMA Mitigation Grants, Emergency Management Performance Grant, DOT general budget.
RESPONSIBLE AGENCY(s): Sheriff's OES, El Dorado County DOT
ESTIMATED COMPLETION TIME: On-going efforts to inspect identified areas, once funding is secured the actual project completion could be one to two weeks.
EFFECT on POPULATION: A culvert/roadway washout could block access to residents and emergency vehicles causing potential life threatening incident. Emergency access measures could exceed the actual permanent replacement cost.

EFFECT on EXISTING STRUCTURES: Could reduce and/or eliminate flooding threat to existing structures.
EFFECT on NEW CONSTRUCTION: New construction would bring the drainage structure into compliance with federal, state and local codes with a significant benefit to the public.
EFFECT on ECONOMY: Can reduce property damage loss – keep businesses open. Create business opportunities and jobs.
COST-BENEFIT EFFECTIVENESS: The cost of replacement of an existing culvert or drainage structure that is clearly undersized would provide a significant cost savings as compared to the mitigation efforts to reconstruct after a washout or roadway failure.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: Construction industry standards, updated hydrological requirements and recognized disaster potential should be considered and corrective, proactive measures taken, in preparation for flood and severe weather events.

HAZARD: All Hazards
PRIORITY: High
ACTION: 10
STRATEGY: Continue to provide National Incident Management System (NIMS) training to all first responders.
ESTIMATED COST: Since the 2004 LHMP, County OES has facilitated the delivery of NIMS training to all first responders and from here there will be a need to train new hires and provide training on new NIMS courses. The estimated costs per year is XXXXXXXXXXXXXX
POTENTIAL FUNDING SOURCES: FEMA Grants, Homeland Security Grants, and Emergency Management Performance Grants
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, public/private partners in public safety.
ESTIMATED COMPLETION TIME: On-going to stay in compliance with federal and state training and certification requirements.
EFFECT on POPULATION: Potentially lifesaving when first responders respond in a coordinated and well managed effective manner. .
EFFECT on EXISTING STRUCTURES: A coordinated and well managed response will increase the likelihood of reducing the impact of the emergency-disaster event.
EFFECT on NEW CONSTRUCTION: A highly trained and effective public safety service may encourage and attract new development.
EFFECT on ECONOMY: Will strengthen a community's ability to withstand disaster events and in turn reduce economic losses.
COST-BENEFIT EFFECTIVENESS: A highly skilled and knowledgeable public safety service will respond to disaster events in a more effective manner thus reducing response time costs, and the potential for loss of life and property. The cost of training and exercising first responders is minimal compared to what can be saved.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: None.

HAZARD: All Hazards
PRIORITY: High
ACTION: 11
STRATEGY: Seek grant funding for the continued updates of the Local Hazard Mitigation Plan (LHMP).
ESTIMATED COST: Approximately $40,000 per for a hired consultant. Staff time for Sheriff-OES, Planning Commission, Board of Supervisors, City Councils, and Board of Directors of Special Districts
POTENTIAL FUNDING SOURCES: FEMA Grants and Emergency Management Performance Grants.
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, public/private partners in public safety.
ESTIMATED COMPLETION TIME: On-going to seek grant funds and have the update work completed on time as required.
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of the planning actions taken.
EFFECT on NEW and EXISTING STRUCTURES: Continued analysis of potential hazards, vulnerabilities, risks, and mitigation strategies will establish the needed information to act upon to protect new and existing structures.
EFFECT on NEW CONSTRUCTION: New construction to be in compliance with federal, state and local ordinances to safeguard life and property.
EFFECT on ECONOMY: Will strengthen a community's ability to withstand and recover from disaster events.
COST-BENEFIT EFFECTIVENESS: The cost of updating the LHMP will be minimal compared to what can be saved when disaster strikes. Private and public enterprises who build structures and infrastructure that are built to withstand foreseeable potential disaster events may see lower insurance costs and create a sense of sustainability for future development and investment.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: None.

HAZARD: Rock-Mudslides
PRIORITY: High
ACTION: 12
STRATEGY: District staff shall routinely evaluate and designate those sections of water conveyance system flumes and canals identified as having a high probability of being subjected to a landslide type event.
ESTIMATED COST: Ground movement and slope creep is a continuous and dynamic geological process, impacted and aggravated by weather, rain, freeze-thaw conditions, earth tremblers, and human activities. The conditions are continuously changing and the cost of mitigating landslide hazards is difficult to estimate.

Each year the lands above the flume system are inspected and highly probable rock fall and slide areas are identified and prioritized for remediation in attempt to avoid catastrophic damage to the flume system.

The District maintains a running 5 year plan for canal and flume upgrades to replace older and deteriorating sections of wooden flumes with concrete, stabilize foundations and trestles, and remove rock fall hazards from above each respective section of flume.

In the five year planning period, for years 2012 through 2016, the District is programming repairs and/or replacements to thirteen sections of flumes and canals, totaling 4,668 lineal feet of the existing hydro system. The 5 year program has an anticipated cost of over $16 million dollars. Included in the planned cost of improvements for each section of flume is mitigation of landslide hazards. The cost of hazard mitigation is significantly less than the subsequent loss of facilities and services as listed in the Benefits below.
POTENTIAL FUNDING SOURCES: Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Emergency Management Performance Grant, El Dorado Irrigation District.
RESPONSIBLE AGENCY(s): El Dorado Irrigation District
ESTIMATED COMPLETION TIME: On-going planning efforts, including seasonal facility inspections and annual planning efforts.
EFFECT on POPULATION: A loss of 40% of water service capability by the District would necessitate mandatory conservation measures for businesses, domestic use, agricultural irrigation, and could impact fire protection capabilities. An outage could last for three months or longer and result in significant losses to the local economy.
EFFECT on NEW and EXISTING STRUCTURES: Thirteen sections of flumes have been identified as having aged or deteriorating sections of support and structure, and will be very susceptible to failure from impact by a landslide event. Capital Improvement Planning is ongoing to schedule and upgrade these sections based on prioritization and budget availability.
EFFECT on NEW CONSTRUCTION: The potential for landslide hazard will be reviewed with each section of existing canal and flume to be upgraded with new construction. Structures will be constructed as best practical to withstand the impact of this hazard.
EFFECT on ECONOMY: Reliability of a county wide water supply for domestic and emergency use is critical to maintain the current level of business as well as support new development and growth. Even a temporary loss of water supply, inability to meet emergency demands, or Hwy 50 closure would have a significant impact on local business and could weaken the potential for growth or cause a relocation of current business and residents out of the area. A hydro-water conveyance system outage resulting from a landslide event impacting a flume could last for three months or longer and result in significant losses to the local economy.
COST-BENEFIT EFFECTIVENESS: Improves reliability of canal systems for life safety, reductions in property loss, power generation, and public water supply. The benefit of the hazard mitigation costs will primarily be avoidance of the following costs:

- Avoidance of catastrophic damage to the environment and potential loss of life resulting from a flume failure and uncontrolled discharge of up to 1,000 cfs (448,800 gpm) of water.

- Loss of up to 40% of the Districts water sales revenue for the duration of a flume outage, ranging $400,000 to $600,000 per month.
- Loss of hydropower generation revenues, typically $1,000,000 per month, with summer peak revenues of $1,700,000 per month.
- Loss of water availability for domestic, emergency, and fire suppression purposes.
- Loss of water availability for agricultural irrigation and subsequent damages to local crops.
- Cost of flume repairs which can range from $2,000 to $8,000 per lineal foot depending on the type of construction (wood vs. concrete), type of support (on grade or trellis supported), and accessibility (some sections are accessible only by foot or by helicopter).

Costs to re-route and emergency pump up to 600 AF/month of treated water via two high lift pump stations to serve water to the area normally served by the Reservoir 1 WTP, which would be shut down by a hydro-system outage. During summer months the demand in this zone is typically 1,000 AF per month and therefore emergency pumping

STRATEGY COMPARISON: This strategy should be implemented on a regular basis with annual reviews and updates.

DISCUSSION: Landslides refer to a wide variety of processes that result in the perceptible downward and outward movement of soil, rock, and mud under gravitational influence. They are primarily associated with steep slopes (i.e., greater than 15 percent), however they may also occur in areas of generally low relief and occur as cut-and-fill failures, river bluff or ditch failures, lateral spreading landslides, collapse of mine-waste piles, and failures associated with quarries and open-pit mines. Precipitation, topography, and geology affect landslides and debris flows. Human activities, such as mining, road construction, and changes to surface drainage areas, also affect the landslide potential. Landslide hazards can result in destruction of structures, roads, utilities, forested areas and cause injuries and death.

The majority of the District's water and wastewater treatment facilities, pump stations, storage tanks, and reservoirs are located in the western half of the county at lower elevations and on flatter terrain where the potential of landslide damage is reduced. The District's hydro-water conveyance system delivers approximately 40% of the District's source water and includes 17,000 lineal feet of above grade wooden and concrete flumes, much of which is located in the higher elevation and steeper terrain portions of the Sierras and susceptible to landslide and rock fall hazards and damage. An additional 83,000 lineal feet of water conveyance canals are also subject to inundation, blockage and damage resulting from landslide activities, including rock falls, mudslides and tree falls caused by earth movement. Other facilities that provide single points of access to the headwaters of the flume system and maintaining a critical water conveyance siphons have been identified as being in danger of rock fall hazards due to large diameter boulders precariously perched directly above. A landslide type event could cause catastrophic failure and loss of use of facilities for water conveyance resulting in an immediate loss of water for domestic use, irrigation, fire suppression, and power generation.

Probability: Landslide hazards in the form of rock falls and mudflows have occurred routinely in the past in El Dorado County, resulting in closures to Highway 50, significant erosion and environmental damage, structural damage to the water conveyance flumes and their respective support structures and abutments. The probability of future landslides, including rock falls and soil hazards events is **high.**

HAZARD: Terrorism
PRIORITY: High
ACTION: 13
STRATEGY: The Disaster Mitigation Act of 2000 requires extensive public information and input, and this is in direct conflict with maintaining confidentiality of critical infrastructure security information necessary in the protection of key assets and critical infrastructure against acts of domestic or international terrorism. The Hazard Mitigation Planning Committee (HMPC) determined it was in the community's best interest not to publicly share specific information about vulnerability to human-caused hazards.

Terrorist threats fall into three main categories: concentrated populations (e.g., office buildings, churches, casinos, fairgrounds), system elements (e.g., railroad and highway bridges, pipeline and conveyances, communications nodes); and facilities/structures (e.g., treatment plants, communications centers, medical facilities). A threat, vulnerability, capabilities, and needs assessment has been completed. Although these documents are confidential, the work involved analyzing and rating potential threats, determining the vulnerability of the community, evaluating existing capabilities and determining additional community needs.
ESTIMATED COST: To be determined (TBD)
POTENTIAL FUNDING SOURCES: FEMA Grants, Homeland Security Grants and Emergency Management Performance Grants.
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, public/private partners in public safety.
ESTIMATED COMPLETION TIME: On-going.
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of the planning actions taken.
EFFECT on NEW and EXISTING STRUCTURES: Continued analysis of potential, vulnerabilities, risks, and mitigation strategies will establish the needed information to act upon to protect new and existing structures.
EFFECT on NEW CONSTRUCTION: Same as above.
EFFECT on ECONOMY: Will strengthen a community's ability to withstand and recover from a terrorist event.
COST-BENEFIT EFFECTIVENESS: The cost of mitigation can greatly out weight the losses of life and damage to property which is the intended targets and results of terrorism.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: None.

HAZARD: Avalanche
PRIORITY: Low
ACTION: XXXXXXXXXXXXXXXXXXX

IV. Hazard Mitigation Goals and Policies

STRATEGY: District staff shall designate those sections of water conveyance system flumes and canals identified as having an avalanche hazard potential. Currently 13 sections of flume along with a section of above grade pipeline located below Echo Lake have been identified as susceptible to hazard and included in the 5 year capital improvement program for upgrade.
ESTIMATED COST: Flume repairs/replacement historically range from $1,000 to $8,000 per lineal foot depending on the type of construction (wood vs. concrete), type of support (on grade or trellis supported), and accessibility (some sections are accessible only by foot or by helicopter). Additionally, significant staff time is incurred annually to monitor conditions in the high elevation and remote conditions of the flume locations. District staff typically walks and monitor conditions during the winter for ice blockages and trees falling from weight of snow across a flume or canal. Snow or a fallen tree caused by an avalanche can partially block a canal or flume causing a back up of the upstream water surface creating a breach and overflow condition that would erode the flume support structure and lead to failure.
POTENTIAL FUNDING SOURCES: Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Emergency Management Performance Grant, El Dorado Irrigation District.

RESPONSIBLE AGENCY(s): El Dorado Irrigation District.
ESTIMATED COMPLETION TIME: On-going planning efforts, including seasonal facility inspections and annual planning efforts. Seeking grant funds and have the update work completed on time as required.

EFFECT on POPULATION: Minimal impact as avalanches would occur in winter when canal and flume flows are reduced, domestic water demands are lower and can be supplied via alternative pumping strategies, and erosion and environmental concerns would be minimized by snow pack coverage.

EFFECT on NEW and EXISTING STRUCTURES: Thirteen sections of flumes have been identified as having aged or deteriorating sections of support and structure, and will be very susceptible to failure from impact by an avalanche event. Capital Improvement Planning is ongoing to schedule and upgrade these sections based on prioritization and budget availability.
EFFECT on NEW CONSTRUCTION: The potential for avalanche hazard will be reviewed with each section of existing canal and flume to be upgraded with new construction. Structures will be constructed as best practical to mitigate or withstand the impact of this hazard.

EFFECT on ECONOMY: Reliability of a county wide water supply for domestic and emergency use is critical to maintain the current level economic condition as well as support new development and growth. Even a temporary loss of water supply, inability to meet emergency demands, or Hwy 50 closure would have a significant impact on the local economy and could weaken the potential for growth or cause a relocation of current business and residents out of the area.

COST-BENEFIT EFFECTIVENESS: Improves reliability of canal systems for life safety, reductions in property loss, power generation, and public water supply. The benefit of the hazard mitigation costs will primarily be avoidance of the following costs:

- Avoidance of catastrophic damage to the environment and potential loss of life resulting from a flume failure and uncontrolled discharge of up to 1,000 cfs (448,800 gpm) of water.
- Loss of up to 40% of the Districts water sales revenue for the duration of a flume outage, ranging $400,000 to $600,000 per month.
- Loss of hydropower generation, averaging $1,000,000 revenue per month during winter.
- Loss of water availability for domestic, emergency, and fire suppression purposes.
- Loss of water availability for agricultural irrigation and subsequent damages to local crops.
- Costs to re-route and emergency pump up to 600 AF/month of treated water via two high lift pump stations to serve water to the area normally served by the Reservoir 1 WTP, which would be shut down by a hydro-water conveyance system outage.

STRATEGY COMPARISON: This strategy should be implemented on a regular basis with annual reviews and updates.

DISCUSSION: Avalanche hazards do exist each winter in the upper elevations of eastern El Dorado County. The majority of the District's water and wastewater treatment facilities, pump stations, storage tanks, and reservoirs are all in the lower elevations on flatter terrain where the potential of avalanche damage is negligible to non-existent. However, the District's hydro-water conveyance system, for consumptive water, firefighting, and power generation purposes, includes17,000 lf of above grade wooden and concrete flumes, much of which is located on steep slopes in the higher elevations of the Sierras and susceptible to avalanche hazards and damage.

Avalanches occur naturally and unpredictably when loading of new snow increases stress at a rate faster than strength develops, and the slope fails. Event probability is greater on steeper slopes and where deposition of wind-transported snow is common. The hazard typically affects a small number of people in recreational activities such as snowboarding, snowmobiling, and hikers who venture into backcountry area. For the El Dorado Irrigation District specifically the hazard is that the impact from an avalanche could either 1) impact trees causing them to fall onto and damage a section of flume or 2) directly impact and cause catastrophic failure of a section of flume.

The consequence could be as significant as a release of uncontrolled flows of 100 cfs up to 1,000 cfs cascading down the Sierra slopes. The duration of the uncontrolled flows could be up to several hours due to heavy snow conditions inhibiting accessibility for verification and flow shutdown. Further, depending on the location of the flume break the uncontrolled releases of water could cause significant erosion, landslide, mudslide, Hwy 50 blockage, road closure, and loss of life.

Example Past Occurrences: Several examples of recent events indicating the probability of snow related damage, including avalanches, which actually occurred include:

- Extreme depths of wet and heavy snow during the winter of 2010/2011 caused a roof collapse at one structure and damage to multiple other roofs in Pollock Pines, at an elevation of 3,800 feet. The District's flume system is entirely above this elevation and susceptible to heavy snow loading and avalanches.

- District crews encountered snow depths of up to 12 feet at Strawberry during facility maintenance operations. These volumes of snow occur in the upper Sierras in the same regions where the District water conveyance flumes are located and could contribute to occurrence of an avalanche and hinder repair or rescue operations.
- This kind of potential for an emergency condition will continue to occur on an annual basis.

HAZARD: Seismic and Geologic Hazards
PRIORITY: Low
ACTION: 14
STRATEGY: Continue to incorporate into local hazard mitigation planning and the County's General Plan enforcement of Objective 6.3.1 Building and Site Standards and enforce regulations that protect against seismic and geologic hazards.
ESTIMATED COST: Staff time
POTENTIAL FUNDING SOURCES: County, City, Special District Budgets
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, public/private partners in public safety.
ESTIMATED COMPLETION TIME: On-going
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of the planning and enforcement actions taken.
EFFECT on EXISTING STRUCTURES: Identify areas of the county and nearby region where seismic and geologic hazards can impact existing and new structures. Provide education of how to mitigate these hazards.
EFFECT on NEW CONSTRUCTION: Identify areas of the county and nearby region where seismic and geologic hazards can impact existing and new structures. Enforce building and construction standards that mitigate the effects of these hazards.
EFFECT on ECONOMY: Can strengthen a community's ability to withstand and recover from seismic and geologic disaster events.
COST-BENEFIT EFFECTIVENESS: The costs associated with staff time in identifying and enforcing building codes and General Plan objectives are far less costly than the losses that can occur from a devastating seismic – geologic disaster event.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: Seismic and geologic hazards have been identified as a low frequency event that can have both a low and high impact potential.

HAZARD: Dam Inundation
PRIORITY: Low
ACTION: 15
STRATEGY: Continue to incorporate into local hazard mitigation planning and the County's General Plan enforcement of Objective 6.4.2 Dam Inundation to identify and mitigate hazards, and utilize reverse 911 technologies to warn vulnerable populations.
ESTIMATED COST: Staff time to identify hazards and plan for mitigation strategies. The cost of Reverse 911 is approximately $20,000 per year.

POTENTIAL FUNDING SOURCES: County, City, Special Districts budgets, public and private owners of dams. Some of these costs may be eligible for reimbursement through the Emergency Management Performance Grants.
RESPONSIBLE AGENCY(s): Sheriff's OES, cities, fire districts, and community service districts, public/private partners in public safety, public and private owners of dams.
ESTIMATED COMPLETION TIME: On-going.
EFFECT on POPULATION: Potentially lifesaving given the preventive nature of the planning and enforcement actions taken. Vulnerable populations can be warned of a dam failure via the reverse 911 system.
EFFECT on EXISTING STRUCTURES: Identify areas of the county that may be impacted by a dam failure. Plan and take mitigative actions to protect existing structures.
EFFECT on NEW CONSTRUCTION: Identify areas of the county that may be impacted by a dam failure and prevent construction in those areas. Enforce building and construction standards that mitigate the effects of these hazards.
EFFECT on ECONOMY: Can strengthen a community's ability to withstand and recover from a dam failure.
COST-BENEFIT EFFECTIVENESS: The costs associated with staff time in identifying and enforcing building codes and General Plan objectives are far less costly than the losses that can occur from a dam failure. The cost of the reverse 911 system is well worth the cost when considering you can warn vulnerable populations quickly and aid their safe evacuation.
STRATEGY COMPARISON: This mitigation strategy should be implemented on a regular basis and in conjunction with any other implemented strategy.
DISCUSSION: Dam inundation hazards have been identified as a low frequency event that can have both a low and high impact potential.

V. Monitoring, Evaluating and Updating the Plan

Introduction

The El Dorado County Local Hazard Mitigation Plan will be reviewed when the General Plan is reviewed. The time horizon for the 2004 El Dorado County General Plan is twenty years. It is expected that an update will occur by 2025. The following quote was taken from the El Dorado County General Plan:

"State planning law simply states that a jurisdiction shall "periodically review and revise, as necessary, the General Plan" (Government Code §65103[a]). Once adopted, the County expects the new General Plan to provide guidance through 2025, though regular review may reveal the need for periodic revisions. An exception is the Housing Element, which must be updated every five years pursuant to state law."

Our Plan will be reviewed every 5 years under the direction of the Local Disaster Council and County OES personnel, unless there is significant justification that it should be done earlier.

El Dorado County is fortunate to have one Sheriff Lieutenant, one Sheriff Sergeant, three Sheriff's Deputies, and one department analyst assigned to the Sheriff's Office of Emergency Services. It is important to note that the six people assigned are responsible for many aspects of public safety. Because this unit is all-encompassing, the assigned personnel have the opportunity to interact with all facets of public safety including schools, hospitals and special districts. The El Dorado County Sheriff's OES division's primary responsibility is disaster planning, mitigation, management and education. This unit also manages Homeland Security issues, the largest volunteer search and rescue team in California, workplace violence situations and special events. Because of their broad base of contacts, El Dorado County Sheriff/OES personnel are constantly aware of disaster/emergency threats, occurrences and the mitigation/response needs of the County.

Any disaster or potential disaster information comes to Sheriff OES with little communication effort. Because of the relationships formed since the Sheriff assumed command of County OES, information from all allied agencies in the county and from the state flows to the OES unit freely. In reference to monitoring and evaluating the plan, this can be a constant effort, since allied agencies within El Dorado County communicate on a regular basis the plan can be updated at anytime. All the agencies and departments involved in the process of writing this plan have very close day-to-day working relationships with Sheriff/OES. At any given time the data disk containing this plan can be updated. Some examples of Sheriff/OES involvement with allied agencies are-, members of the Fire Chief's Association, members of the local disaster council, close allied relationships with Placerville and South Lake Tahoe Police, close allied relationships with all Federal, State and local fire districts, members of the Safe Schools Committee, close relationships with Barton and Marshall hospitals and a close working relationship with all public response agencies. In El Dorado County we have become very interactive and user friendly resulting from an open door and open minds. Any agency in El Dorado County who has concerns about disaster mitigation does not have to wait X amount of years; changes and amendments can be made at any time, therefore defining a living document.

Implementation Through Existing Programs

In August of 2004 El Dorado County adopted a new General Plan. In February 2009 the "LHMP 2004" was added to the General Plan as an annex. Upon completion of the 2009 plan it will be submitted to be incorporated as an update to the 2004 plan. The El Dorado County Planning Department was very instrumental in the writing of this plan as well as the General Plan. In El Dorado County, Wildland Fires are the most likely disaster. In reference to existing programs: The El Dorado County Fire Safe Council was formed by the County Board of Supervisors during 2003. This program is responsible for evaluating fire mitigation measures and implementing programs such as "defensible space", clearing of unimproved parcels and the "chipper program".

Other existing programs are implemented by the County Building Department in reference to building standards, which include earthquake mitigation. The County Department of Transportation has an existing program for clearing culverts and is the lead agency in distributing sand for sand bagging during storm runoff mitigation efforts. Two water agencies that operate in El Dorado County, El Dorado Irrigation District and the South Tahoe Public Utilities District, have very comprehensive plans that deal with mitigating water related incidents. This LHMP enhances the plans that are already in place. El Dorado County is fortunate to have a family of public safety professionals who work very close together. With the implementation of the California Standardized Emergency Management System (SEMS), and National Incident Management System (NIMS), all public safety agencies now work under the same guidelines. Because of these relationships all individual agencies in County Government have access to these plans.

Continued Public Involvement

El Dorado County Government seeks public involvement whenever any planning process is initiated. The Transportation Department, Environmental Management, Building Department, Emergency Services and many others have response and operational plans that were prepared from the work of a combination of professional planners, members of the unit, supervisors and the public. At any time a citizen or a citizens' group can voice concerns to the Sheriff/OES or any other governmental body to address mitigation issues. When the LHMP is complete it will be posted on the County Web Page under the OES/Homeland Security icon.

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

In an effort to solicit continued and new public involvement with the LHMP planning and review process, a press release to the local media outlets will be provided which will invite public review and comment regarding the 2009 LHMP. A link to the Sheriff / OES web page will give the public access to the LHMP, a video of the planning process, as well as a tentative agenda for the 2014 review and update of the LHMP