The requirements for risk assessment are described below:

DMA 2000 REQUIREMENTS: RISK ASSESSMENT OVERVIEW

Risk Assessment

Requirement §201.4(c)(2): The State plan **must** include a risk assessment that provides a factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy, and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments.

Source: FEMA, Standard State Hazard Mitigation Plan Review Crosswalk 2008

3.1 OVERVIEW OF RISK ASSESSMENT

A risk assessment requires the collection and analysis of hazard-related data to enable the State to identify and prioritize mitigation actions that will reduce losses from potential hazards. There are five risk assessment steps in the hazard mitigation planning process, as outlined below:

Step 1: Identify and Screen Hazards

Hazard identification is the process of recognizing natural and human-caused events that threaten an area. There are two general categories of hazards: Natural and human-caused:

- Natural hazards result from unexpected or uncontrollable natural events of sufficient magnitude to cause damage.
- Human-caused hazards result from human activity and include technological hazards and terrorism.

Hazards are identified by investigating past history of occurrence of these hazards and by gathering scientific data indicating prehistoric occurrences and likelihood of recurrence of these hazards. Even though a particular hazard may not have occurred in recent history in the study area, all hazards that may potentially affect the study area are initially considered. This screening and categorization process will allow us to concentrate efforts on developing mitigation strategies for those hazards categorized as higher risk.

Step 2: Profile Hazards

Hazards are profiled by first collecting data on the location, previous occurrence and probablility of future occurrence of each natural hazard. After this data is collected, each hazard is categorized based on these data. It is helpful in the profiling process to review existing plans and studies and use maps where appropriate.

Step 3: Identify Assets

Assets are defined as population; buildings; critical facilities and infrastructures; economic resources; cultural and environmental resources that may be affected by hazard events.

Step 4: Assess Vulnerabilities

A vulnerability analysis predicts the extent of exposure that may result from a hazard event of a given intensity in a given area. The assessment provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing the State to focus attention on areas with the greatest risk of damage.

Step 5: Analyze Potential Losses

The final stage of the risk assessment process provides a general overview of vulnerable populations, structures, critical facilities and resources in hazardous areas. This information provides groundwork for decisions about where the mitigation strategies would be most effective. A useful modeling tool to accomplish this is HAZUS, a risk assessment software program developed by FEMA to analyze potential losses from floods, hurricane winds, and earthquakes. HAZUS couples current scientific and engineering data with geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after, a disaster occurs.

3.2 NEVADA'S RISK ASSESSMENT PROCESS

The requirements for hazard identification, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 REQUIREMENTS: RISK ASSESSMENT

Identifying Hazards

Requirement §201.4(c)(2)(i): The State risk assessment **shall** include an overview of the type of all hazards that can affect the State.

Element

Does the **new or updated** plan provide a description of the type of **all natural hazards** that can affect the State?

If the hazard identification omits (without explanation) any hazards commonly recognized as threats to the State, this part of the plan cannot receive a satisfactory score.

Source: FEMA, Standard State Hazard Mitigation Plan Review Crosswalk 2008

3.2.1 Identifying and Screening Hazards

NMHP Subcommittee initially considered FEMA's listing of hazards and added any hazards specific to Nevada that were missing from the FEMA list and removed any that are not pertinent to Nevada. The subcommittee then used state-specific data, recent occurrence of natural disasters, local plans, and the individual expertise of its members to screen the list for those hazards that should be profiled for Nevada. The data in Table 3-1 below are the result of this screening process.

Table 3-1. Identification and Screening of Hazards Affecting Nevada

Hazard Type	Should It Be Profiled?	Explanation
Natural Hazards		
Avalanche	Yes	Avalanches affect a small portion of the State—Tahoe, Lee Canyon, and Ruby Mountains.
Canal failure	Yes	Nevada has experienced localized flooding due to failure of irrigation canal walls. The committee decided that it should be included under the Flood category.
Coastal storm	No	Nevada is not located in an area prone to coastal storms.
Coastal erosion	No	Nevada is not located in an area prone to coastal erosion.
Dam failure	Yes	There have been no federal declarations due to dam failure; however, Nevada has several high-hazard dams. The committee decided that it should be included under the Flood category.
Drought	Yes	Statewide drought declarations were issued in 2002 and 2004.
Earthquakes	Yes	Nevada ranks as the third state in frequency of large earthquakes over the last 150 years.
Epidemic	Yes	This hazard could cause an extreme economic downturn for the State of Nevada particularly in the casino industry.
Expansive soils	Yes	Expansive soils have caused infrastructure damage in the Reno-Sparks area.
Flood	Yes	Flood damage occurs regularly in Nevada. Flooding may result from rapid snow-melt, thunderstorm-induced flash floods, mudslides, dam failure, or failure of canal walls.
Infestations	Yes	Infestations impact Nevada's economy through the direct destruction of crops and natural resources as well as indirectly by increasing susceptibility to wildfire.
Landslide	Yes	In Nevada, rockslides are more common than the normal landslide seen in other areas. They tend to be localized; however, this hazard can occur with earthquakes, major storms, floods, and melting ice and snow.
Severe Weather Hazards: The subcommittee decided that the following severe weather hazards should be profiled individually		
Extreme heat	Yes	This hazard can affect areas across the entire state.
Hail and thunderstorms	Yes	The entire state is susceptible to thunderstorms which cause localized flooding and wildfire.
Severe winter storm and exteme snowfall	Yes	Normally Nevada can handle winter storms except when these storms are severe.

Table 3-1. Identification and Screening of Hazards Affecting Nevada

Hazard Type	Should It Be Profiled?	Explanation
Tornado	Yes	Although tornados in Nevada are rare, they do occur.
Windstor	Yes	All counties in Nevada are susceptible to severe and strong windstorms which have caused property damage.
Land subsidence and ground failure	Yes	The southern part of the State is particularly vulnerable to land subsidence due to groundwater extraction. Other parts of the state are also affected by subsidence or more rapid ground failure due to mine dewatering or the presence of underground mine workings adjacent to populated areas. *(Definition has been expanded)*
Tsunami/seiche	Yes	Lake Tahoe could have 10-meter-high waves generated by an earthquake under or adjacent to the lake.
Volcano	Yes	Nevada is downwind from potential volcanic eruptions, most importantly Mammoth Lakes, Mt. Lassen, and Mt. Shasta, California. Major eruptions could cause ash fall in Nevada.
Wildfire	Yes	The terrain, vegetation and weather conditions in the State of Nevada are favorable for the ignition and rapid spread of wildland fires.
Human-caused		
Hazmat	Yes	All Hazardous Material Events preparedness, planning, response and mitigation efforts are addressed separately from this plan under the State Emergency Response Commission and the Department of Conservation and Natural Resources.
Terrorism/WMD	Yes	All Terrorism/WMD preparedness, planning, response and mitigation efforts are addressed separately from this plan by the Office of Homeland Security.

3.2.2 Prioritization of Hazards

The Nevada Hazard Mitigation Planning Committee used seven criteria to prioritize the hazards likely to affect the State of Nevada. These seven criteria are magnitude, duration, economic impact, area affected, frequency, vulnerability, and state and community priorities.

The members assigned the values given below for each criterion and performed a numerical analysis based on these values to arrive at the ranking used to categorize the screened hazards as Very High, High, Medium, Low, or Very Low risk.

Criterion One: Magnitude

Magnitude refers to the physical and economic impact of the event. Magnitude factors are represented by:

- Size of event
- Life threatening nature of the event
- Economic impact of the event
- Threat to property including the following sectors: public; private; business and manufacturing; tourism; and agriculture.

Value:

1. Very Low Handled by community
2. Low Handled at city/town level
3. Medium Handled at county level
4. High State must be involved
5. Very High Federal declaration needed

Criterion Two: Duration

Duration refers to the length of time the disaster affects the State and its citizens. Some disaster incidents have far-reaching impact beyond the actual event occurrence such as the September 11, 2001 event. Duration factors include:

- Length of physical duration during emergency phase
- Length of threat to life and property
- Length of physical duration during recovery phase
- Length of time affecting individual citizens and community recovery
- Length of time affecting economic recovery, tax base, business and manufacturing recovery, tourism, threat to tax base and threat to employment

Value:

1. Very Low Critical facilities and/or services lost for 1 to 3 days
2. Low Critical facilities and/or services lost for 4 to 7 days
3. Medium Critical facilities and/or services lost for 8 to 14 days
4. High Critical facilities and/or services lost for 15 to 20 days
5. Very High Critical facilities and/or services lost for more than 20 days

Criterion Three: Economic impact

Distribution of the event refers to the depth of the effects among all sectors of the community and State, including both the geographic area affected as well as distribution of damage and recovery of the economy, health and welfare, and the State/community infrastructure.

Distribution factors include the following:

- How widespread across the state are the effects of the disaster?
- Are all sectors of the community affected equally or disproportionately?
- How will the distribution of the effects prolong recovery from the disaster event?

Value:

1. Very Low Community - Only the immediate community or part of a

town/city is affected

2. Low City/Town - entire town/city is affected
3. Medium County - effects are felt at the county level
4. High State - the entire state will be affected by the event
5. Very High Federal - effects are felt nationwide (e.g. Hurricane Katrina-sized)

Criterion Four: Area affected

Area affected refers to how much area is physically threatened and potentially impaired by a disaster risk. Area affected factors include:

- Geographic area affected by primary event
- Geographic, physical, and economic areas affected by primary risk and potential secondary effects.

To aid in the assessment of this criterion, hazard maps of some areas were prepared and used to determine the geographic extent of hazards and to define the approximate boundaries of areas at risk.

Value:

1. Very Low Community - Only the immediate community or part of a town/city is affected
2. Low City/Town - entire town/city is affected
3. Medium County - effects are felt at the county level
4. High State - the entire state will be affected by the event
5. Very High Federal - effects are felt nationwide (e.g. Hurricane Katrina-sized)

Criterion Five: Frequency

The frequency of the risk refers to the likelihood of recurrence of a hazardous event, based on historic occurrence and scientific data.

Value:

1. Very Low Occurs less than once in 1,000 years
2. Low Occurs less than once in 100 to once in 1,000 years
3. Medium Occurs less than once in 10 to once in 100 years
4. High Occurs less than once in 5 to once in 10 years
5. Very High Occurs more frequently than once in 5 years

Criterion Six: Vulnerability

The vulnerability refers to how susceptible the population, community infrastructure and state resources are to the effects of the hazard. Vulnerability factors include:

- History of the impact of similar events
- Mitigation steps taken to lessen impact
- Community and State preparedness to respond to and recover from the event

Value:

1. Very Low 1 to 5% of property in affected area severely damaged
2. Low 6 to 10% of property in affected area severely damaged
3. Medium 11 to 25% of property in affected area severely damaged
4. High 26 to 35% of property in affected area severely damaged
5. Very High 36 to 50% of property in affected area severely damaged

Criterion Seven: State and community priorities

State and community priorities refer to the importance placed on a particular hazard by the citizens and their elected officials. The factors affecting these priorities are:

- Long term economic impact on portions of the State or community
- Willingness of the State or community to prepare for and respond to a particular hazard
- More widespread concerns over one particular risk than other hazard
- Cultural significance of the threat associated with a hazard
- Potential for long term community or cultural disruption presented by the hazard
- Information provided by by the Subcommittee on the results of the hazard profiling

Value:

1. Very Low Advisory
2. Low Considered for further planning in the future
3. Medium Prompt action necessary
4. High Immediate action necessary
5. Very High Utmost immediacy

Subcommittee members assigned a value of 1 through 5 for each hazard criterion and performed a numerical analysis based on these values to arrive at a ranking of the risk posed by each of the profiled hazards to the state.

3.2.3 Categorization of Screened Hazards

Using the above values for the seven criteria listed, the 2009 Planning Subcommittee assigned each of the profiled hazards to one of the following risk categories based on a combination of the factors listed for each. Subcommittee members provided input to the final ranking based on their respective areas of expertise.

- **Very High Risk:** Of utmost immediacy requiring Federal declaration, well beyond the State's available resources and ability to respond; critical facilities and or services lost for more than 20 days, economic or physical effects are felt nationwide, occurs more frequently than once in five years, and/or is likely to occur in the future; more than 36% of property is damaged in the affected area.
- **High Risk:** Immediate action necessary, considered beyond the State's available resources and ability to respond, substantial property loss and financial impact to the entire State, critical facilities and/or services lost for 15-20 days, occurs once in five to ten years, 26 to 35% of property is lost or damaged in the affected area.
- **Medium Risk:** Prompt action necessary which may be beyond the State's available

resources and ability to respond, handled at county level, Critical facilities and/or services lost for 8-14 days, effects felt at the county level, occurs less than once in 10 to 100 years, 11-25% of property lost or damaged within the affected area.

- **Low Risk:** Should be planned for in the future, within the State's ability to respond with available resources. Critical facilities and/or services lost for 4-7 days, an entire town-city may be affected, occurs less than once in 100 to 1000 years, or 6 to 10 % of property lost or damaged within the affected area
- **Very Low Risk:** Advisory only, handled by the affected community, critical facilities and/or services lost for 1-3 days, only the immediate community or part of a community is affected, occurs less than once in 1000 years or damages less than 5% of the property in the affected area.

After assessing the information from the NHMP Subcommittee members' Hazard Profiling Worksheets, ratings were assigned to the hazards most likely to occur in the State of Nevada as shown below in Table 3-2. Due to the limited resources available, the Planning Subcommittee will focus the development of mitigation strategies on those hazards categorized as Very High Risk and High Risk. As more resources become available and mitigation activities are completed, additional mitigation strategies can be developed for lower-ranked hazards.

Table 3-2. Categorization of Hazards

Very High Risk	High Risk	Medium Risk	Low Risk	Very Low Risk
Earthquake	Flood	Epidemic	Drought	Avalanche
Terrorism/WMD	Wildfire	Severe winter storm	Hazardous materials event	Expansive soils
			Severe windstorm	Extreme heat
			Tsunami/seiche	Land subsidence and ground failure
				Hail and thunderstorm
				Infestation
				Tornado
				Volcano

3.3 PROFILING HAZARDS

Once the screening and prioritization process was completed the Subcommittee moved on to Step 2 of the Risk Assessment process, profiling of hazards. The requirements for profiling hazards, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 REQUIREMENTS: RISK ASSESSMENT

Profiling Hazards

Requirement §201.4(c)(2)(i): The State risk assessment **shall** include an overview of the location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate … .

Element

Does the risk assessment identify the **location** (i.e. geographic area affected) of each natural hazard addressed in the **new or updated** plan?

Does the **new or updated** plan provide information on **previous occurrences** of each hazard addressed in the plan?

Does the **new or updated** plan include the **probability of future events** (i.e. chance of occurrence) for each hazard addressed in the plan?

Source: FEMA, Standard State Hazard Mitigation Plan Review Crosswalk 2008

The specific hazards profiled in the Nevada HMP have been examined in a methodical manner based on the following factors:

- Nature
- History (previous occurrences)
- Location, severity, and probability of future events

Each hazard profile contains a table of hazard ratings for the local jurisdictions (counties, communities, or tribal entities). The information was derived from the County's approved hazard mitigation plan or the 2007 Hazard Risk Assessment Survey completed by County Emergency Managers and tribal entities.

All of the screened hazards were profiled. However, a vulnerability assessment to include loss estimates to State facilities was only conducted for the hazards categorized as Very High Risk: wildfire, flood, and earthquake.

The profiled hazards are presented in Section 3.3 in alphabetical order. The order of presentation does not signify the level of importance or risk.

3.3.1 **Avalanche** (Very Low Risk)

3.3.1.1 *Nature*

An avalanche occurs when a large mass of new dry snow detaches from a mountainside and slides or falls downward. Since the new snow layer is not compact, it could slide down to the base of the mountain.

The following three variables interact to determine whether an avalanche is possible:

1) Terrain: the slope must be steep enough to avalanche.

2) Snow pack: the snow must be unstable enough to avalanche.

3) Weather: Weather is another important variable. Changing weather can quickly increase instability.

3.3.1.2 *History*

The avalanche history in the table below was gathered from a variety of online resources and includes adjacent areas of the northern Sierra Nevada in California that would impact emergency services in northern Nevada.

Table 3-3. History of Nevada and adjacent Sierra Nevada Avalanche Occurrences

Date	Location	Details
7 April 1882	Genoa area, NV	The “extraordinary” snows of 1882 caused an avalanche at 5:30 AM that destroyed much of the town of Genoa. At least 18 lives were lost and many residences destroyed.
13-16 January 1952	Sierra Nevada west of Reno	Heavy snow in Reno and the Sierra Nevada caused snow avalanches that trapped an express train with 196 passengers and a crew of 30 at about 7000 feet elevation in the Sierra Nevada for three days before they were evacuated on a relief train to Roseville CA. Many passengers fell ill and one engineer died.
1968	Kyle Canyon, Clark Co, NV	In 1968 and avalanche occurred in Kyle Canyon on the Spring Mt Range and came through Echo Subdivision killing two people.
2 January 1969	Slide Mountain at Mount Rose ski area, NV	An avalanche on Slide Mountain at Mount Rose buried a19-year-old college freshman while skiing with friends. His body was found five days later.
21 December 1969	Mount Rose Highway, NV	An avalanche buried the Mt. Rose Highway in 20 feet of hard packed snow, completely blocking 150 feet of highway. No one was hurt.
29 January 1972	Mount Rose Ski area, NV	A four-day storm brought over 2 feet of new snow to The Chutes ski run area on Mount Rose. At around 3 pm, seven young men and teenagers were in the area of old Northwest Tower 9. Four were standing on the cornice above three who were on the ski run when the slope failed beneath the group on the cornice and caught all seven, completely burying three of them in a composite avalanche that deposited up to 20 foot depth of snow. The ski patrol was on sceneand initiated a rescue within 10 minutes. One of the buried young men was rescued and two died despite nearly 100 people assisting in the search.
31 March 1982	Alpine Meadows Ski Area, near Lake Tahoe, CA	An avalanche hit the Summit Chairlift and several ski area buildings and buried the parking lot under 10 to 20 feet of snow. It killed 7 people, injured 5 others, destroyed or damaged several buildings, chair lifts and vehicles causing total monetary loss of approximately 1.6 million dollars.

Feb 9, 1985	Squaw Valley, CA	About 100 houses were ordered evacuated in the Squaw Valley area due to avalanche danger after a blizzard dumped more than four feet of snow in the Sierra Nevada. I-80 and U.S. 50 were closed over the mountain passes due to extreme avalanche threat.
18 February 1986	Sierra Nevada, NV	Up to 8 feet of new snow in the Sierra Nevada caused numerous avalanches and rock/snow slides that blocked both I-80 and Amtrak train tracks west of Reno. The same storm system caused flooding that caused a state of emergency to be declared in Washoe, Douglas, Storey, Carson, and Lyon counties.
31 December 1992	Mammoth Lakes, Sierra Nevada, CA & NV	A 20-year-old Lakeport, Calif., man was killed in an avalanche on a slope in Sherwin Bowl ski resort just south of Mammoth Lakes. Interstate 80 and U.S. Route 50, were closed for 2 days over the passes through the Sierra between northern California and Nevada due to heavy snow and avalanche danger.
4-7 January 1993	Sierra Nevada	Up to five feet of new snow in the Tahoe basin caused an avalanche that buried two cars and closed Highway 89 for nine hours in the north Tahoe area. No one was hurt. In the same series of storms, a California man, his wife and infant son were traveling by car near the Nevada-Oregon state line when their vehicle was stuck and buried in the blizzard, but they were found alive and rescued more than a week later.
4 January 1995	Kirkwood Ski Area in the Sierra Nevada, CA	An avalanche buried a groomer but he was found by a trained dog and was dug out and survived.
10 March 1996	Kirkwood Ski Resort, CA	An avalanche at the Kirkwood Ski Resort trapped a worker who survived.
23 December 1996	Sugar Bowl Ski Area in the Sierra Nevada CA	An avalanche buried & killed a snowboarder.
8 December 1997	Mount Rose Highway, NV 431, NV	The Mount Rose Highway, NV 431, was closed for about an hour over the summit after an avalanche covered the highway in 7 feet of snow. No one was hurt.
12 Feb 1998	Near Donner Ski Ranch in the Sierra Nevada	A snowboarder who was making a snowboarding video was swept away and killed in an avalanche after he fell 300 feet.
6 Feb 1999	In the Sierra Nevada near Truckee CA	An avalanche in the Sierra Nevada buried four people for hours, killing one. The four had been sledding and walking along the shore of a lake 35 miles west of Reno.

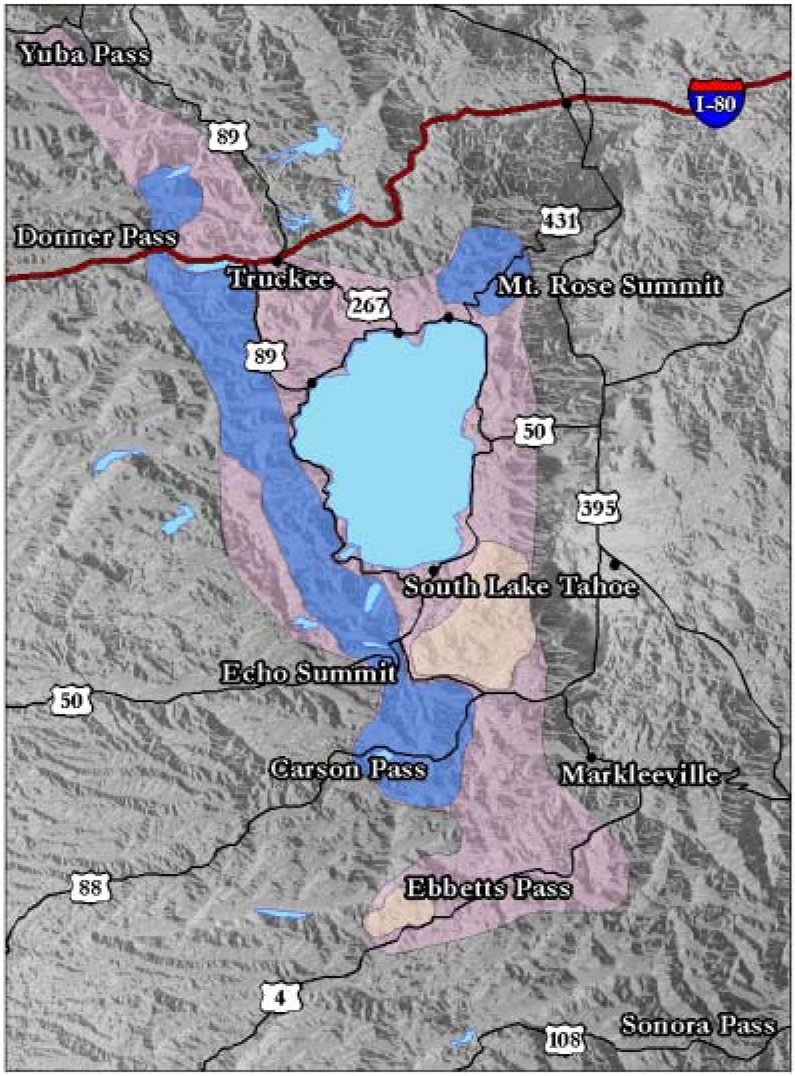
22 February 2001	Alpine Meadows/ Squaw Valley area in Sierra Nevada, CA	Two 17-year-old boys were killed by an avalanche near the Lake Tahoe-area ski resort of Squaw Valley in Sierra Nevada.
2 December 2001	Alpine Meadows ski area, CA	Avalanche at ski area, no fatalities.
15 December 2002	Mt. Rose ski resort, NV	A skier/snowboarder was lost and presumed trapped in an avalanche triggered after three skiers entered an out-of-bounds area just east of Mt. Rose ski resort. Two skiers made it back to the ski area.
5 Jan 2002	Mount Rose, NV	Avalanche, no injuries.
8 March 2002	Donner Pass Ski area, Sierra Nevada CA	Avalanche kills one skier.
26 April 2003	Lake Tahoe area, NV	A snowmobiler was killed in an avalanche in a remote area of the Sierra Nevada south of Lake Tahoe.
1 Jan 2004	Boreal Ridge in Sierra Nevada CA	Avalanche caused one fatality.
4 Jan 2004	Sierra Nevada near Truckee, CA	Avalanche buries skiers and snowboarders.
24 Feb 2004	Mount Charleston ski area, NV	Multiple avalanches, no one killed.
9 Jan 2005	Lee Canyon, Mount Charleston, NV	An avalanche 20 feet high swept a 13-year-old Las Vegas boy off a ski chair lift to his death at Las Vegas Ski & Snowboard Resort. Later US Forest Service investigation determined the snow deposited by the avalanche to be 75 feet wide and about 300 feet long. An avalanche of that magnitude had never before happened in the 40-year history of the ski resort.
10 Jan 2005	Sierra Nevada, CA, NV	Heavy snow and extreme avalanche danger closed the main highways over the Sierra Nevada.
2 February 2006	Near Twin Lakes in the Sierra Nevada, CA	Avalanche near Twin Lakes in Sierra Nevada buried three skiers, one of whom died; the others dug out.
April 2005	Mount Tom on the Nevada-California border	Two women skiers died after being buried by an avalanche while descending Mount Tom along the California-Nevada border mountain in the Sierra Nevada.

21 February 2005	Between Sugar Bowl and Squaw Valley ski resorts north of Lake Tahoe in the Sierra Nevada, CA	A cross-country skier was killed after she became trapped by a backcountry avalanche in the Sierra Nevada, between the Sugar Bowl and Squaw Valley ski resorts north of Lake Tahoe. Two other members of the party were trapped by the avalanche, but were able to dig out relatively quickly.
12 February 2007 Mount Rose ski area	Mount Rose ski area, NV	A ski patrol member was caught in an avalanche while conducting avalanche control at Yellow Jacket, a run in the Extreme Chutes of Mount Rose-Ski Tahoe resort. A slab of snow broke loose above him and he was swept 600 feet down the mountain, but was only partially buried. He suffered a broken leg and a cut to his head.
27 February 2007	Ruby Mountains Elko County, NV	Up to 16 inches of snow in the Ruby Mountains caused avalanches that threatened snowmobilers and skiers. Snow depths in upper Lamoille Canyon were between 3 and 4 feet.
Dec 2008	Squaw Valley ski restort, CA	Avalanch kills one skier
18 February 2009	Slide Mountain side of Mount Rose ski area, NV	An avalanche occurred on the Slide Mountain side of the Mount Rose ski area and Search & Rescue were dispatched but no one was reported to have been trapped by the avalanche.
4 March 2009	Squaw Valley USA ski resort, Sierra Nevada, CA	An avalanche at Squaw Valley USA ski resort in the Sierra killed a veteran ski patrol member who was working on avalanche control when he was partially buried by a slide, dug out, but later died at a hospital in Reno. I-80 and U.S. 50 were closed for avalanche control.

3.3.1.3 *Location, Severity, and Probability of Future Events*

Avalanche possibilities exist in Douglas, Elko, Clark, and Washoe Counties although there have been no written records of avalanches occurring in the more populated areas of these counties. Incline Village and Crystal Bay are under avalanche advisory several times during the winter months. The Ruby Mountains in Elko County also have this risk, but only in unpopulated areas. Avalanches can also occur in Clark County where one avalanche-related death occurred on Mount Charleston in the Spring Mountains in January 2009.

Figure 3-1. Map of Sierra Avalanche Center's Forecast Area



Source: Sierra Avalance Center, http://www.sierraavalanchecenter.org /

The Sierra Avalanche Center maintains a website, http://www.sierraavalanchecenter.org , with avalanche advisories for the Sierra posted by professional avalanche forecasters. This avalanche advisory is provided through a partnership between the Tahoe National Forest and the Sierra Avalanche Center. This advisory describes general avalanche conditions in the Central Sierra Nevada including both California and Nevada and applies only to backcountry areas outside established ski area boundaries. This website includes avalanche facts, FAQs, myths, and useful safety information as well as links to other sites:

Wherever possible, transportation corridors have been constructed to avoid avalanche hazard and are well maintained with state and local resources. When avalanches do occur, they generally affect only roads in the Tahoe basin and those that cross the Sierra Nevada.

These roads are closely monitored during periods of heavy snowfall and closed if avalanche danger threatens motorists. These road closures may cause long delays and/or detours for motorists and truckers. Most avalanche events are located in unpopulated areas that fall under the ownership of the U.S. Forest Service where damage to current and future structures is minimal. Danger to humans increases with winter recreation in these areas such as snowmobiling, cross country skiing, and snowshoing. By far the greatest past eaths abd injuries due to avalanches have occurred at established ski areas where the same fresh deep snow on steep slopes that attracts skiers also iitiates avalanaches.

Avalanches are considered to be in the “Very Low Risk” hazard category because they are likely to affect few people in Nevada. The avalanches that do occur will most likely be handled efficiently by ski resorts, local authorities, the Nevada Department of Transportation, and/or the U.S. Forest Service.

Most avalanche-related injuries and fatalities will likely continue to be related to recreationalists drawn to the steep snow-covered slopes prone to avalanches. Most developed ski areas have avalanche control measures and rescue teams on site, however, an ever-increasing number of outdoor enthusiasts are using snowmobiles in undeveloped areas with no avalanche controls or available emergency personnel. In 2009 twice as many snowmobilers died in avalanches in the U.S. as did participants in any other winter sports activities. As population increases and as more snowmobilers venture into the winter backcountry, avalanches may become an increasing threat in Nevada in the future, but currently, they do not account for a large number of deaths or injuries in this state.

Due to the location and severity of avalanche hazard, mitigation actions are relegated to the local jurisdictions where the hazards exist. The State will support local jurisdiction activities in lessening this hazard.

Table 3-4. Avalanche Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City	X			
Churchill County				X
Clark County				X
Douglas County	X			
Elko Band				X
Elko County	X			
Ely Shoshone Tribe				X
Esmeralda County				X
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X

Storey County	X			
Washoe County	X			
Washoe Tribe	X			
White Pine				X
Source: Local state approved HMP				

3.3.2 Drought (Low Risk)

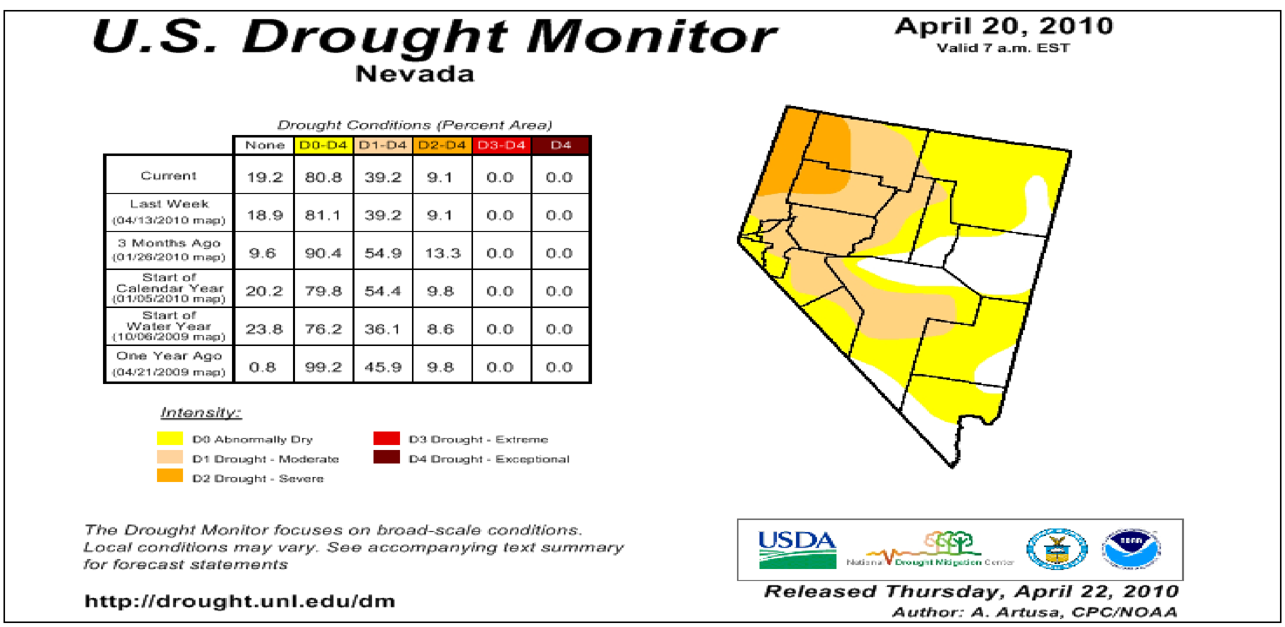
3.3.2.1 *Nature*

According to the National Weather Service, drought is defined as a prolonged period of time during which there is an extended decline in expected precipitation over one or more seasons spread over a considerable geographic area. This differs from normal desert conditions that exist in Nevada where average annual precipitation ranges from 4 inches per year in Clark County to 12 inches in Storey County, averaging 9 inches per year statewide making it the driest state in the U.S. Severity of drought can be aggravated by other factors such as high temperature, high wind, and low relative humidity. Drought damages agriculture, tourism, fish and wildlife, water and sewer systems which in turn impacts the economic, environmental, social, and municipal structure of the state.

The National Weather Service provides a weekly drought monitor viewable by state as shown in Figure 3-2 and by region as shown in Figure 3-3 to help the public in mitigating losses and maximizing economic gains relative to drought. Since the drought outlook changes constantly and could change significantly before this report is revised, real-time current updates for these maps are available at this link:
http://www.drought.unl.edu/DM/monitor.html

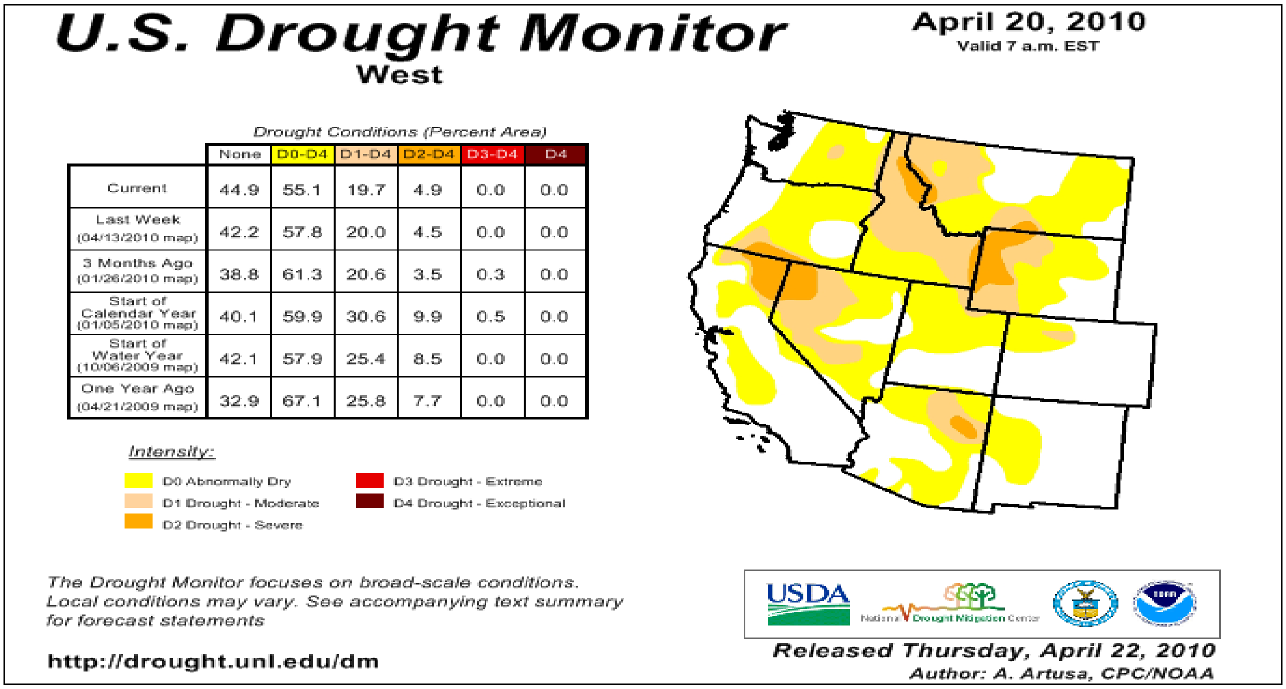
The site includes drought forecasts up to 12 months out from current date.

Figure 3-2. 2010 Drought Monitor Map for Nevada from the National Weather Service



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	19.2	80.8	39.2	9.1	0.0	0.0
Last Week (04/13/2010 map)	18.9	81.1	39.2	9.1	0.0	0.0
3 Months Ago (01/26/2010 map)	9.6	90.4	54.9	13.3	0.0	0.0
Start of Calendar Year (01/05/2010 map)	20.2	79.8	54.4	9.8	0.0	0.0
Start of Water Year (10/06/2009 map)	23.8	76.2	36.1	8.6	0.0	0.0
One Year Ago (04/21/2009 map)	0.8	99.2	45.9	9.8	0.0	0.0

Figure 3-3. U.S. Seasonal Drought Outlook for the Western U.S. through 22 April 2010 from the National Weather Service



3.3.2.2 *History*

Droughts have been a major cause of economic loss and environmental damage throughout the history of the State of Nevada. Prolonged drought has caused crop failures, loss of livestock and wildlife, and shortage of potable water. Additionally, drought has caused insect infestations, dust storms, and urban-wildland interface fires. In January, 2009, the U.S. Department of Agriculture designated 15 of Nevada's 17 counties as primary natural disaster areas due to losses caused by ongoing drought that began January 1, 2008. Those counties are: Carson City, Esmeralda, Lyon, Churchill, Eureka, Mineral, Clark, Humboldt, Pershing, Douglas, Lander, Storey, Elko, Lincoln, and Washoe. Farm operators in Nye and White Pine counties in Nevada also qualify for natural disaster benefits because their counties are contiguous.

The State Climatologist prepared historical data on drought for each county from National Climatic Data Center (NCDC) records from 1895 to the present that is presented in Appendix K.

3.3.2.3 *Location, Severity, and Probability of Future Events*

The historical data presented by the State Climatologist in Appendix K will assist each county in its preparedness and response planning. These data demonstrate the recurrence of drought in every county throughout the state and provide a basis for the probability of recurrence of drought throughout the state. The probability of a prolonged drought exists in all counties of the state of Nevada and can affect the entire state. Analysis of the data above show that in 2002 and 2004, the U.S. Department of Agriculture designated all seventeen counties in Nevada as drought affected, and by 2004, most of Nevada and much of the southwestern U. S. were in the fifth year of prolonged drought. Also, at the time of writing this update in 2010, 15 of Nevada's 17 counties were still under a January 2009 U.S. Department of Agriculture disaster declaration due to drought.

Drought was ranked as a "Low Risk" hazard to Nevada by the NHMP subcommittee. Drought effects are mitigated through the Nevada Drought Plan, which defines the stages of drought in the state and outlines the state's response during a drought. The State of Nevada Drought Plan is administered by the Drought Review and Reporting Committee chaired by the Nevada State Climatologist. The Nevada Drought Plan was first written in 1991 to address the need to know when drought conditions become severe enough to require action by the state to mitigate impact on the state's resources. The plan establishes the system of coordination among affected stakeholders to provide assistance in mitigating the impact of drought. These include a broad cross section of agricultural municipal, tribal, economic stakeholders who would be affected by drought. The plan also establishes a process for obtaining federal assistance if required.

The State of Nevada Drought Plan (revised by the Division of Water Resources in 2003) is available online at the following link:

http://water.nv.gov/WaterPlanning/wat-plan/PDFs/July%202003%20Drought%20Plan.pdf

The table below summarizes the drought hazard rating in the hazard mitigation plans of counties and tribal entities.

Table 3-5. Drought Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City		X		
Churchill County				X
Clark County		X		
Douglas County				X
Elko Band	X			
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County			X	
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County			X	
Lyon County				X
Mineral County				X
Nye County			X	
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley		X		
South Fork Band Tribe				X
Storey County		X		
Washoe County			X	
Washoe Tribe			X	
White Pine				X

3.3.3 **Earthquakes** (Very High Risk)

3.3.3.1 ***Nature***

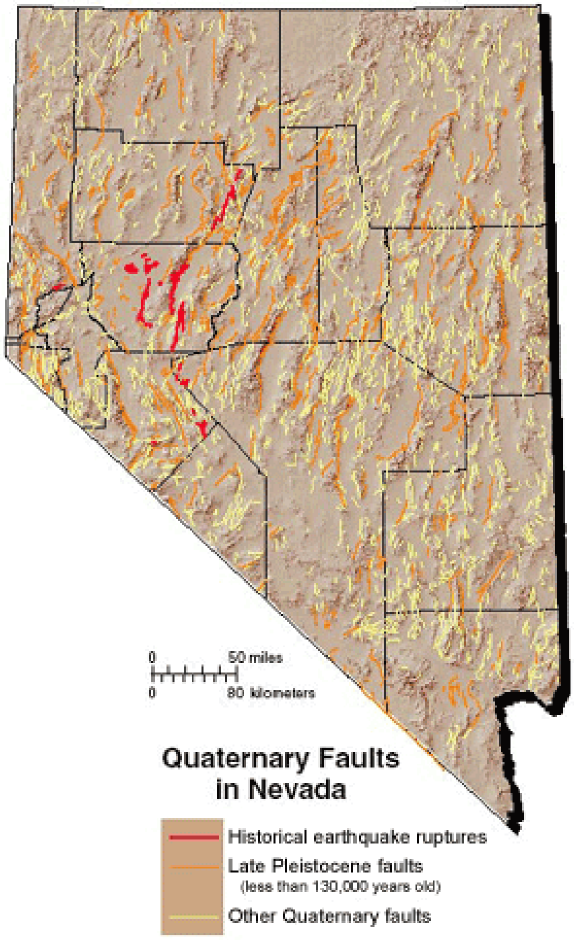


Figure 3-4. Quaternary Fault Map of Nevada from Nevada Bureau Mines and Geology Special Publication 27

An earthquake is sudden shaking usually caused by rapid, subsurface fault movement. This releases strain accumulated within the Earth's crust. Earthquakes are one of the largest natural hazards and have the potential to create catastrophic, comprehensive disasters. The effects of an earthquake can be damaging far beyond the site of its occurrence and usually occur without warning. After just a few seconds, earthquakes can cause massive damage and extensive casualties. The most common effect of an earthquake is ground motion, which is the vibration or shaking of the ground. Other potentially damaging effects include surface offset, landslides and rockfalls, and the ground becoming fluidized.

The severity of ground motion generally increases with the size of an earthquake and decreases with distance from the fault or epicenter. Ground motion causes waves in the Earth's interior, also known as body waves, and along the earth's surface, known as surface waves. There are two primary kinds of body waves. P (primary) waves are longitudinal or compressional waves similar in character to sound waves that cause back-and-forth oscillation along the direction of travel. S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side-to-side. There are also two kinds of surface waves: Rayleigh waves, which cause a rolling motion like ocean waves and Love waves, which shake from side-to-side. Buildings and other structures need to be designed to withstand the shaking from earthquakes, and people need to be mindful of the potential threat from the contents of buildings being shaken down.

In addition to ground motion, several secondary hazards can occur from earthquakes, such as surface faulting. Surface faulting is the offset of the Earth's surface caused by movement along a fault. Displacements along faults during a single earthquake vary both in terms of length and width, but can be significant (e.g., up to 20 feet), as can the length of the surface rupture (e.g., up to 70 miles). Surface faulting can cause severe damage to buildings, highways, railways, pipelines, and tunnels.

Earthquake-related ground failure due to liquefaction is another secondary hazard. Liquefaction occurs when seismic waves pass through saturated granular soil, causing the granules to collapse into the empty spaces between grains. This causes water pore pressure to increase sufficiently to make the soil behave like a fluid for a brief period. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 feet, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet), and loss of bearing strength (structures sink into the ground or tip). Liquefaction can cause severe property damage.

The effects of earthquake waves at the surface can be measured using the Modified Mercalli Intensity (MMI) scale, which consists of rankings based on observed human behavior, building effects, and ground deformation. The size of an earthquake is measured by the earthquake magnitude scale (M), which is based on the size and duration of seismic waves, accounting for distance from the event.

Figure 3-5. Fault Scarp in the Fairview Peak Area, Nevada, formed by the December 16, 1954, Earthquake. (Photograph from the National Geophysical Data Center.)

The Modified Mercalli Scale

The Modified Mercalli scale (Roman numerals I-XII) is used to measure the intensity of an earthquake in a particular area. It differs from the magnitude scale, which measures the energy released by an earthquake.

Table 3-6. Modified Mercalli Scale

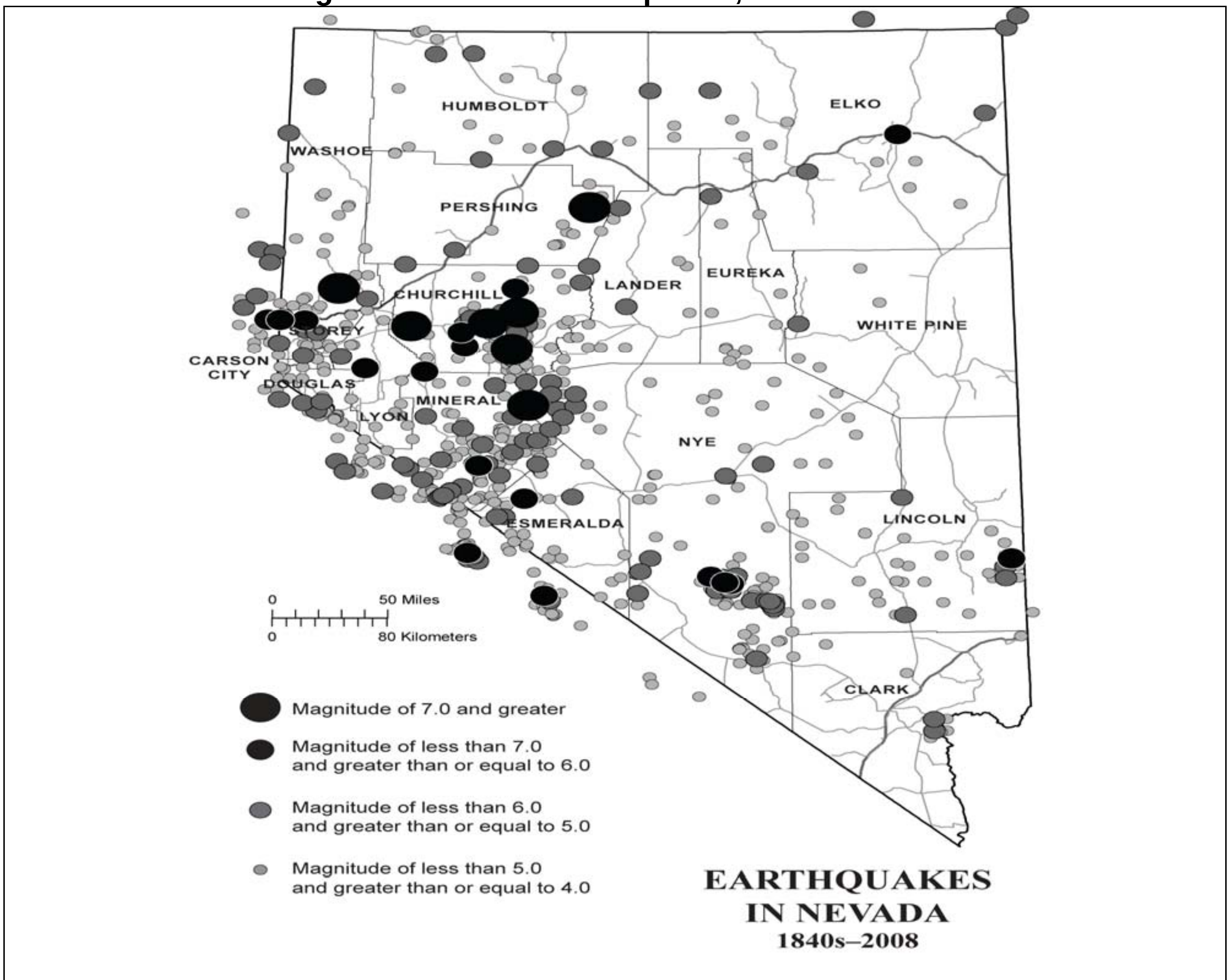
I	Barely felt.
II	Felt by a few sensitive people, some suspended objects may swing.
III	Slightly felt indoors as though a large truck were passing.
IV	Felt indoors by many people, most suspended objects swing, windows and dishes rattle, and standing autos rock.
V	Felt by almost everyone, sleeping people are awakened, dishes and windows break.
VI	Felt by everyone, some are frightened and run outside, some chimneys break, some furniture moves, and slight damage.
VII	Considerable damage in poorly built structures, felt by people driving, most are frightened and run outside.
VIII	Slight damage to well-built structures, poorly built structures are heavily damaged.
IX	Underground pipes breaks, foundations of buildings are damaged and buildings shift off foundations, considerable damage to well-built structures.
X	Few structures survive, most foundations destroyed, water moved out of riverbanks

	and lakes, avalanches and rockslides, railroads rails are bent.
XI	Few structures remain standing, total panic, large cracks in the ground.
XII	Total destruction, objects thrown into the air, the land appears to be liquid and is visibly rolling like waves

3.3.3.2 *History*

The State of Nevada ranks in the top three states subject to the largest earthquakes over the last 150 years. Only Alaska and California have had more large (magnitude 7 or greater) earthquakes. Table 3-7 is a partial listing of significant historical earthquakes in Nevada from 1860 to 2008 with magnitudes of 5.0 or greater. Figure 3-6 shows a map of earthquake locations in Nevada and adjacent parts of California from the 1840s to 2008. Geologically young faults, located in all parts of Nevada (figures 3-4 and 3-8), are the sources of earthquakes.

Figure 3-6. Nevada Earthquakes, 1840s to 2008



Earthquakes in the Nevada region recorded from the 1840s to 2008. (Nevada Seismological Laboratory)

Table 3-7. Significant Historical Earthquakes in Nevada from the 1840s to 2008

Date	Magnitude	Location	Nearest Community[1]
1840s	7+	Western Nevada	Fallon
Mar. 15, 1860	6.8	Western Nevada	Virginia City
Dec. 27, 1869	6.7	Olinghouse	Wadsworth
Dec. 27, 1869	6.1	Carson City	Carson City
Jun. 3, 1887	6.3	Carson City	Carson City
Apr. 24, 1914	6.1	Reno area	Reno
Oct. 3, 1915	7.3	Pleasant Valley	Winnemucca
Dec. 21, 1932	7.1	Cedar Mountain	Gabbs
Jan. 30, 1934	6.3	Excelsior Mtns.	Mina
Dec. 29, 1948	6.0	Verdi area	Verdi
May 24, 1952	5.0	Lake Mead area	Boulder City
Jul. 7, 1954	6.6	Rainbow Mtn.	Fallon
Aug. 8, 1954	7.0	Rainbow Mtn.	Fallon
Dec. 16, 1954	7.2	Fairview Peak	Fallon
Dec. 16, 1954	7.1	Dixie Valley	Fallon
Sep. 22, 1966	6.0	Clover Mountain	Caliente
Sep. 12, 1994	5.9	Double Spring Flat	Gardnerville
Feb. 21, 2008	6.0	Town Creek Flat	Wells
May 25, 2008	5.0	Mogul	Mogul

1 Not necessarily the only communities affected by the earthquake.
Source: Diane de Polo, UNR Seismological Laboratory

There is no doubt that Nevada is in earthquake country. Historically, there has been a magnitude 7 or greater earthquake about every thirty years somewhere in Nevada; the last one was in 1954, over 50 years ago. Table 3-8 presents some earthquakes that have occurred in Nevada in the last decade, many near populated areas.

Table 3-8. Nevada Earthquakes in the last Decade

Place	Date	Description
Douglas County Minden-Gardnerville, NV	23 June 2000 11:00 AM PDT	The Nevada Seismological Laboratory recorded an earthquake of M = 3.6 at 7:02 AM (PDT) Friday, June 23, near Minden-Gardnerville, Nevada. Another event of M = 3.3 at 6:55 AM preceded it. Due to its relatively small size, no damage was expected.
Douglas County Topaz Lake, NV	26 September 2000 12:10 PM PDT	The Nevada Seismological Laboratory recorded an earthquake of M = 4.7 at 12:20 AM (PDT) Tuesday, September 26, near Topaz Lake, Nevada. The preliminary location of this event is 38.66N, 119.52W, 2 miles southeast of Topaz Lake and approximately 16 miles southwest of Wellington, Nevada. The depth was computed to be approximately 9 km (6 mi). Many foreshocks were recorded during the hours prior to this earthquake, and a foreshock of approximately M = 3.0 occurred a few seconds prior to the main event. Numerous aftershocks have been recorded. This

Table 3-8. Nevada Earthquakes in the last Decade

Place	Date	Description
		event occurred in a moderately active seismic zone which has had at least 3 nearby (<10 km) earthquakes in the last decade of M > 4.
Washoe County Gerlach, NV	16 November 2000 2:00 PM PDT	The Nevada Seismological Laboratory recorded an earthquake of M = 3.8 at 5:07 AM (PST) Thursday, November 16, near Gerlach, Nevada. The preliminary location of this event is 40.50N, 119.48W, approximately 10 mi. south of Gerlach, Nevada. The depth was computed to be approximately 3 km (2 mi). This event occurred in a small area which has had 12 earthquakes > M 2 and 2 earthquakes > M 3 since October 5 of this year.
Washoe County Gerlach, NV	19 November 2000 6:30 PM PDT	The Nevada Seismological Laboratory recorded an earthquake of M = 4.3 at 4:54 AM (PST) Sunday, November 19, near Gerlach, Nevada. The preliminary location of this event is 40.49N, 119.51W, approximately 12 mi. south of Gerlach, Nevada. The depth was computed to be approximately 5 km (3 mi).
Washoe County	2 December 2000 11:00 AM PDT	The Nevada Seismological Laboratory recorded an earthquake of ML = 4.9 at 7:34 AM (PST) Saturday, December 2, 2000, west of Truckee, California. Aftershocks of M = 3.0 at 7:37 AM and 3.2 at 8:30 AM followed it. The preliminary location of the larger event is 39.38 degrees North and 120.46 degrees west. This location is about 4 miles north of the Kingvale exit on I80, or about 15 miles west-northwest of Truckee. The depth was computed to be approximately 12 km (5 mi). There is a sequence of small aftershocks.
Washoe County	10 August 2001 2:00 PM PDT	There was a magnitude 5.4 earthquake August 10, 2001, at 1:19 p.m. It was located at 39.828 N, 120.532 W, with a preliminary depth of 14 kilometers. It was located approximately 5 miles north of the community of Graegle, California and 41 miles south of Susanville, California. This earthquake was widely felt throughout eastern California and western Nevada. Minor damage and/or injury would be expected for an event of this size. A number of aftershockswere recorded. This region has experienced smaller events of a similar character in the past few years.
Elko County	October 2001 10:37 PM PDT	There was a magnitude 4.6 earthquake at 10:37 PM (local time) about 50 km (30 mi) north of Elko, Nevada. It was located at 41.225 N, 115.858 W. The location is somewhat uncertain because this is beyond the fringe of the NSL network and because a station east of Elko was the closest at 74 km (46 mi) from the epicenter. This earthquake was felt in the Elko area.
Nye County	14 June 2002 9:30 AM PDT	There was a magnitude 4.4 earthquake June 14, 2002, at 5:40 a.m. It was located at 36.7150 N, 116.3003 W, with a preliminary depth of 12 kilometers (~ 7 mi). This location is approximately 20 km (~ 12 miles) southeast of the proposed nuclear waste repository at Yucca Mountain and just inside of Hwy 395 between Indian Springs and Beatty, Nevada. This earthquake occurred in the aftershock zone of the M 5.6 Little Skull Mountain earthquake of June 29, 1992. The area has been active since that earthquake, but this is the largest event in over 6 years.
Washoe County Sparks, NV	19 July 2002 9:30 AM PDT	There was a magnitude 2.4 earthquake Friday, July 19, 2002, at 6:38 A.M. It was located at 36.5442 N, 119.7599 W, with a preliminary depth of 13 kilometers (~ 8 mi). This location is

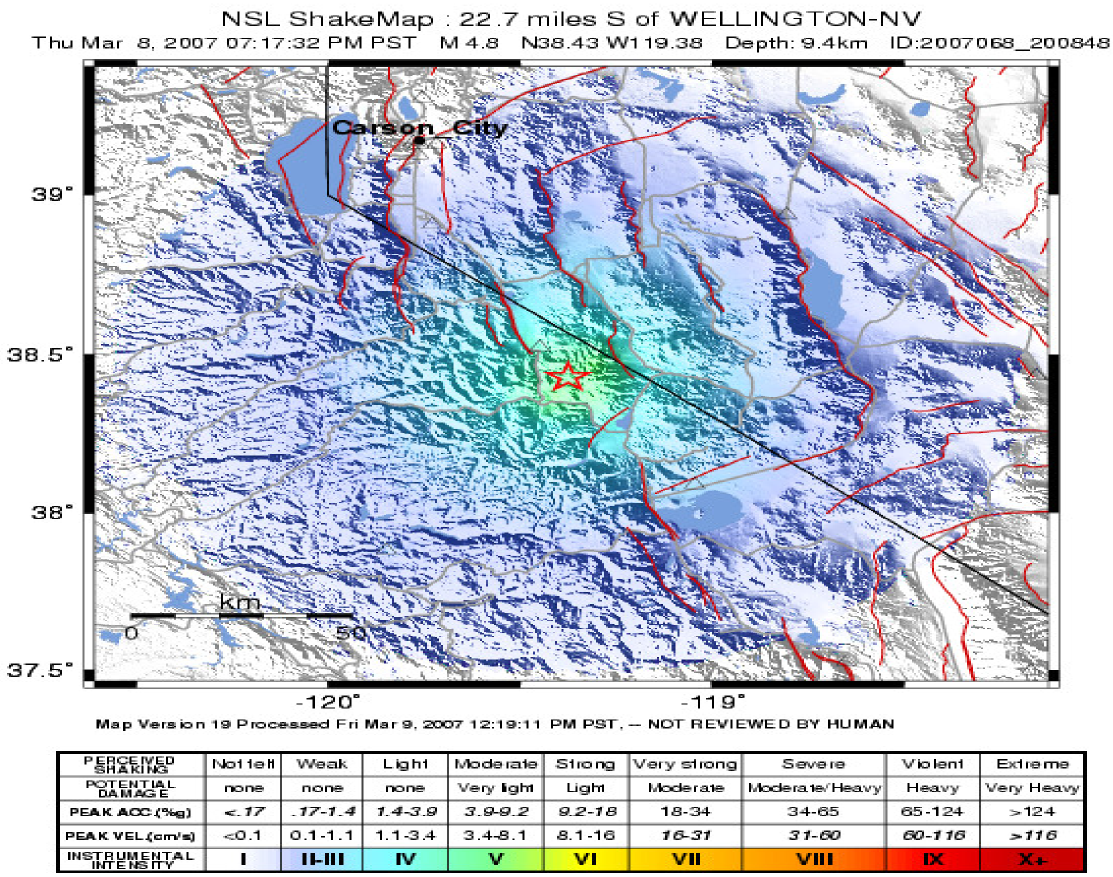
Table 3-8. Nevada Earthquakes in the last Decade

Place	Date	Description
		approximately near the intersection of Pyramid Highway with Interstate 80 in Sparks, Nevada. This earthquake, although very small in magnitude, was apparently felt by several people in Sparks.
Churchill County Storey County	21 October 2002 4:00 PM PDT	There was a magnitude 3.5 earthquake October 21, 2002, at 3:31 p.m. It was located at 39.533 N, 119.156 W, with a preliminary depth of 11 kilometers (~ 7 mi). It was located approximately 10 km (~ 7 mi) southeast of Fernley NV. This earthquake was felt in the Fallon and Fernley areas. No reports of damage or injury have been received.
Churchill County Silver Springs, NV	21 November 2002 9:00 AM PST	The NSL recorded a magnitude 3.5 earthquake at 11:51 PM PST on November 20, 2002. It was located at 39.388 N, 119.193 W, with a preliminary depth of 13 kilometers (~ 8 mi). This location is approximately 7 km (~ 4 mi) southeast of Silver Springs NV.
Mineral County Mina, NV	29 May 2003 5:00 PM PDT	A magnitude 4.0 earthquake was recorded today at 3:52 PM, PDT, May 29, 2003. It was located at 38.262 N, 117.904 W, with a preliminary depth of 8 kilometers (5 miles). This location is approximately 23 km (14 miles) southeast of Mina, Nevada. This is a remote area in the southern part of the Monte Cristo Range. This event was preceded by an M 3.7 earthquake at 11:33 AM PDT at approximately the same location and also by some other smaller, intervening shocks.
Douglas County Boulder City, NV	17 September 2003 12:30 PM PDT	A magnitude 2.7 earthquake was felt at 11:02 PM, PDT (September 17, 2003). It was located at 35.94 N, 114.70 W, with a preliminary depth of 3.6 km (2 miles). This location is approximately 15 km (9 miles) southeast of Boulder City, Nevada.
Washoe County Reno, NV	April 10, 2004 3:00 PM PDT	A magnitude 2.4 earthquake was recorded Saturday, at 6:57 AM PDT on April 10, 2004, in Reno, Nevada. It was located at 39.507 N, 119.767 W, with a preliminary depth of 8.6 kilometers (~ 5 miles). This location is approximately under the Reno International Airport. The earthquake was felt by many residents of Reno/Sparks.
Washoe County Reno, NV	June 3, 2004 9:00AM PDT	A magnitude 4.5 earthquake was recorded Thursday, at 1:54 AM PDT on June 3, 2004, in the Reno - Lake Tahoe region, Nevada and California. It was located at 39.334 N, 120.007 W, with a preliminary depth of 8.6 kilometers (~ 5 miles). This location is approximately 6 miles (10 km) north of Kings Beach (and the north shore of Lake Tahoe), and nearly on the Nevada - California state line. We located five minor foreshocks, with the largest being a (preliminary) magnitude 2.7 foreshock at 1:25 AM. and a large number of aftershocks. The largest so far was at 4:16 AM (preliminary magnitude 1.5). The earthquake was felt as light to weak shaking throughout the Reno and Lake Tahoe region.

Table 3-8. Nevada Earthquakes in the last Decade

Place	Date	Description
Esmeralda County	20 September 2004 11:00 AM PDT	A magnitude 5.0 earthquake was recorded (Monday, September 20) at 9:51 AM PDT near Mono Lake, California, nearly on the Nevada border. It was located at 38.024 N, 118.642 W, with a preliminary depth of 5.5 kilometers (~3 miles). This earthquake follows two larger events on Saturday, September 18, at 4:02 and 4:43 PM PDT; their magnitudes were 5.5 and 5.4, respectively. All three events are within roughly 3 km (~2 miles) of one another. The location of these events is roughly 30 miles south of Hawthorne, Nevada, and 30 miles northwest of Mammoth Lakes, California. Numerous aftershocks (nearly 1000 so far) of the Saturday events have been observed at the Nevada Seismological Laboratory.
Washoe County Reno, NV	27 December 2004 12:00 PM PST	A magnitude 2.5 earthquake was felt at 7:12 AM, PST (December 27, 2004). It was located at 39.594 N, 119.795 W, with a preliminary depth of 3.4 km (~2 miles). This location is approximately 5 miles north of downtown Reno, Nevada in the Sun Valley area. This is the largest of a swarm of over 100 micro-earthquakes seen in this area by the Nevada Seismological Laboratory. The M 2.5 earthquake was reported to be felt by at least three people. Earthquakes with magnitudes as small as M 2 have been reported in the Reno vicinity in the past.
Washoe County Lake Tahoe	26 June 2005 12:50 PM PDT	A magnitude 5.0 earthquake was recorded Sunday, at 11:45 AM PDT on June 26, 2005, in the Reno - Lake Tahoe region, Nevada and California. It was located at 39.315 N, 120.060 W, with a preliminary depth of 13.2 kilometers (~ 6.6 miles). This location is approximately 8 miles (12 km) east of Truckee, California, and close to the Nevada – California state line. This earthquake occurred in the same active area, where a M 4.5 earthquake was recorded on June 3, 2004. The earthquake was felt widely throughout the Reno and Lake Tahoe region.
Douglas County Wellington, NV	8 March 2007 19:17:32 PST	A magnitude 4.8 earthquake was recorded 22.7 miles south of Wellington, NV. The quake map for this event is in Figure 3-7.
Wells area, Elko County, NV	21 February 2008 6:16 am	A magnitude 6.0 earthquake was recorded at 6:16 am on 21 February 2008; epicenter was about 5.5 miles (9 km) northeast of Wells. There were at least three quake-related injuries, and this quake did extensive damage to unreinforced masonry buildings in and around the town of Wells. There were several propane leaks and widespread non-structural damage caused by the quake.
Mogul-Somersett, west of Reno, Washoe County	25 April 2008 11:38 PM PST	A magnitude 5.0 earthquake (moment magnitude 5.0, local magnitude 4.7) occurred in this populated residential area. It caused approximately $2 million in damage.

Figure 3-7. NSL Shake Map for 22.7 miles south of Wellington Nevada



Source: Nevada Seismological Laboratory.

3.3.3.3 *Location, Severity, and Probability of Future Events*

In Nevada, faults occur along many of the range fronts, within ranges, and within valleys. Normal-slip faults, those that down-drop the ground during earthquakes, commonly appear as steps in the landscape related to the vertical offset, whereas strike-slip faults, that offset the ground sideways, usually are expressed by linear features, such as elongate valleys, and alignments of features, such as springs. Historical earthquakes have ruptured both kinds of faults in Nevada.

In the *Hazard Mitigation Survey* and the *County Hazard Mitigation Plans,* Eureka and Clark Counties considered this risk as low. Eureka considered the county's water and sewer lines could be at risk in case of an earthquake. Clark County cited Yucca Mountain as a problem in case of an earthquake. Carson City considered this risk high citing problems with collapsing buildings after an earthquake. Also, Churchill, Douglas, Lincoln, Nye, Story and

Washoe Counties considered this risk to be high. Douglas County has some of the most active faults in Nevada. Lincoln County has many known faults, although the hazard appears to be lower in this county than in most counties in Nevada. Nye County has had two major earthquakes and several minor earthquakes. Washoe County was concerned with residential and commercial structural damage, transportation loss due to major highways through the county, and utility damage.

In the *Tribal Hazard Mitigation Survey,* Ely Shoshone Tribe, Shoshone-Paiute Tribes of Duck Valley, and South Fork Band Council considered this hazard as low risk. Shoshone-Paiute Tribes of Duck Valley mentioned that there are eighteen identified fault lines on the Duck Valley Indian Reservation. The Confederated Tribes of Goshute Reservation identified this hazard as a probability of moderate. All of the tribes that answered this survey mentioned that structural damage to residential buildings would be a major problem with this hazard.

According to the Nevada Seismological Laboratory and Nevada Bureau of Mines and Geology, Nevada has recently active Quaternary faults that are the sources of earthquakes located throughout the state, so an earthquake could occur at any time in any part of the state. Considerable information about earthquake hazards is available online through the Nevada Bureau of Mines and Geology (http://www.nbmg.unr.edu/), the Nevada Seismological Laboratory (http://www.seismo.unr.edu), the University of Nevada, Las Vegas (http://earthquakes.unlv.edu/outreach/), and the U.S. Geological Survey (http://earthquake.usgs.gov/). The Nevada Bureau of Mines and Geology (NBMG) has released two new products that help define the location, severity, and probability of earthquakes in the state. NBMG Map 167, *Quaternary Faults in Nevada,* is available in pdf format or as an online, interactive map that allows the user to locate faults near a given address and on topographic maps and aerial photographs. Links:

http://www.nbmg.unr.edu/dox/m167.pdf

and

http://www.nbmg.unr.edu/dox/of099.pdf

Table 3-9 contains a list of some of the major active faults in Nevada.

Table 3-9. Some Major Active Faults in Nevada

Fault	Potential Earthquake Magnitude	Length in Miles (km)	Slip Rate in Millimeters Per Year*	Average Time Between Earthquakes (years)**
Genoa fault	7.4	47 (75)	1 - 3	1,500 - 4,000
Pyramid Lake fault zone	7.3	47 (75)	0.4 - 1.1	1,500 - 4,000
Toiyabe Range fault zone	7.3	69 (110)	0.1 - 0.8	2,000 - 15,000
Steptoe Valley	7.2	87 (139)	0.04 - 0.1	18,000 - 45,000

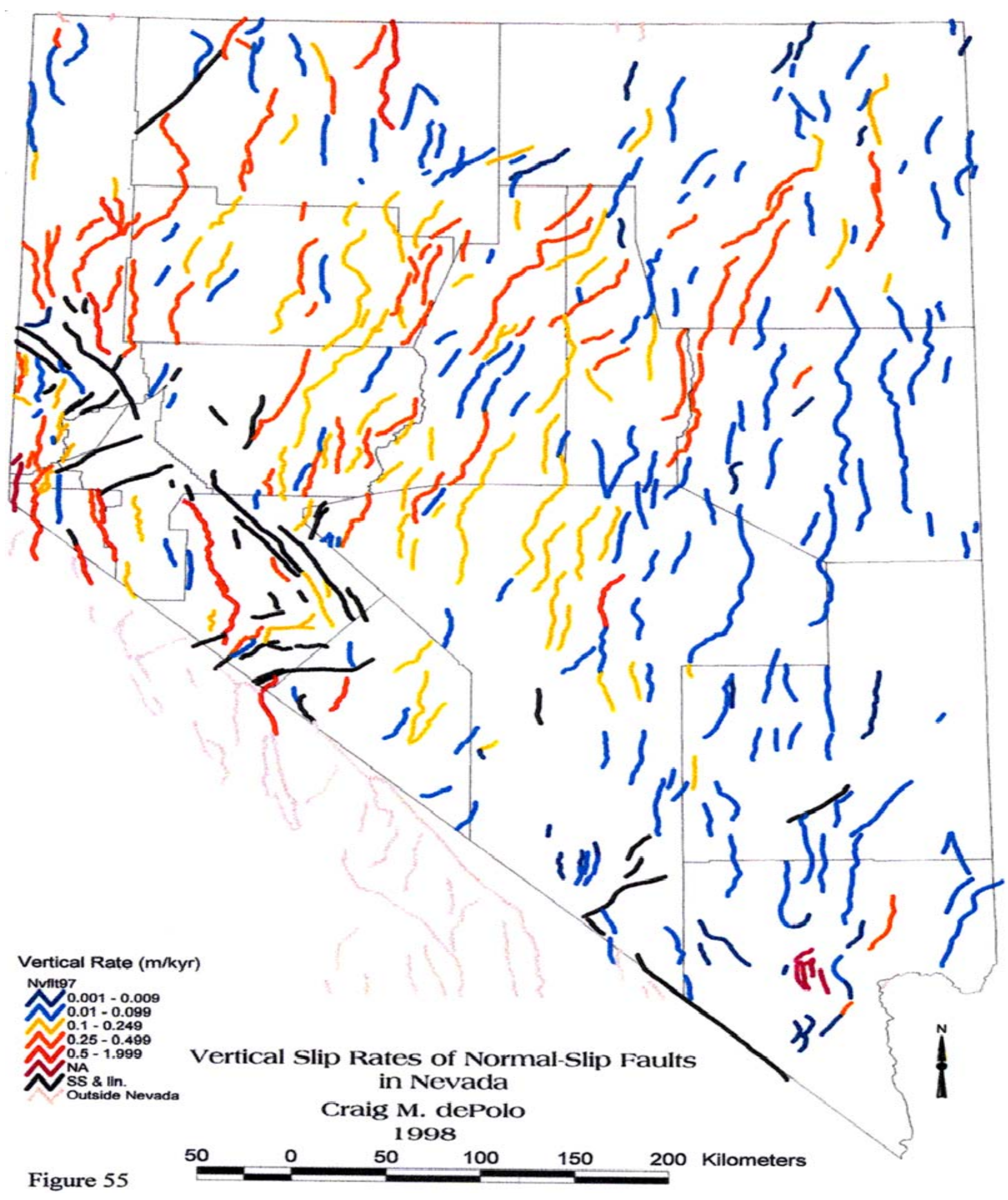
Table 3-9. Some Major Active Faults in Nevada

fault zone				
Ruby Mountains fault zone	7.2	62 (99)	0.05 - 0.3	10,000 - 100,000
Mt. Rose fault zone	7.1	25 (40)	0.2 - 0.4	2,000 - 10,000
Dixie Valley fault zone	7.1	60 (96)	0.3 - 0.6	6,000 - 12,000
Carson City fault	6.8	9 (14)	0.4 - 1	1,500 - 8,000
Frenchman Mountain fault zone	6.8	16 (26)	0.02 - 0.2	5,000 - 50,000
Black Hills fault	6.8	17 (27)	0.05 - 0.2	5,000 - 20,000

*Scientists usually use metric values, particularly millimeters per year, for slip rates of faults. To convert to inches per year, multiply by 0.039.
**Because we lack detailed studies, these values are approximations that cover wide ranges of potential values.

Source: Living with Earthquakes in Nevada, NBMG Special Publication 27.

Figure 3-8. Vertical Slip Rates of Normal-Slip Faults in Nevada



Source: NV Bureau of Mines & Geology

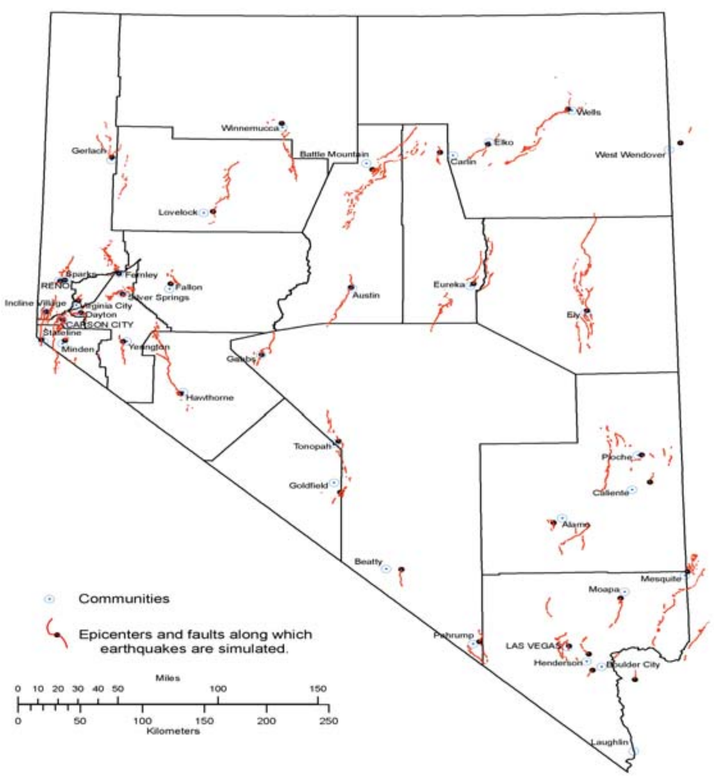
3.3.3.4 Vulnerability Assessment and Analysis of Potential Losses

The following information is taken from NBMG Open-File Report 09-08, *Estimated Losses from Earthquakes near Nevada Communities*, which is available in Appendix M and online at this link:

http://www.nbmg.unr.edu/dox/of098/Scenarios/OpenFileReport09-8.pdf

Figure 3-9 below shows the location of the thirty-eight Nevada communities chosen for the scenarios for this report. It estimates losses from earthquakes that could occur near the communities, which include all county seats and major population centers. The online report includes links to detailed loss estimation scenarios for each community for each of the given earthquake values. The report uses the Federal Emergency Management Agency's sophisticated loss-estimation computer model, HAZUS-MH, to estimate such factors as total economic loss, numbers of buildings receiving extensive to complete damage, number of people needing public shelter and hospital care, and number of fatalities from earthquakes of magnitude 5.0, 5.5, 6.0, 6.5, and 7.0. The probability of occurrence of each of these earthquake magnitudes for the listed communities is also tabulated using the U.S. Geological Survey's probabilistic seismic hazard analysis and is shown in Table 3-10 below.

Figure 3-9. Location of the 38 communities in Nevada for which HAZUS earthquake scenarios have been developed



Note: The faults chosen for the earthquake scenarios are also shown. The epicenters of the earthquakes were chosen at the fault position that is closest to the community.

Table 3-10. Probabilities of Earthquakes of Various Magnitudes Occurring Within 50 years Within 50 kilometers (31 miles) of 38 Major Communities in Nevada.

County	County seat *or other community*	% Probability of magnitude greater than or equal to:					Rank by Probability
		5.0	5.5	6.0	6.5	7.0	
Carson City	Carson City	>90	~80	70	50-55	12-15	2
Churchill	Fallon	80-90	~60	35	20-25	6-8	14
Clark	Las Vegas	40-50	~30	12	4-5	<0.5	28
	Boulder City	50-60	~30	12	4-5	<0.5	23
	Henderson	50-60	~30	12	4-5	<0.5	23
	Laughlin	10-20	~5	2-3	0.5-1	<0.5	38
	Mesquite	20-30	~15	4-6	2	<0.5	35
	Moapa	40-50	~25	10	4-5	<0.5	30
Douglas	Minden	>90	~80	67	50-60	10-12	6
	Stateline	>90	~80	60-70	40-50	10	9
Elko	Elko	30-40	~25	10-15	6-8	0.5-1	31
	Carlin	40-50	~30	10-15	6-8	0.5-1	27
	Wells	30-40	~20	9	6	0.5-1	32
	West Wendover	20	~10	4	1-2	<0.5	37
Esmeralda	Goldfield	80-90	~55	20-30	5-10	<1	15
Eureka	Eureka	40-50	~30	10-15	4-6	<0.5	28
Humboldt	Winnemucca	50-60	~35	15-20	5-10	1-1.5	22
Lander	Battle Mountain	60-70	~40	18	10	1.5	20
	Austin	60-70	~40	20	10-15	2-3	19
Lincoln	Pioche	30-40	~20	6-10	2-3	<0.5	33
	Alamo	70-80	~50	20-25	6-8	<0.5	17
	Caliente	50-60	~35	10-15	4	<0.5	23
Lyon	Yerington	>90	~75	60	40-45	12	8
	Dayton	>90	~80	70-75	50-55	15-18	1
	Fernley	90	~70	48	35	8	12
	Silver Springs	>90	~70	50-60	30-40	10-12	11
Mineral	Hawthorne	>90	~75	61	30-40	10-12	10
Nye	Tonopah	70-80	~50	20-30	5-10	<1	17
	Beatty	70-80	~55	30-40	20-30	10-12	16
	Gabbs	90	~65	40-50	20-25	6-8	13
	Pahrump	30-40	~25	5-10	3	<1	33
Pershing	Lovelock	50-60	~35	10-20	10	1-2	21
Storey	Virginia City	>90	~80	70	50	12-15	3
Washoe	Reno	>90	~80	67	50	12-15	4
	Gerlach	40	~25	10-15	6-10	2-3	26
	Incline Village	>90	~80	60-70	40-50	10-12	7
	Sparks	>90	~80	67	50	12-15	4
White Pine	Ely	20-30	~15	4-6	1.5-2	<0.5	35

Source: Data taken from maps produced by the U.S. Geological Survey and accessible at this link: http://eqint.cr.usgs.gov/eqprob/2002/index.php

What these Magnitudes Mean

Although it is nearly impossible to specifically predict what an earthquake of a given size might do to a community, the earthquake sizes presented relate to different general levels of damage. Generally, the greater the magnitude, the stronger the shaking will be and the longer the shaking will last.

Magnitude 5 earthquakes are distinctly felt by almost everybody and can cause rockslides and nonstructural damage, such as heavy, unsecured objects falling off shelves.

Magnitude 6 earthquakes can cause significant nonstructural damage, especially in basins and along ridge tops.

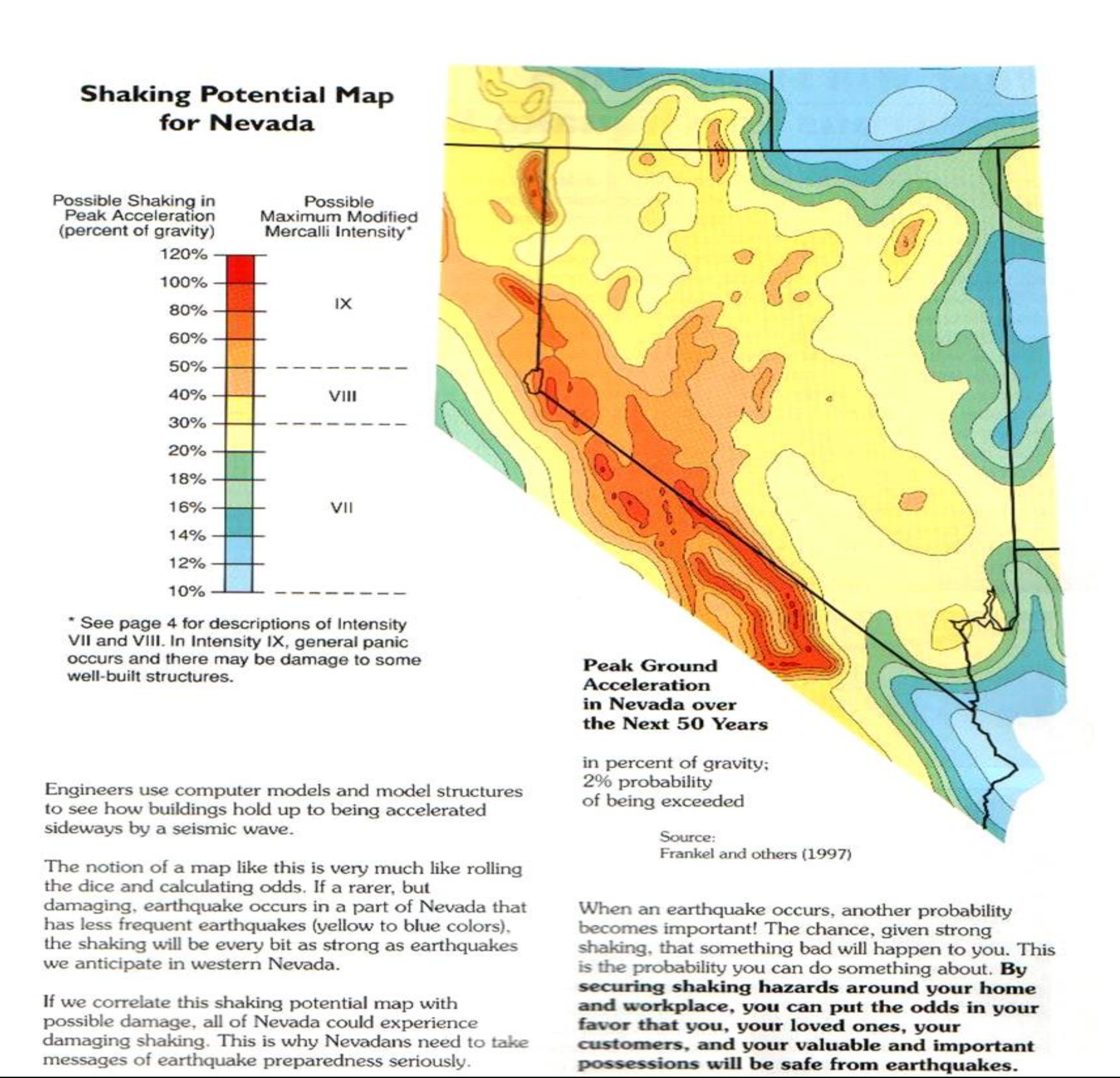
Magnitude 6.5 earthquakes can create surface offsets, may be of longer duration, and can cause significant damage.

Magnitude 7 earthquakes cause widespread structural and nonstructural damage, and require a significant “recovery period” for communities to get back to the way they were before the quake.

It is noteworthy that the earthquake that struck Wells Nevada on 21 February 2008, was a magnitude 6.0 event. The probability of such an earthquake striking the Las Vegas urban area is higher than the probability for Wells, and the probability of such an earthquake striking the Reno-Sparks-Carson City urban corridor is considerably higher than for Wells.

A shaking potential map for the entire state of Nevada is shown in Figure 3-10.

Figure 3-10. Shaking Potential Map for Nevada



Source: Nevada Bureau of Mines and Geology Special Publication 27

HAZUS damage estimates for individual communities for each scenario magnitude earthquake may be accessed online at this link:

http://www.nbmg.unr.edu/dox/of098/Scenarios/OpenFileReport09-8.pdf

Table 3-11. HAZUS Summary Estimates for Total Economic Losses

County	County seat *or other community*	Total Economic Loss	% Probability	Rank by Loss
Carson City	Carson City	$650,000,000	70	6
Churchill	Fallon	$110,000,000	35	13
Clark	Las Vegas	$7,200,000,000	12	1
	Boulder City	$1,400,000,000	12	5
	Henderson	$2,500,000,000	12	2
	Laughlin	$79,000,000	2-3	16
	Mesquite	$54,000,000	4-6	20
	Moapa	$94,000,000	10	14
Douglas	Minden	$340,000,000	67	10
	Stateline	$590,000,000	60-70	7
Elko	Elko	$160,000,000	10-15	12
	Carlin	$9,800,000	10-15	35
	Wells	$30,000,000	9	25
	West Wendover	$19,000,000	4	28
Esmeralda	Goldfield	$13,000,000	20-30	33
Eureka	Eureka	$34,000,000	10-15	24
Humboldt	Winnemucca	$46,000,000	15-20	21
Lander	Battle Mountain	$18,000,000	18	31
	Austin	$26,000,000	20	26
Lincoln	Pioche	$19,000,000	6-10	29
	Alamo	$5,100,000	20-25	37
	Caliente	$10,000,000	10-15	34
Lyon	Yerington	$56,000,000	60	19
	Dayton	$340,000,000	70-75	11
	Fernley	$62,000,000	48	17
	Silver Springs	$60,000,000	50-60	18
Mineral	Hawthorne	$24,000,000	61	27
Nye	Tonopah	$18,000,000	20-30	30
	Beatty	$6,500,000	30-40	36
	Gabbs	$2,600,000	40-50	38
	Pahrump	$84,000,000	5-10	15
Pershing	Lovelock	$17,000,000	10-20	32
Storey	Virginia City	$490,000,000	70	9
Washoe	Reno	$1,900,000,000	67	3
	Gerlach	$39,000,000	10-15	23
	Incline Village	$510,000,000	60-70	8
	Sparks	$1,800,000,000	67	4
White Pine	Ely	$44,000,000	4-6	22

Note: Figures are derived from a magnitude 6.0 earthquake on a fault close to each of the scenario communities and probability of a magnitude 6 or greater earthquake occurring within 50 years within 50 kilometers (31 miles) of each community.
Source: NV Bureau of Mines & Geology, UNR

Table 3-11 indicates that damage from major earthquakes could range from hundreds of thousands of dollars in sparsely populated rural counties to billions of dollars in urban areas. Tens of thousands of buildings could suffer extensive or complete damage. Fatalities could reach into the hundreds. Thousands of people may need public shelter. Importantly, many earthquakes are likely to cause significant, simultaneous damage in multiple counties. In particular, a major earthquake anywhere in the Reno-Carson City urban corridor is likely to cause significant damage in not only Carson City but also in adjacent Douglas, Storey, and southern Washoe Counties.

Table 3-12 ranks the top ten Nevada communities by potential economic losses due to the scenario earthquake. Not surprisingly, the counties with the largest populations are generally the ones with the most at risk.

Table 3-12. HAZUS Top Ten Nevada Communities for Highest Potential Economic Loss from Earthquake

County	County seat *or other community*	Total economic loss	% Probability (see Table3-9)	Rank by Loss
Clark	Las Vegas	$7,200,000,000	12	1
Clark	*Henderson*	$2,500,000,000	12	2
Washoe	Reno	$1,900,000,000	67	3
Washoe	*Sparks*	$1,800,000,000	67	4
Clark	*Boulder City*	$1,400,000,000	12	5
Carson City	Carson City	$650,000,000	70	6
Douglas	*Stateline*	$590,000,000	60-70	7
Washoe	*Incline Village*	$510,000,000	60-70	8
Storey	Virginia City	$490,000,000	70	9
Douglas	Minden	$340,000,000	67	10
Source: HAZUS, NBMG, UNR				

HAZUS program runs also demonstrate that essential facilities will be severely stressed following major earthquakes. The HAZUS program predicts that few hospitals in the epicenter areas will have sufficient beds to accommodate the number of injured people, which means that plans need to be improved for transporting injured people to other jurisdictions. Fire stations, police stations, and schools will most likely be operating at reduced capacity, and there will be significant damage to utilities and transportation systems.

HAZUS is a modeling tool only. Given all the uncertainties in actual ground shaking and damage potential during earthquakes, HAZUS damage estimates are likely to differ from actual losses by a factor of between two and ten. Nonetheless, HAZUS provides a reasonable, widely accepted methodology for assessing vulnerabilities and ranking areas by relative risk.

From a geological perspective, it is obvious that all areas of Nevada will experience major earthquakes at some time in the future. Thus, all communities are justified in preparing for a serious earthquake scenario regardless of the probability of occurrence of an earthquake of that magnitude, particularly in the consideration of using earthquake-resistant building standards in the design and planning of critical facilities.

Table 3-13 below summarizes the ratings for earthquake hazard by counties and tribal entities. These data were acquired from approved county hazard mitigation plans or from hazard mitigation surveys sent to counties and tribes in 2007 and returned to NHMP subcommittee.

Table 3-13. Earthquake Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County	X			
Douglas County			X	
Elko Band	X			
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County		X		
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County			X	
Lyon County				X
Mineral County				X
Nye County			X	
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley			X	
South Fork Band Tribe				X
Storey County			X	
Washoe County			X	
Washoe Tribe		X		
White Pine				X

3.3.4 **Epidemic** (Medium Risk)

3.3.4.1 ***Nature***

Although most microbes that live in our environment perform functions essential to our survival, a small percentage of those that enter our bodies cause an infectious disease. Infectious diseases emerge, suddenly or gradually, in various environments, and may spread across a region or even the world. Infections that occur in greater than normal numbers in a single location such as a hospital, hotel or neighborhood could be considered an outbreak. An infectious disease that occurs in greater than normal numbers in several communities or that crosses geographical boundaries is considered an epidemic. The same infectious disease that spreads from country to country is considered a pandemic.

Epidemics have occurred throughout human history and in some cases have influenced history. The last pandemic occurred in 2009-2010 with the emergence of the novel H1N1 Type A Influenza. Although this pandemic was less virulent than previous pandemics, H1N1 caused millions of infections more than the normal seasonal flu, many deaths and a significant impact on the global economy. A more virulent form of influenza such as H5N1 Avian Influenza could have catastrophic results. Infectious disease has the potential to affect more people and create more economic harm than any natural disaster or terrorist act. “The most menacing bioterrorist is Mother Nature,” says veteran science journalist Madeline Drexler.

Although epidemics and outbreaks of disease have traditionally been associated with disease caused by infectious agents, in the second half of the 20th century the term epidemic has also become associated with non-infectious disease such as obesity and diabetes, or disease caused by lifestyle and environmental factors such as smoking-related heart disease and cancer clusters. In this plan, we will address only epidemic disease caused by infectious agents.

The impact of outbreaks of pathogens on communities differs depending upon the disease, the population of the community, the age of the primary targets, socio-economic situation of the community affected and the public health response of the community. For example, 100 cases of meningitis across Las Vegas may be a concern, but 10 cases of the same meningitis may close the entire school system in Fallon. Four deaths from an infectious disease may not stretch public health resources in Reno, but may create an emergency in Yerington.

Disease outbreaks and epidemics are not confined to human populations. Diseases like hoof-and-mouth disease and mad cow disease, if introduced into the livestock population, could decimate the beef industry for decades. Currently there is a global influenza pandemic in birds. The H5N1 avian influenza virus infects mainly wild birds, but can also infect poultry. This virus has been known to transmit infection from chickens to humans with deadly results. Finding H5N1 in a domestic bird population could result in the culling of a state’s entire population of poultry in an attempt to isolate the virus from transmission into the human population.

Pandemic influenza and other emerging epidemic diseases present a major threat to life, economies and security in an increasingly globalized world. The impact of disease epidemics has increased dramatically as the world becomes ever more interconnected. Airlines now carry an estimated 1.6 billion passengers every year. Trade, commerce and financial markets are increasingly interrelated. In 2009, Mexico reported an outbreak of a novel strain of influenza which had not been previously recorded in human circulation. Because there was little immunity to this strain of influenza, and because of modern routes of travel and transmission, it became a global pandemic within 4 months.

Some challenges presented by epidemics:

- Epidemics associated with emerging and re-emerging infectious diseases are now occurring in historically unprecedented numbers. Since 2001, the World Health Organization (WHO) has verified more than 1100 epidemics of international importance.
- Over 70% of new and emerging diseases originate in animals. This requires improved cooperation between animal and human health sectors at the national and international level, especially in the areas of detection, risk assessment and risk reduction.
- National public health systems are weak in many areas and are put under further stress by poverty and political instability. The lack of disease surveillance and response capacity in one part of the world is a threat to all. Investment in strong national alert and response systems is a vital investment in global health security.

The Centers for Disease Control and Prevention (CDC) have listed 83 reportable diseases that have the potential to be the next human epidemics. For a full listing, go to the CDC website: http://www.cdc.gov/ncphi/disss/nndss/PHS/infdis2010.htm

The Nevada Department of Agriculture has listed 97 reportable diseases that have the potential to be the next animal epidemics. For a full listing go to their website: http://agri.nv.gov/Animal2_Reportable_Diseases.htm

Some recent emerging and re-emerging infectious diseases globally are shown on the map in the Figure below.

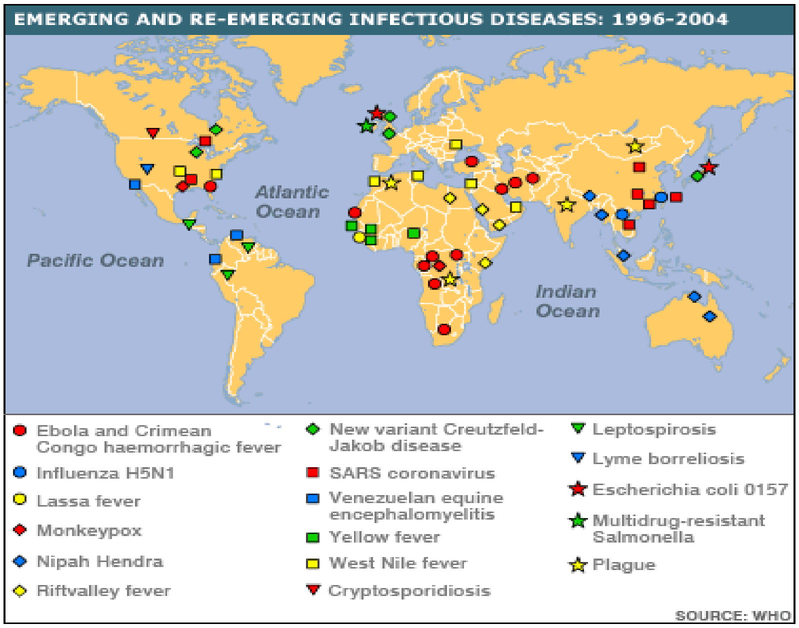


Figure 3-11. WHO Emerging & Re-Emerging Infectious Diseases

Note: This graphic does not include the H1N1 Pandemic of 2009-2010

In Nevada, we have seen occurrences of anthrax, whooping cough, and measles. Some of our rodents carry the plague bacteria and the Hantavirus pathogen. In 2009-1010, the H1N1 influenza affected the population in each county and strained our public health capacity. Unless there is significant immunity built up for emerging or re-emerging diseases, any population can be vulnerable.

3.3.4.2 History

Table 3-14 below presents 20th Century incidences of pandemics, epidemics, and major infectious disease affecting people in the U.S.

Table 3-14. 20th Century U.S. Pandemics and Epidemic Occurrences

Date	Details
1918-1919	The influenza pandemic of 1918 and 1919, known as the **Spanish Flu or Swine Flu**, had the highest mortality rate in recent history for an infectious disease. More than 20 million persons were killed worldwide, some 500,000 of which were in the U.S. alone (CDC, October 1998).
1916, 1949	**Polio epidemics** prior to the advent of the polio vaccine killed over 7,000 people in 1916 and over 3,000 in 1949.
1957, 1968	In the 20th century the world also experienced **influenza pandemics** in 1957 and 1968, which although were less virulent than the 1918 Spanish Flu, caused millions to be infected and many deaths.
1999, 2002	**West Nile Virus (WNV)**, a seasonal infection transmitted by mosquitoes, caused an epidemic which grew from an initial U.S. outbreak of 62 disease cases in 1999 to 4,156 reported cases, including 284 deaths, in 2002 (CDC, July 8, 2003).

1980 – 2000	Physicians began seeing immunodeficiency disorders in gay men. This was the beginning of the **AIDS** pandemic. In twenty years AIDS claimed over 40 million people worldwide.
2003	**Severe acute respiratory syndrome (SARS**) was estimated to have killed 915 and infected 8,422 worldwide by mid-August 2003 (Word Health Organization, August 15, 2003). In the U.S., there were 175 suspect cases and 36 probably cases, although no reported deaths (CDC, July 17, 2003).
2003-present	Although most cases go unrecognized, **Norovirus** is believed to affect over 20 million people in the U.S. each year. Norovirus accounts for 96 percent of all non-bacterial outbreaks of gastroenteritis (Arizona Department of Health Services, March/April 2003).
2009 – 2010	In April of 2009, **novel H1N1 influenza** virus started to circulate in Mexico. It soon spread to the United States and within 2 months of its first isolation the virus became a global pandemic.

Table 3-15 below presents recent occurrences and outbreaks of infectious of major infectious disease affecting people in in Nevada.

Table 3-15. Recent Historical Occurrences or Outbreaks in Nevada

Date	Details
February 1992	**Cholera** outbreak confirmed. At least 26 passengers from Aerolineas Argentinas Flight 386 that brought a cholera outbreak to Los Angeles traveled on to Las Vegas, where 10 showed symptoms of the disease. Cholera or cholera-like symptoms developed in 67 passengers of Flight 386.
Spring 2000	Five cases of the **measles** confirmed. Outbreak identified and confirmed, Clark County Health District (CCHD) Office of Epidemiology (OOE) worked with the Immunization Clinic and the media to alert the community about preventing the spread of the disease.
October 2004	**Norovirus** confirmed at a major public accommodation facility on the Strip in Las Vegas.
2004	During October 13-19, a total of 200 cases of human **West Nile Virus** were reported in 20 states, which included Nevada. During 2004, 40 states including Nevada reported a total of 2,151 cases of human West Nile Virus.
Fall 2004	**Chickenpox** (varicella) outbreak in Clark County, Nevada elementary school. 32 students from all grades were infected.
April 2006	**Norovirus** outbreak at a Reno, Nevada daycare, Noah's Ark. 30 Norovirus cases were confirmed. 2 additional people were infected after the daycare had been cleaned and sanitized.
March 2007	A **norovirus** outbreak in Las Vegas, Nevada sickened at least 215 inmates and 41 staff members at the Clark County Detention Center. Most of those sickened complained of stomach-related distress such as diarrhea, vomiting and cramps. None were hospitalized.
2009 - 2010	The **novel H1N1** influenza virus became a global pandemic and in Nevada thousands of people were infected leading to 40 deaths.

3.3.4.3 Location, Extent, and Probability of Future Events

The past history of outbreaks and the 2009–2010 H1N1 influenza pandemic have shown us that the state is vulnerable to emerging disease epidemics. The nature of jet travel has brought an unprecedented mode of disease transmission from an affected area to any other country in the world. The existence of Las Vegas and Reno as major world-class vacation destinations provides the potential for an influx of epidemic-causing pathogens from other countries. The Subcommittee ranked epidemic as a “medium risk” hazard in Nevada.

In Nevada, the Nevada State Health Division (NSHD) and Local Health Authorities (LHAs) have surveillance systems in place, in cooperation with CDC to actively test for communicable diseases. Local sentinel providers send specimens to the Nevada State Health Laboratories and are required to report findings to NSHD. Epidemiologists track symptoms and diseases to determine if outbreaks are occurring and if mitigation practices need to be employed.

Public health professionals have many ways to keep communicable diseases from becoming epidemics. Required immunizations are the most effective way to protect a community from some infectious diseases. Other ways include public information, personal hygiene, social distancing and in certain cases, isolation and quarantine measures are employed.

For animal disease mitigation, immunizations and disease screening are used to protect domesticated animals. If a disease outbreak is present in a localized herd, culling may be an option to prevent the spread of disease.

Table 3-16 below summarizes the epidemic hazard rating in the hazard mitigation plans of counties and tribal entities.

Table 3-16. Epidemic Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County			X	
Douglas County				X
Elko Band			X	
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County	X			
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X

Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County		X		
Washoe County	X			
Washoe Tribe				X
White Pine				X

3.3.5 **Expansive Soils** (Very Low Risk)

3.3.5.1 *Nature*

Soils and soft rock that tend to swell or shrink due to changes in moisture content are commonly known as expansive soils. Changes in soil volume present a hazard primarily to structures built on top of expansive soils. The most extensive damage occurs to highways and streets.

In the United States, two major groups of rocks serve as parent materials of expansive soils; they occur more commonly in the West than in the East. The first group consists of ash, glass, and rocks of volcanic origin. Glass and aluminosilicate minerals in these volcanic materials often decompose to form expansive clay minerals (most commonly smectite, a group of clay minerals that incorporate water in their crystal structures). The second group consists of sedimentary rock containing clay minerals, examples of which are the shales of the semiarid West-Central States. Because clay materials are most susceptible to swelling and shrinking, expansive soils are often referred to as swelling clays. Expansive soils also include soils with sodium sulfate, which occur in Las Vegas Valley. Also related to expansive soils are collapsible soils, such as the soils in Las Vegas Valley that contain gypsum (hydrated calcium sulfate).

Expansive soils can be recognized by visual inspection in the field. Shales, claystones, weathered volcanic rocks, and residual soils containing smectite often have a characteristic "popcorn" texture, especially in semi-arid areas.

Most engineering problems caused by swelling clays involve soils underneath areas covered by buildings and slabs or layers of concrete and asphalt, such as those used in construction of highways, walkways, and airport runways.

Houses and one-story commercial buildings are more apt to be damaged by expansive soils than are multi-story buildings, which usually are heavy enough to counter the swelling pressures. However, if constructed on wet clay, multi-story buildings may be damaged by shrinkage of the clay if moisture levels are substantially reduced, such as by evaporation from beneath heated buildings.

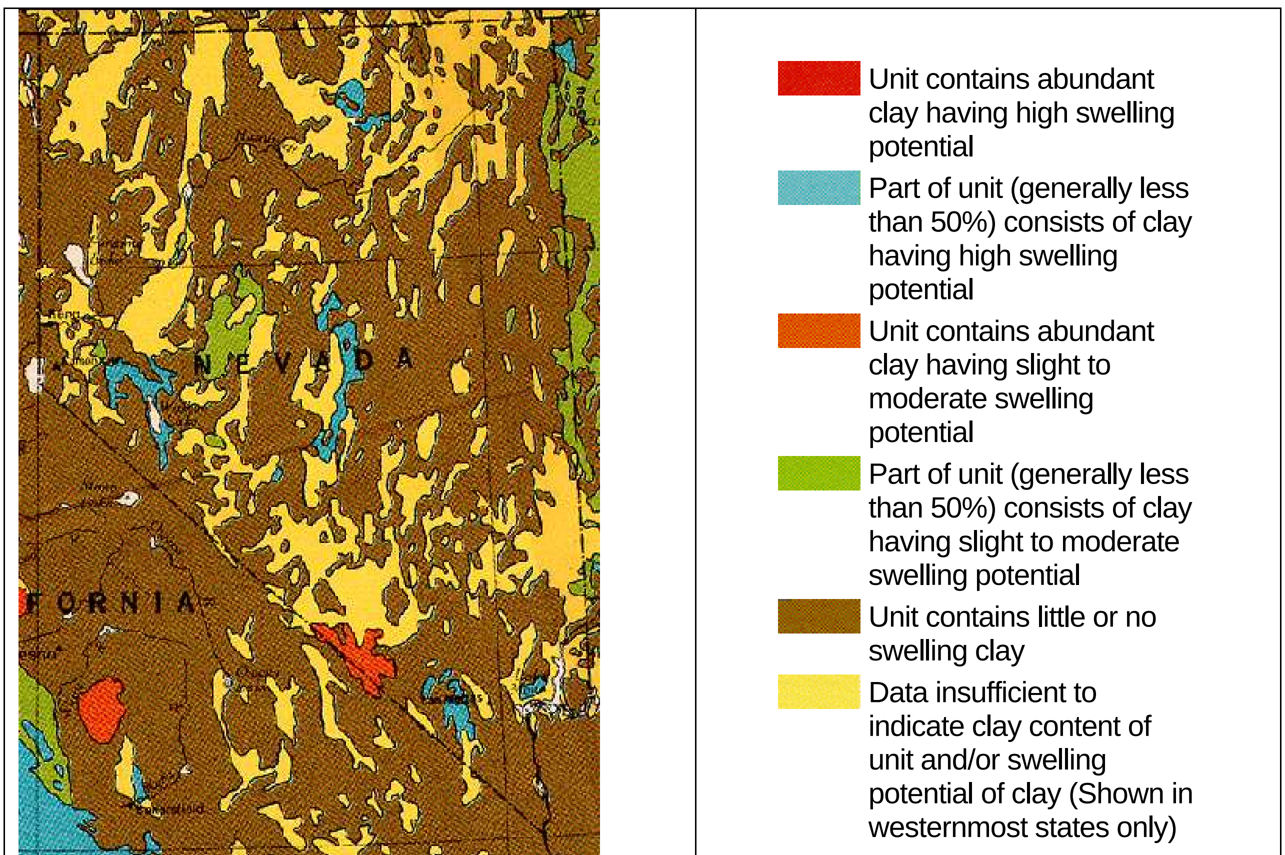
The best means to prevent or reduce damage from expansive soils is avoidance. When other choices are not possible, applied engineering practices such as removal of the soil, application of heavy loads, preventing access to water, presetting, or stabilization are necessary.

3.3.5.2 *History*

In 1957 the Las Vegas and Eldorado Valleys Area Survey of soil was completed. The area had problems with house roofs displacing up to 18 inches and concrete slab floors rising as much as 3 feet. In the report, the soil scientists found that these homes were destroyed by swelling soils. Salts in the soil became deliquescent at air temperatures of 41 to 45 degrees F. Upon becoming deliquescent, the salts (sodium sulfate) in the soils took on 10 molecules of water from the atmosphere, causing the damage to homes and other buildings.

Between 1994 and 1999, Beazer Homes constructed and sold 206 single-family residences on a 40-acre residential subdivision in North Las Vegas. In April 2000, three homeowners filed a complaint against Beazer Homes for constructional defects to their homes. The complaint alleged that their houses' foundations and concrete slabs were damaged by expansive soils. *Shuette v. Beazer Homes Holding Corp., 121 Nev. Adv. Op. 82* (2005)

Figure 3-12. Soil Map of Nevada



Source: 1989 U.S. Geological Survey, Swelling Clays Map Of The Conterminous U.S. by W.W. Olive, A.F. Chleborad, C.W. Frahme. Julius Schlocker, R.R. Schneieder, and R.I. Shuster; 1989

In 1997, Southern Nevada added a required swell test (1803.3) to their building code amendments. This test would determine if certain buildings required special design considerations to counteract soil expansion.

In the 2003 Edition of the International Building Code, The City of Reno amended Chapter 18, Soils and Foundations. They added this sentence to 1802.1 General. "The Building Official may require certification of freedom from plastic or expansive materials in base for concrete slabs, fills, and foundations."

In Nye County on the northwest side of Pahrump Valley, expansive soils were blamed for causing foundation and septic damage to homes in the area. Because of the septic damage, some of the land in the area was contaminated. In response, the Nye County Commission passed a bill in October 13, 2006, requiring disclosure of soil conditions to the buyer.

Expansive clays occur in and near urban areas of Washoe and Storey Counties where hydrothermal alteration (associated with volcanism several million years ago) has converted volcanic rocks to smectite. The problem has been most acute to date in the hills on the north side of Reno and Sparks, but similar rocks occur in the foothills of Peavine Peak, the Virginia Range, and the Carson Range. As development encroaches higher up the slopes, this hazard will become more of a risk to homeowners.

In the *Tribal Hazard Mitigation Survey,* the South Fork Band reported this hazard as low.

3.3.5.3 *Location, Severity and Probability of Future Events*

At this time, the risk of damage due to expansive soils occurs near the higher populated areas of Clark, Nye, and Washoe counties.

Each of these counties has been amending their building codes as described above to avoid damage caused by this risk. Even so, there are many homeowners in these areas filing lawsuits to pay for past damage to their homes from expansive soils.

Expansive soils are considered to be in the "Very Low Risk" hazard category from a State perspective because this hazard will most likely be handled efficiently by local authorities through their building codes or by the Nevada Department to Transportation through their building practices in areas prone to this hazard. The Subcommittee will continue to monitor this hazard in the future.

Table 3-17 below summarizes the expansive soil hazard rating in the hazard mitigation plans of counties and tribal entities.

Table 3-17. Expansive Soils Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City				X
Churchill County				X
Clark County				X
Douglas County				X
Elko Band				X
Elko County				X
Ely Shoshone Tribe				X
Esmeralda County				X

Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County				X
Washoe County				X
Washoe Tribe				X
White Pine				X

3.3.6 **Extreme Heat** (Very Low Risk)

3.3.6.1 ***Nature***

Heat may kill by pushing the human body beyond its limits. In extreme heat, evaporative cooling is diminished and the body must work extra hard to maintain a normal temperature. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat.

Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."

Heat waves kill more people in the United States than any other disaster. It was estimated by the University of Delaware that, on the average, 1500 American city dwellers die each year due to heat. By comparison, annual deaths from tornados, earthquakes and floods combined average fewer than 200 nationwide.

Excessive heat during the nighttime hours is a predictor of heat-related injury and deaths. Nighttime temperatures in the 85^{th} percentile of the temperature distribution are likely to set the stage for an increase in heat-related deaths and injuries.

Livestock and pets are also at great risk for heat-related death or injury during long periods of temperatures in the 85^{th} percentile.

Extreme heat coupled with higher elevation produces a hazard to air-traffic due to lower density of hot air. In July of 2006 Las Vegas McCarran International Airport canceled or delayed commercial flights because of heat and altitude density guidelines. Smaller, less powerful aircraft are more at risk of heat related performance problems. Other effects of heat waves include buckled roadways and train derailments.

3.3.6.2 *History*

Las Vegas is located in a broad desert valley in extreme southern Nevada extending over about 600 square miles elongate from northwest to southeast. Mountains surrounding the valley rise 2,000 to 10,000 feet above the valley floor. The valley is bounded on the north by the Sheep Range, while Boulder City and the Lake Mead National Recreation Area are considered its southern extent. To the west are the Spring Mountains, which include Mt. Charleston, the region's highest peak at 11,918 feet. Several smaller ranges line the eastern rim of the valley, including the Muddy Mountains, the Black Mountains and the Eldorado Range.

Official weather observations began in 1937 at what is now Nellis Air Force Base. In late 1948, the U.S. Weather Bureau moved to McCarran Field, now McCarran International Airport. The Las Vegas Valley summers display classic desert southwest characteristics. Daily high temperatures typically exceed 100 degrees with lows in the 70s. The summer heat is tempered by the extremely low relative humidity. Because of the valley's typical summer temperatures, residents who are not careful can be overcome by heat-related illness such as sunburn, heat exhaustion, heat cramps, and heat stroke.

Northern Nevada also experiences extreme heat conditions in the summer months. The month of July, 2002 set records for high temperatures. On July 10th and 11th, the Reno Airport reached 108 º F, setting an all time record for that area.

Heat Extremes

Table 3-18 is a summary of heat extreme data prepared by the State Climatologist for each county in Nevada, showing the average number of days per year with temperstures greater than 100 º F. This is based on the historical record of available climate summary data for representative sites within each county. The data will assist each county in its emergency preparedness and response planning for heat extremes. The complete report of heat extremes throughout Nevada from which this table is summarized is contained in Appendix K.

Table 3-18. Heat Extremes by Community

County	Community	Average number of days per year with temperature above 100 º F
Carson City	Carson City	1.34
Churchill	Fallon NAS	10.65
Churchill	Hawthorne Airport	8.98
Clark	Searchlight	24.87
Clark	Las Vegas Airport	74.48
Clark	Indian Springs	68.15
Clark	Valley of Fire	83.31
Clark	Mesquite	96.8
Douglas	Minden	2.79
Douglas	Glenbrook	0.00
Douglas	Topaz Lake	1.92
Elko	Elko Airport	3.01
Elko	Jiggs	0.46

Table 3-18. Heat Extremes by Community

County	Community	Average number of days per year with temperature above 100 º F
Elko	Tuscarora	0.00
Elko	Clover Valley	0.00
Elko	San Jacinto	0.60
Esmeralda	Coaldale Junction	32.10
Esmeralda	Goldfield	0.73
Esmeralda	Silverpeak	23.45
Eureka	Eureka	0.35
Eureka	Beowawe	5.06
Humboldt	Winnnemucca Airport	5.86
Humboldt	Quinn River Crossing	3.73
Lander	Battle Mountain	9.55
Lander	Austin	0.18
Lincoln	Elgin	29.81
Lincoln	Caliente	13.84
Lincoln	Pioche	1.49
Lincoln	Pahranagat	28.36
Lyon	Wellington	0.33
Lyon	Yerington	3.62
Lyon	Fernley	10.28
Mineral	Mina	12.65
Mineral	Thorne	8.69
Nye	Tonopah	2.03
Nye	Pahrump	50.71
Nye	Sarcobatus	28.10
Nye	Duckwater	1.12
Nye	Smoky Valley	0.84
Pershing	Imlay	7.64
Pershing	Lovelock Derby Field	11.11
Pershing	Paris Ranch	20.26
Pershing	Derby Field	6.02
Storey	Virginia City	0.02
Washoe	Reno Airport	15.42
Washoe	Vya	0.06
Washoe	Sand Pass	5.57
Washoe	Nixon	4.72
White Pine	Ely Yelland Field	0.04
White Pine	Lund	0.35
White Pine	McGill	0.20
Source: NV State Climatologist		

3.3.6.3. *Location, Severity, and Probability of Future Events*

Although heat extreme hazard occurs mainly in the southern portion of the state, all of the counties reach high temperatures in the summer months, mainly in July.

In the *Hazard Mitigation Survey,* Storey and Washoe Counties considered this hazard as a low threat. Washoe County did indicate that death of people and livestock, buckled railways, and train derailments could be caused by this hazard. Churchill County considered this hazard to be a moderate threat.

In the *Tribal Mitigation Survey,* Ely Shoshone Tribe and the South Fork Band considered this hazard as a high threat. Ely Shoshone Tribe indicated that this hazard affected people and livestock. The South Fork Band indicated that this hazard happened yearly. It caused dry vegetation and wildfires on the reservation. Coupled with possible electrical-system failures that could occur as a result of the extreme heat, large numbers of residents, tourists, and the state's economy could be affected. Increased public awareness of the seriousness of dehydration and heat-related illnesses as well as energy conservation measures are warranted throughout the State.

The hazard rating for extreme heat is considered a "Very Low Risk" hazard in Nevada. The table below summarizes the heat extreme hazard rating in the hazard mitigation plans of counties and tribal entities.

Table 3-19. Extreme Heat Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City				X
Churchill County				X
Clark County				X
Douglas County				X
Elko Band				X
Elko County				X
Ely Shoshone Tribe				X
Esmeralda County	X			
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County				X
Washoe County	X			

Washoe Tribe				X
White Pine				X

3.3.7 **Floods** (High Risk)

3.3.7.1 ***Nature***

Flooding is the accumulation of water where there is usually none or the overflow of excess water from a stream, river, lake, canal, reservoir, or coastal body of water onto adjacent floodplains. Floodplains are lowlands adjacent to water bodies that are subject to recurring floods. Flooding may occur slowly over several days as a result of rainfall or snowmelt, or rapidly due to an event such as an earthquake or dam failure. Flooding due to dam failure is a special case addressed in a separate subsection below.

Floods also occur along streams and arroyos (stream channels that are normally dry) that do not have classic floodplains. These include flash floods in mountains (sometimes with rapidly rising water several tens of feet deep) and on alluvial fans, which are typically fan-shaped, gently sloping areas between the steep parts of mountain ranges and the nearly flat valley floors. Because much of Nevada is part of the Great Basin (an area of internal drainage, in which streams are not connected to rivers that flow to the oceans), flood waters will commonly drain into interior lakes (e.g., Walker Lake at the terminus of the Walker River, Pyramid Lake at the terminus of the Truckee River), wetland areas (e.g., Carson Sink at the terminus of both the Carson and Humboldt Rivers), or playas (normally dry lake beds, such as Roach Lake, south of Las Vegas, where a new airport is planned).

Floods are described in terms of their extent (including both the horizontal surface area affected and the vertical depth of floodwaters) and the related probability of occurrence.

Factors contributing to the frequency and severity of flooding include the following:

- Rainfall intensity and duration.
- Antecedent moisture conditions.
- Watershed conditions, including steepness of terrain, soil types, amount and type of vegetation, and density of development.
- Changes in landscape resulting from wild fires (loss of moisture-trapping vegetation and increased sediment available for runoff).
- The existence of attenuating features in the watershed, including natural features such as swamps and lakes, and human-built features such as dams, irrigation ditches, and canals.
- The existence of flood control features, such as levees, flood control channels, and detention basins.
- Velocity of flow.
- Availability of sediment for transport, and the susceptibility of the bed and banks of the watercourse to erosion.

Floods from snow melt caused by heavy, long duration rainfall can occur anytime between October and March. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions, when the ground is frozen and infiltration is minimal, or when warm rain on the snow in higher elevations of the tributary areas adds snow melt to rain flood run-off. These storms are also known as wet-mantle storms.

Severe but localized flooding may also result from cloud burst storms centered over tributary basins. These storms may occur from late spring to early fall, but generally occur in June, July, and August. Run-off from cloud bursts is characterized by high peak flows with a short duration. These storms are also known as dry-mantle storms.

Floods are natural events that are considered hazards only when people and property are affected. Nationwide, on an annual basis, floods have resulted in more property damage than any other natural hazard. Physical damage from floods includes the following:

- Inundation of structures, causing water damage to structural elements and contents.
- Erosion or scouring of stream banks, roadway embankments, foundations, footings for bridge piers, and other features.
- Impact damage to structures, roads, bridges, culverts, and other features from high-velocity flow and from debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, increasing loads on these features or causing overtopping or backwater effects.
- Destruction of crops, erosion of topsoil, and deposition of debris and sediment on croplands.
- Release of sewage and hazardous or toxic materials as wastewater treatment plants are inundated, storage tanks are damaged, and pipelines severed.

Floods also cause economic losses through closure of businesses and government facilities; disrupt communication; disrupt utilities such as water and sewer service; result in excessive expenditures for emergency response; and generally disrupt the normal function of a community.

3.3.7.2 *History*

The history of flooding on Nevada provides the factual basis for establishing the location, severity and probability of future flooding in Nevada. A chronology of major flooding information is presented below in two tables, Table 3-20 for Northern Nevada (includes the Truckee, Carson, Walker and Humboldt watersheds) and Table 3-21 for southern Nevada (includes the Las Vegas area, the lower Colorado River watersheds, and Lincoln County). In addition to major flooding along Nevada's rivers, localized flooding has occurred as a result of dam failure, flash floods, debris flows, and mudslides, and failure of canal walls and other irrigation structures, some of which have caused declarations of disaster in parts of Nevada. Major flooding events of this type are also included in the tabulated flood chronologies. Flood studies often use historical records, such as stream flow gauges, to determine the probability of occurrence for floods of different magnitudes. The probability of occurrence is expressed as a percentage for the chance of a flood of a specific extent occurring in any given year. Table 3-20 below summarizes most major flooding events in northern Nevada, specifically in the Carson, the Truckee, the Walker and the Humboldt River basins.

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
December 1852	Carson Valley	Two days of heavy snowfall followed by four days of warm rain caused flooding reported in the Carson Valley and likely along other western Nevada rivers as well.	Little damage occurred because most settlements were located away from the low areas. No figures available.
December 1861-January 1862	Carson and Truckee River Basins	Warm rain following heavy snow in December 1861 caused widespread flooding that caused Carson Valley to become a lake.	Little reported damage because most settlements were located along the eastern slope of the Sierra Nevada away from the low areas. No figures available.
1862	Humboldt River Basin	Earliest year in which widespread flooding was recorded throughout the Humboldt River and its sub-basins.	Due to limited human inhabitation, little is known of the damage or effects of the flood. No figures available
December 1867-January 1868	Carson and Truckee River Basins	Unseasonably warm rain from late December through early January melted heavy snow pack in the Sierra Nevada. Carson Valley became a lake and flooding exceeded the 1861 flood crest. All bridges in the Carson Valley were swept away.	No figures available
December 1867-January 1868	Humboldt River Basin	Wet-mantle flooding in the South Fork of the Humboldt River and its tributaries caused localized flooding.	Few records of damage are available.
January-June 1870	Humboldt River Basin	Wet-mantle flooding in the South Fork of the Humboldt River and its tributaries caused localized flooding.	Few records of damage are available.
April 25 1876	Humboldt River Basin	Failure of an irrigation dam across the Humboldt River at Shoshone Canyon, about 22 miles east of Battle Mountain near present-day Dunphy resulted in a huge volume of water rushing through the canyon and flooding several ranches in the river bottom below.	No figures available
July 23 1876	Humboldt River Basin	A series of heavy thunderstorms in the headwaters of Maysville, Crum, Dean and Lewis canyons draining Mount Lewis, southeast of Battle Mountain caused severe localized dry-mantle	No figures available

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
		floods downstream. The most severe was the Lewis Canyon flood that destroyed nearly every building in the mining town of Lewis. Heavy rain. Along the stream bottoms, 50-foot high cottonwoods and willow thickets were uprooted and mixed together with bottom soil and huge boulders into debris flows that traveled up to 10-12 miles downstream.	
August 15 1878	Humboldt River Basin	Thunderstorm-induced dry-mantle flooding caused a wall of water, mud and rocks up to ten feet high to flow down Pony Canyon and along Main Street in Austin. The flood destroyed both residential and commercial buildings, and left a three-foot layer of mud and debris in Austin's streets. It took three months of intense efforts to fully repair the damage.	No figures available
January-May 1881	Little Humboldt River Basin	Sustained rains on heavy winter snow pack caused extensive localized flooding. All reservoir dams along Kelly Creek and in Squaw Valley were completely destroyed and were never rebuilt. Mines were flooded, mill dams and roads were washed out, bridges were damaged and livestock drowned.	No figures available
June 27 1883	Humboldt River Basin	The last remaining dam on the Humboldt River at Lovelock broke leaving a number of the largest ranchers without irrigation water.	No figures available
May-June 1884	Humboldt River Basin	Rapid snow melt and heavy spring rains caused an extensive period of wet-mantle flooding in the Humboldt River Basin and its tributaries. In Austin, flooding damaged the Manhattan Mill and the sawmill. Reese River washed out the Nevada Central Railroad line 40 miles south of Battle Mountain. Flooding along the lower Humboldt formed a vast lake extending over thirty miles from Beowawe to Battle Mountain, covering the railroad track and damaging the road bridge across the Humboldt River in Battle Mountain. Later in June, the dam	Few records of damage are available.

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
		at the Humboldt dike outflow of the Humboldt River and Toulon Lakes, was blown up by local ranchers after which it was never rebuilt.	
January-February 1886	Reese River sub-basin of the Humboldt River Basin	Heavy rain on snow pack caused flooding along the entire Reese River drainage system and Humboldt from Austin to Battle Mountain causing extensive erosion and sedimentation damage.	No figures available
March-June 1890	Humboldt River Basin	Spring melting of the huge snow pack from the 1889-1890 “Winter of White Death” caused flooding that destroyed bridges on the only two main N-S roads between Elko and the White Pine mines, closing those roads. Maggie and Susie Creeks flooded low-lying areas of Carlin. Flooding caused heavy livestock losses along the Reese River drainage, near Battle Mountain, and in Paradise Valley that eventually drove the large cattle companies into liquidation. Two of Lovelock Valley’s five irrigation dams along the Humboldt River were completely washed away.	No figures available
May 1906	Humboldt River Basin	Heavy rainfall caused the failure of a reservoir dam with six deaths resulting. Various structures were damaged and horses and mules died. Southern Pacific railroad tracks were undermined.	Six lives were lost. No figures available on other losses.
March 1907	Walker, Carson and Truckee River Basins	Snow and later rain from March 16 through March 20 flooded the Truckee, Carson and Walker Rivers. The Truckee River severely damaged the Electric Light Bridge. In Carson Valley, all bridges on the East and West Forks and the main-stem of the Carson River as well as Carson River were destroyed or seriously damaged.	No figures available
February - April 1907	Humboldt River Basin	Heavy rains melted deep winter snow pack in the lower Humboldt River Basin below Battle Mountain caused flooding along the entire lengths of both the Little Humboldt River and the main Humboldt River, and their tributaries. Flooding drowned one person and some livestock.	No figures available
February-April	Humboldt	Warm rain on snowpack caused the worst	No figures available

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
1910	River Basin including Mary's River	flooding in history with a greater than 100 year recurrence interval. Carlin, Elko, Battle Mountain, Winnemucca, and Lovelock areas were all severely flooded. Flooding severely damaged mining camps and all railroad bridges and tracks in the region. All major irrigation dams and canals were washed out throughout the region	
July 1913	Little Humboldt River Sub-basin	Dry mantle flooding from severe thunder and rainstorms. Widespread damage to hay fields in Paradise Valley, Humboldt County. A stranded automobile was covered with 25 to 30 feet of debris.	No figures available
January-April 1914	South fork Humboldt River	Rain on melting snow caused wet mantle flooding that damaged multiple bridges, roads, trestles, reservoirs, diversion channels, and farms.	No figures available
February - March 1917	Humboldt River Basin	Wet-mantle flooding along the lower reaches of the Humboldt River Basin caused considerable road and bridge damage below Lamoille Creek. High water in the South Fork drainages washed out roads and bridges between Jiggs and Elko and lowlands around Ryndon were inundated. Pine Creek flooding damaged or destroyed the railroad grade and bridges disrupting railroad traffic for two weeks.	No figures available
June 22 1918	Humboldt River Basin	Heavy rains in the Santa Rosa Mountains caused dry-mantle flooding in the Paradise Valley area of the Little Humboldt River sub-basin. There was localized flooding along drainages west and northwest of Paradise Valley.	No figures available
January 1921	Truckee Canal, part of the TCID irrigation system	The Truckee Canal was breached at approximately Station 1100+00. (later identified by the Regional Engineer in field review following 2008 breach).	No figures available
February-March 1921	Humboldt River Basin	Wet mantle flooding caused moderate damage to railroad track and bridges and extensive damage to meadow lands in the basin.	No figures available
April–June 1922	Humboldt River Basin	Wet mantle flood event locally within the Maggie Creek and Little Humboldt River sub-basins. (Maggie Creek experienced its highest flow on record, which stood	No figures available

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
		until 1962).	
July 1927.	Browns Creek, SW of Reno, Washoe County	More than two inches of rainfall per hour caused the Grass Lake irrigation reservoir to fail flooding land below.	No figures available
March 1928	Walker, Carson and Truckee River Basins	Snow and rain from March 23 through March 26 caused flooding in the Carson Valley, where both forks of the Carson River and the main-stem Carson River overflowed their banks, but little damage was caused.	No figures available
March–June 1932	Humboldt River Basin	Rapid heavy snowmelt caused flooding in the Humboldt River Basin, especially in Lovelock Valley. The Big Five Diversion was washed out (damaged earlier in 1910 and 1914)	No figures available
December 1937	Carson and Truckee River Basins	Heavy rain on snowpack from December 9 through December 13 caused flooding. On the East Fork Carson River, the Douglas Power (Rithenstrothf) Dam was severely damaged. In the south end of Carson Valley near Gardnerville, the flood on the East Fork Carson River crested at 10,300 cfs late in the afternoon of December 11.	No figures available
December 1937-May 1938	Humboldt River Basin	Heavy snows and rain caused extensive flooding in the Little Humboldt River sub-basin and bridge damage in Paradise Valley.	No figures available
April-May 1942	Humboldt River Basin	Severe wet mantle event caused extensive flooding in Elko with water several feet deep in the streets, as well as Battle Mountain. Extensive damage to bridges, roads, irrigation structures, dams, canals, ranch buildings and erosion damage to cropland range areas.	No figures available
January 1943	Upper Humboldt River Basin	Severe wet mantle flooding washed out Hot Creek reservoir and levees in Elko County. Flooding closed highways and caused severe damage to railroads, roads, bridges, and structures throughout the basin.	No figures available
November December 1950	Walker, Carson and Truckee River Basins.	From November 13 to December 8, continued rain and high temperatures melted early snow pack in the Sierra Nevada causing flooding along the Walker, Carson and Truckee Rivers. The greatest	The estimate of damages in the three river basins was $4.4 Million ($27.6 million in

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
		discharge was in the urban areas of Reno and Sparks, where water stood 4 feet deep in the main floor of the Riverside Hotel. Over 3,500 acres of agricultural land in the Truckee Meadows East of Reno was flooded. Two deaths were reported, and about 200 persons were evacuated from their homes.	1997 dollars) (U.S. Geological Survey, 1954); of this $2.0 million ($12.3 million in 1997 dollars) was in Reno.
February-May 1952	Humboldt River Basin	Wet mantle flood due to rapid melting of the snowpack caused considerable damage throughout the basin to roads, bridges, railroad tracks, ranches. Much watershed erosion and extensive damage to dams and levees.	No figures available
July 1952	Humboldt River	Reese River sub-basin. Violent summer thunderstorms caused extensive mud- and debris flows of water, mud, rocks, and logs on many of the Toiyabe Range drainages south of Austin. Extensive gullying, channel head-cutting and sheet erosion damaged crop irrigation systems.	No figures available
December 1955	Truckee, Carson and Walker River Basins	Intense late December storm dropped 10 to 13 inches of rain that melted snow pack in the Northern Sierra Nevada causing flooding along the Walker, Carson and Truckee Rivers. Downtown Reno area flooding was as extensive as in 1950 but damage to buildings was not as severe as that of the 1950 flood due in part to pumping and erection of sandbag dikes. The Reno airport was flooded to a depth of 4 feet. Derby Dam on the Truckee River east of Vista failed, and Hobart Dam, at the headwaters of Franktown Creek failed and released water that severely damaged U.S. 395.	The estimate of damages in the three river basins was $3,992,000 ($22,327,000 in 1997 dollars) One life was lost.
December 1955	Truckee, Carson and Walker River basins	Flooding on tributary streams draining the area surrounding Reno and Sparks caused damage to property in areas away from the Truckee River.	No estimates
August 6-28 1961	Humboldt River Basin	Battle Mountain subbasin. A series of thunderstorms resulted in severe channel cutting, mud & rock flows and sedimentation in streams draining the western slopes of the Cortez Range in	No figures available

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
		Crescent Valley.	
February 1962	Humboldt River Basin	Wet mantle flooding caused extensive damage to Battle Mountain, where over 200 residents were evacuated due to water depth of up to 5 feet . Up to 1,500 head of cattle drowned. There was extensive railroad damage and damage to buildings, diversion structures, irrigation ditches, and cultivated fields throughout the basin.	Estimated 1962 value of losses was approximately $1.5 million.
January February 1963	Truckee, Walker and Carson River Basins	After months of drought, an intense high-temperature storm lasted from January 28 through February 1, dropping up to 13 inches of precipitation. There was extensive flooding in Reno with about 20 square blocks in the downtown area inundated up to 4 feet deep. The airport was flooded as in 1955.	Damage in the three river basins at the time was estimated at $3,248,000.
December 1964	Truckee and Carson River Basins	Torrential warm rains over December 21-23, melted part of the snow pack causing flooding similar to the December 1955 flood.	The estimate of damages in these two river basins at the time was $2,236,000.
January 1969	Humboldt River Basin	Heavy rain on snow caused flooding on the Little Humboldt River and on Martin Creek which enters Paradise Valley. Peak outflows of the Little Humboldt were recorded at 2,380 cfs	No figures available
May 1983	Ophir Creek, Washoe Valley, Washoe County	A landslide off Slide Mountain hit Upper Price Lake and sent a 15- to 20-foot-high mudflow of water, mud, and boulders traveling 40 mph, down Ophir Creek into Washoe Valley killing one person and covering an 1,800-foot stretch of U.S. Highway 395 with mud and debris.	One person was killed, several injured and multiple residences damaged; No figures on damages.
April-June 1984	Humboldt River Basin	Extensive snow melt with a recurrence interval >100	No data on damages.
February 1986	Truckee and Carson River Basins	Unprecedented rains over a 10-day period in February 1986 caused severe flooding along the in the Truckee and Carson River Basins and to a lesser extent along the Walker River. Maximum precipitation for the period was 12 inches in valley areas, 20 inches in the foothills of the Sierra Nevada, and 30 inches in the higher mountains. Flows in the Truckee River in the Reno-Sparks area and in the Carson River at Carson City were the greatest	Damage resulting from this flood was estimated at the time to be $12,700,000.

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
		since 1963. Downstream on the Carson River near Fort Churchill, the flow was the greatest since record-keeping began in 1911 In the Truckee Meadows. All but two bridges in Reno over the Truckee Rivers were closed. The rains caused several small landslides. Some residents became stranded or were evacuated.	
March 1995	Long Valley Creek, Truckee River Storey County	Flooding occurred in the Rainbow Bend subdivision at Lockwood where Long Valley Creek enters the Truckee River in Storey County	Caused over $2.5 million in damage
December 1996	Truckee Canal – part of the TCID irrigation system	The Truckee Canal (part of the TCID irrigation system) was breached early on in the Truckee River flood event, flooding 60 homes in the Fernley area. Canal breach occurred at approximate Canal Station 800+00 on the north embankment. The breach site was identified by the Regional Engineer in field review following the 2008 canal breach.	More than 60 homes were flooded.
December 1996 - January 1997	Truckee, Carson, and Walker River Basins	Heavy snow and rain from December 1996 into January 1997 melted Sierra Nevada snow pack causing widespread flooding over approximately 63,800 acres. Floods inundated many residences and businesses in the Truckee Meadows, closed most bridges across the Truckee in Reno, closed the Reno/Tahoe International Airport, and flooded warehouses up to 6 feet deep in the industrial sections of Sparks and east Reno.	Two lives were lost: one in Washoe County and one in Douglas County. Direct damages estimated between $167 million and $169 million. Additional hundreds of millions of dollars in lost business and travel.
January 1997	Carson, Douglas, Lyon, Storey and Washoe	Flooding, mudslides and debris flows along smaller drainages in Carson, Douglas, Lyon, Storey and Washoe counties were coincident with the flooding on the major rivers in northern Nevada.	No estimates
June 2002	Northern Reno-Sparks area	Flash flood and debris flow/mudslide occurred on the alluvial fan where the new Spanish Springs High School was in the final stages of completion, Washoe County.	More than $500,000 damage to the new Spanish Springs High School
Dec., 2005-Jan. 2006	Elko County	In Elko County, winter flooding damaged two bridges in Jarbidge, the Midas Road,	

Table 3-20. Chronology of Major Flooding in Northern Nevada

Date	Location	Description	Estimated Losses
		and irrigation structures and cattle guards along the Tuscarora Road.	
Dec. 31, 2005-Jan 1 2006	Truckee River	Up to 6-8 inches of rain in the Lake Tahoe basin caused widespread localized flooding along the eastern Sierra. The Truckee River crested at about 13.6 feet, 2.6 feet above flood stage in downtown Reno, flooding several buildings in the downtown area and an undetermined number of businesses downstream in the Sparks industrial area where it crested at 19.2 feet, 4.2 feet above flood stage. The State EOC was activated and reported that five counties made local declarations.	Undetermined amount
Jan 1 2006	Carson River Basin including tributaries in Carson Valley, Carson City and the Dayton Valley area	Widespread heavy rain from December 30-31, 2005 caused flooding throughout the Carson River Basin. USGS stream flow data indicate the flow at East Fork Carson River near Gardnerville, Nev., peaked at 8,920 cfs; the flow at Carson River near Carson City, Nev. at 13,200 cfs, and the flow at Carson River at Fort Churchill, Nev. at 10,300 cfs.	Undetermined amount
January 5-8 2008	South of Cottonwood Lane, Fernley area, Lyon County	The Truckee irrigation canal breached at 4:19 AM flooding about 800 homes and displacing about 1500 residents from flooded homes in the Green Valley, Tuscany Villa, Aspen Meadows, Shady Grove and Farm Lane areas.	Undetermined as yet

The history of flooding in southern Nevada is summarized below in Table 3-21. Please see Appendix K for additional State Climatologist data pertaining to precipitation extremes by county and Section 7 for flood history sources.

Table 3-21. Summary of Major Flooding in Southern Nevada

Date	Location	Description	Estimated losses
March 31, 1906	Las Vegas Valley	Flooding: 70 miles of track, bridges, and fills were swept away	
August 25, 1906	Las Vegas Valley	Heavy rains: The water washed through the streets in heavy torrents.	
August 15, 1908	Indian Springs area, Las Vegas Valley	Cloudburst: 10 miles west of Las Vegas. Flooding washed out one mile of road.	No property damage estimate is available

Table 3-21. Summary of Major Flooding in Southern Nevada

Date	Location	Description	Estimated losses
August 21, 1909	Las Vegas Valley	Heavy rains caused flooding that damaged 30 feet of railroad track north of Las Vegas.	No property damage estimate is available
January 8, 1910	Las Vegas Valley	Melting snow and torrential storms: Major flooding, washed away farms, trains, roads, etc. A train was washed away in Caliente area. Muddy Valley had the largest flood in years.	No property damage estimate is available
January 15, 1910	Virgin Valley area, Las Vegas Valley	Flooding in the Virgin Valley area washed away a home, dams, livestock and crops.	No property damage estimate is available
January 18, 1911	Las Vegas Valley	The Salt Lake Railway was washed out by flooding.	No property damage estimate is available
March 18, 1911	Las Vegas Valley	Snowstorms and rain flooded out the Salt Lake Railway.	No property damage estimate is available
February 28, 1914	Las Vegas Valley	Several washouts took out the railway. It also took out two farms.	No property damage estimate is available
May 12, 1917	Las Vegas Valley	Large flood: road between Goodsprings and Jean was damaged	No property damage estimate is available
August 4, 1917	Las Vegas Valley	Large flood damaged alfalfa crops on Moapa Indian Reservation	No property damage estimate is available
March 16, 1918	Las Vegas Valley	Large flood damaged farms in Mesquite and Bunkerville	No property damage estimate is available
July 24, 1920	Las Vegas Valley	Heavy storm: crops and boarding house were destroyed	No property damage estimate is available
August 27, 1921	Las Vegas Valley	Heavy torrential rain: Las Vegas had no damage, Moapa Valley had damaged roads, Rio Virgin Valley had a lot of damage.	No property damage estimate is available
January 7, 1922	Las Vegas Valley	Flashflood through Meadow Valley Wash. Damaged railroad tracks to Caliente	No property damage estimate is available
July 14, 1923	Las Vegas Valley	Flashflood: damage to farms, damage to the road from Las Vegas to Searchlight	No property damage estimate is available
July 28, 1923	Las Vegas Valley	Thunderstorm in Las Vegas. caused damage to commercial, residential, and public buildings. Severe fiscal damage to the railroad company.	No property damage estimate is available
August 28, 1925	Las Vegas Valley	Heavy storm: Las Vegas to Searchlight road damaged	No property damage estimate is available
Sep. 19, 1925	Las Vegas Valley	Flash flood caused considerable damage to farms	No property damage estimate is available
August 30, 1927	Las Vegas Valley	Highways around Las Vegas were flooded.	No property damage estimate is available
August	Las Vegas Valley	Heavy deluge washed out highways	No property damage

Table 3-21. Summary of Major Flooding in Southern Nevada

Date	Location	Description	Estimated losses
5, 1929		around Las Vegas and several roads in the city.	estimate is available
August 27, 1929	Las Vegas Valley	Heavy deluge wrecked a state highway near Charleston turnoff	No property damage estimate is available
August 23, 1930	Las Vegas Valley	Cloudburst damaged Arrowhead Trail, section of an underpass, and the highway.	No property damage estimate is available
August 12, 1931	Las Vegas Valley	Heavy rainstorm, cloudburst, structural damage to commercial property.	No property damage estimate is available
July 11, 1932	Las Vegas Valley	Heavy storm. Much structural damage.	No property damage estimate is available
August 27, 1932	Las Vegas Valley	Lower Virgin River Bridge was washed out from three cloudbursts	No property damage estimate is available
August 29, 1932	Las Vegas Valley	Heavy deluge: farms around Mesquite covered in one to three feet of mud	No property damage estimate is available
August 21, 1933	Las Vegas Valley	Heavy deluge: Midway residents reported mud in their homes	No property damage estimate is available
August 21, 1934	Las Vegas Valley	Heavy deluge: Fremont street became a raging river	No property damage estimate is available
September 24, 1935	Las Vegas Valley	Cloudburst washed away roads on the Los Angeles highway	No property damage estimate is available
July 31, 1936	Las Vegas Valley	Cloudburst: two feet of water on Arden Highway. Washed out Charleston Highway.	No property damage estimate is available
September 24, 1937	Las Vegas Valley	Cloudburst near Glendale washed a car over a culvert.	No property damage estimate is available
March 3, 1938	Las Vegas Valley	Continuous rain and flooding caused damage to Boulder City	No property damage estimate is available
June 28, 1938	Las Vegas Valley	Rain at Indian Springs sent flood water to Las Vegas. Telephone lines in Las Vegas were down.	No property damage estimate is available
September 5, 1939	Las Vegas Valley	Heavy rains in Southern Nevada and Southern Utah., also severe damage to the Moapa Indian Reservation	No property damage estimate is available
September 10, 1939	Las Vegas Valley	Heavy rains caused damage to Eldorado Canyon district between Boulder City and Kingman	No property damage estimate is available
February 2, 1940	Las Vegas Valley	Heavy rains caused washouts on the Charleston highway	No property damage estimate is available
August 13, 1941	Las Vegas Valley	Two railway bridges were swept away in the flood.	No property damage estimate is available
August 10, 1942	Las Vegas Valley	Rain and hail, trailer camps were devastated	No property damage estimate is available
July 9,	Las Vegas Valley	Flooding in Overton. Union Pacific	No property damage

Table 3-21. Summary of Major Flooding in Southern Nevada

Date	Location	Description	Estimated losses
1945		railway main line was washed out.	estimate is available
August 1, 1945	Las Vegas Valley	Moapa Valley flooded, damaging crops	No property damage estimate is available
July 25, 1946	Las Vegas Valley	Cloudburst in Mesquite, killing one person.	No property damage estimate is available
October 13, 1947	Las Vegas Valley	Flooding in Las Vegas; Freemont Street flooded; Worst storm since 1945	No property damage estimate is available
Septemb er 8, 1950	Las Vegas Valley	Torrents of water roared down Freemont Street	No property damage estimate is available
July 20, 1951	Las Vegas Valley	Two cloudbursts, standing water in the homes near Boulder highway	No property damage estimate is available
August 28, 1951	Las Vegas Valley	Windstorm and Cloudburst, property damage in North Las Vegas	No property damage estimate is available
Septemb er 21, 1952	Las Vegas Valley	Heavy rainfall, power outage in Henderson	No property damage estimate is available
June 27, 1954	Las Vegas Valley	Heavy rainfall and several cloudbursts, Las Vegas Wash boiled over, several homes were filled with mud.	No property damage estimate is available
July 26, 1954	Las Vegas Valley	Flood torrents throughout the Las Vegas Valley, affected power lines, roads, homes	No property damage estimate is available
August 25, 1955	Las Vegas Valley	Worst storm, Union Pacific railroad was disrupted for 8 hours	No property damage estimate is available
July 26, 1957	Las Vegas Valley	Cloudburst, phones out of service, damage to low-level homes near Charleston Blvd.	No property damage estimate is available
August 21, 1957	Las Vegas Valley	Flooding damaged city streets and shut down highways out of Las Vegas	No property damage estimate is available
June 22, 1958	Las Vegas Valley	Flash flood washed-out a five mile section of Nelson Road	No property damage estimate is available
Novemb er 11, 1958	Las Vegas Valley	Flash flood in Las Vegas	$60,000 worth of damage to Las Vegas including debris cleanup
July 22, 1960	Las Vegas Valley	Flash thunderstorm in Las Vegas, phone lines were downed	No property damage estimate is available
August 29, 1961	Las Vegas Valley	Heavy rainfall, some mobile homes had to be evacuated	No property damage estimate is available
Septemb er 18, 1961	Las Vegas Valley	Lamb Blvd was washout by the deluge, power was knocked out throughout the valley	No property damage estimate is available
April 8, 1965	Las Vegas Valley	Rain washed out road beds in the County	No property damage estimate is available
August	Las Vegas Valley	Flooding, 14th and 25th Streets caved in	No property damage

Table 3-21. Summary of Major Flooding in Southern Nevada

Date	Location	Description	Estimated losses
7, 1967			estimate is available
August 19, 1967	Las Vegas Valley	Flash flood: damaged Highway 95 between Las Vegas and Searchlight	No property damage estimate is available
Septemb er 6, 1967	Las Vegas Valley	Severe flooding: Tonopah Highway damaged	No property damage estimate is available
January 24, 1969	Las Vegas Valley	Rainstorms washed out roads and buried cars in mud	No property damage estimate is available
February 1969	Amargosa River drainage basin and Amargosa Valley, Nye County	Largest recorded flood in 25 years in the Amargosa River drainage	No property damage estimate is available
August 4, 1970	Las Vegas Valley	Heavy rains, damaged county roads	No property damage estimate is available
August 14, 1970	Las Vegas Valley	Heavy rains, water washed over road to Indian Springs, power lines downed	No property damage estimate is available
August 20, 1973	Las Vegas Valley	Las Vegas Wash Marina was severely damaged by a thunderstorm	No property damage estimate is available
Septemb er 14, 1974	Eldorado Canyon, Las Vegas Valley, Clark County	A flash flood/debris flow swept away mobile homes, cars, a restaurant, and drowned at least 9 people in Eldorado Canyon. Water depth was up to 20 feet, and up to 40 feet of sediment was deposited near Nelson's Landing on the shore of Lake Mead.	At least 9 people were killed.
July 3-4, 1975	Las Vegas Valley	Heavy thunderstorm precipitation exceeding 3 inches between Las Vegas and the mountains to the south, west, and north, caused record peak flows of Tropicana Wash, Flamingo Wash, Las Vegas Creek, and Las Vegas Wash.	Two people were drowned. Total property damage was estimated by the Clark County Flood Control District at $4.5 - $5 million
August 10, 1981	California Wash, Logan Wash, Overton Wash, Valley of Fire Wash and the lower Muddy River. Moapa Valley area, Lake Mead Recreation area and Las Vegas	Thunderstorm-related intense rains up to 6.5 inches in less than an hour fell on southern Nevada. The heaviest rain was concentrated over the California Wash, Loqan Wash, Overton Wash, Valley of Fire Wash and the lower Muddy River and produced major flooding and record runoff. Record floods in the Moapa Valley area did the most serious damage. California Wash flooding heavily damaged Hidden Valley Ranch dairy farm, where approximately 500 cows drowned, and twenty mobile homes were destroyed or damaged. Muddy River at Glendale	Tens of millions of dollars worth of damage to the Moapa Valley area, Overton, Lake Mead Recreation area and Las Vegas

Table 3-21. Summary of Major Flooding in Southern Nevada

Date	Location	Description	Estimated losses
		below California Wash overflowed the bridge by 5 to 6 feet	
June 30, 1984	Near Caliente, Lincoln County	Intense thunderstorm caused flash flooding near Caliente, Lincoln County	No estimates
August 14 -16, 1984		Fourth episode of flooding in a month. Up to 3.5 inches of rain from southern Las Vegas to Boulder City caused floods the damaged roads, injured people, caused power outages, engulfed vehicles and flooded four homes in Henderson and 3 units of an apartment complex on East Lake Mead Boulevard.	Officials estimated previous 1984 summer thunderstorm damage to be more than $2 million.
June 9-10, 1990	Las Vegas Valley, Overton area, Jean area	Floods due to intense rainfall caused road closures in the Overton area and wide-spread damage in the Las Vegas Valley. The most intense rainfall was recorded in an area bounded by Tropicana Avenue, Las Vegas Boulevard, Washington Avenue, and Hollywood Boulevard and approximated a 50-year rainfall event in places. Many streets were flooded and there were widespread power outages.A mudslide partially closed the Old LA Highway south of Jean.	Wide-spread damage and two flood-related deaths in the Las Vegas Valley.
August 14-16, 1990	CalNevAri, Las Vegas Valley, Moapa Valley, Glendale, Muddy River, Meadow Valley Wash	Intense localized rainstorms dropped up to 2.5 inches of rain in Las Vegas Valley and In Moapa Valley causing floods that damaged the roads, bridges, railways, businesses, vehicles and flooded at least 26 homes.	$250,000 in damages to the UPRR tracks near Logandale due to flooding of Logan (Benson) Wash. $100,000 estimated damages to public facilities in the Moapa Valley. No estimate of private property damage is available.
September 6-8, 1991	Clark County/ Las Vegas Valley/ County	Localized intense rainfall totaling 1.77 inches on the west side of the Las Vegas Valley flooded streets and caused some damage to sidewalk, curbs, gutters, street pavement and a bridge under construction.	The Clark County Public Works Department estimated the cost of cleanup from this event at $6000 in overtime and equipment.

Table 3-21. Summary of Major Flooding in Southern Nevada

Date	Location	Description	Estimated losses
February 8, 1993	Clark County/ Las Vegas Valley/ County	A powerful Pacific storm dropped up to 2.4 inches of rain during a 16-hour period on southern Las Vegas Valley. There was localized significant erosional damage and street flooding. There was breakout flooding from Washington Avenue Channel, Van Buskirk Channel, and Muddy River	No damage estimate is available.
August 8, 1994	Las Vegas Valley/ County	Intense, localized thunderstorm dropped up to 1.57 inches of rain in NW Las Vegas Valley causing local street flooding and damage to storm drains, vehicles and a number of residences were flooded.	No damage estimate is available.
March 10-11, 1995	Amargosa River drainage basin and Amargosa Valley, Nye County	Nevada Test Site area: U.S 95 was closed, Stockade Wash culverts were damaged at Airport Road, H Road crossing and other roads were covered with sediment, and debris and a Nevada Test Site worker was swept away by the flood waters in Fortymile Wash, but managed to escape.	No damage estimate is available.
August 22-23, 1995	Las Vegas Valley/ County	Two localized intense storms each dumped nearly 3/4" of rain in 15 minutes in the Las Vegas Valley on both August 22 and August 23, causing localized flooding of streets where debris blocked culverts.	One person was swept away and drowned. No property damage estimate is available.
August 9-10, 1997	Las Vegas Valley/ County	Line of thunderstorms caused severe flooding in Las Vegas and Boulder City, severe damage to public and private property	No damage estimate is available.
February 22-23, 1998	Amargosa River drainage, Amargosa Valley, Nye County	A regional storm produced up to 2.81 inches of rain resulting in minor flooding throughout the Amargosa River drainage basin. Floods severely eroded the channel In Fortymile Wash and caused extensive damage to U.S. Highway 95 and to Nevada Test Site roads.	No damage estimate is available.
July 20-24, 1998	Urban areas of the south end of the Las Vegas Valley	Repeated intervals of more than an inch of rainfall in less than an hour in caused localized flooding of streets, damage to drainage systems, and deposition of debris, silt, and sediment on roadways.	Two flood-related deaths were reported. No property damage estimate is available
Septemb	Las Vegas/County	A storm produced as much as 2 inches	The Clark County

Table 3-21. Summary of Major Flooding in Southern Nevada

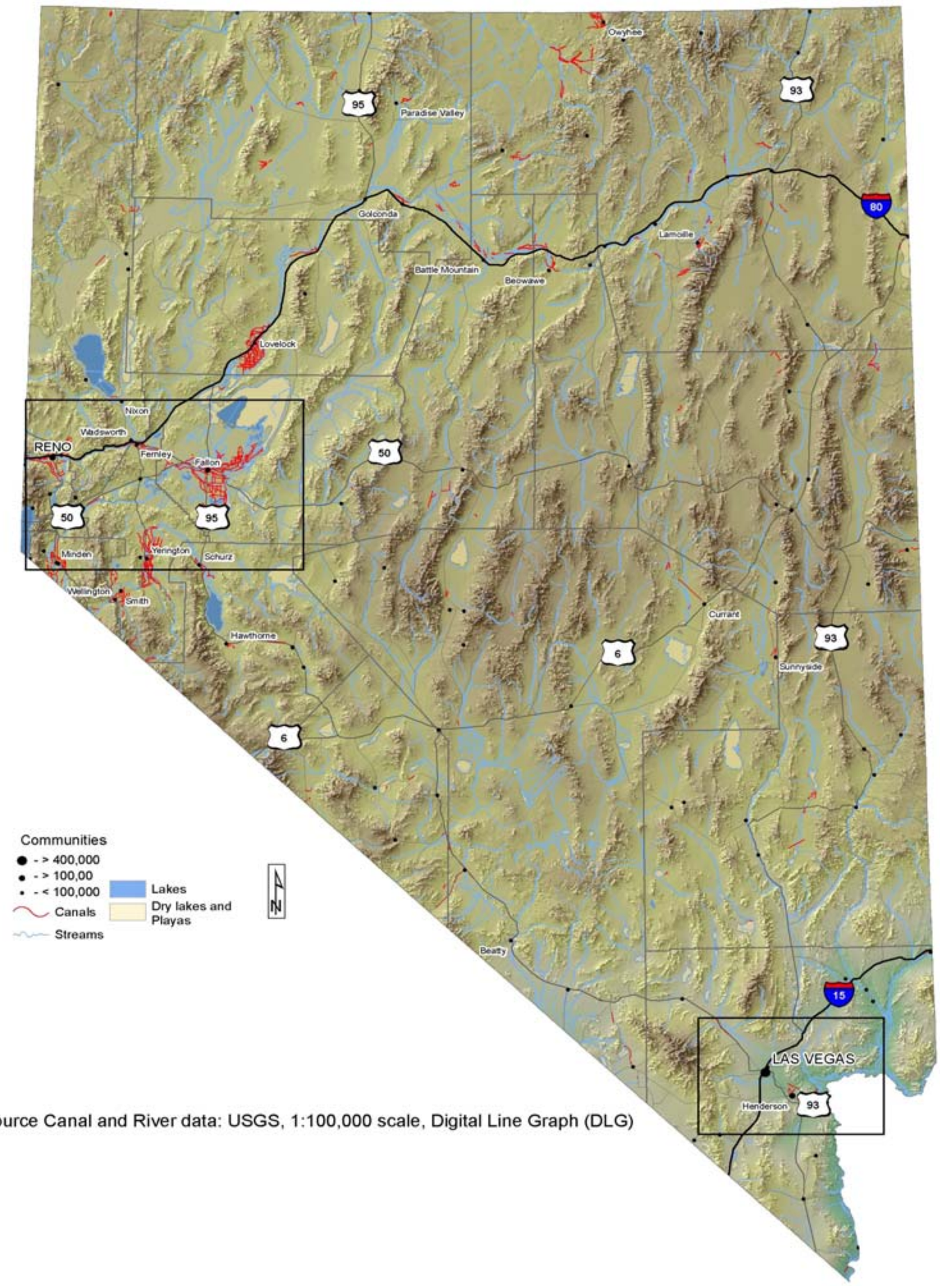
Date	Location	Description	Estimated losses
er 11, 1998		of rainfall in parts of Las Vegas Valley and more than 3 inches of rain in Moapa Valley, causing extensive flooding.	Public Works Department estimated that Moapa Valley sustained damage to roadways amounting to approximately $400,000.
July 8, 1999	Las Vegas Valley	Extreme flooding in washes, channels, and roads caused damage to public and private properties.	No property damage estimate is available
August 19, 2003	Las Vegas Valley	An intense thunderstorm caused flooding in many of the west-east roads in the Northeastern part of Las Vegas.	No property damage estimate is available
Decemb er 2004 to January 10-11, 2005	Las Vegas Valley/Lincoln County	Sustained heavy rains in late Dec. 2004 and early Jan. 2005 caused widespread flooding in Las Vegas Valley, along Meadow Valley Wash, Muddy River, and Virgin River in both Clark and Lincoln Counties.	Total flood and storm damage for Lincoln County was estimated at $9.4 million and $4.5 million for Clark County.
August 2, 2007	Brownstone Canyon area, west Las Vegas Valley	Intense localized thunderstorm dropped over 2.50 inches of rain in a 90-minute period causing flooding that washed out the Calico Basin Road in several locations and closed SR159.	No property damage estimate is available.
August 27, 2007	SW Las Vegas	Up to 3.11 inches of rainfall caused localized residential flooding and numerous reports of swift water rescues.	No property damage estimate is available

3.3.7.3 *Location, Severity, and Probability of Future Events*

3.3.7.3.1 *Location*

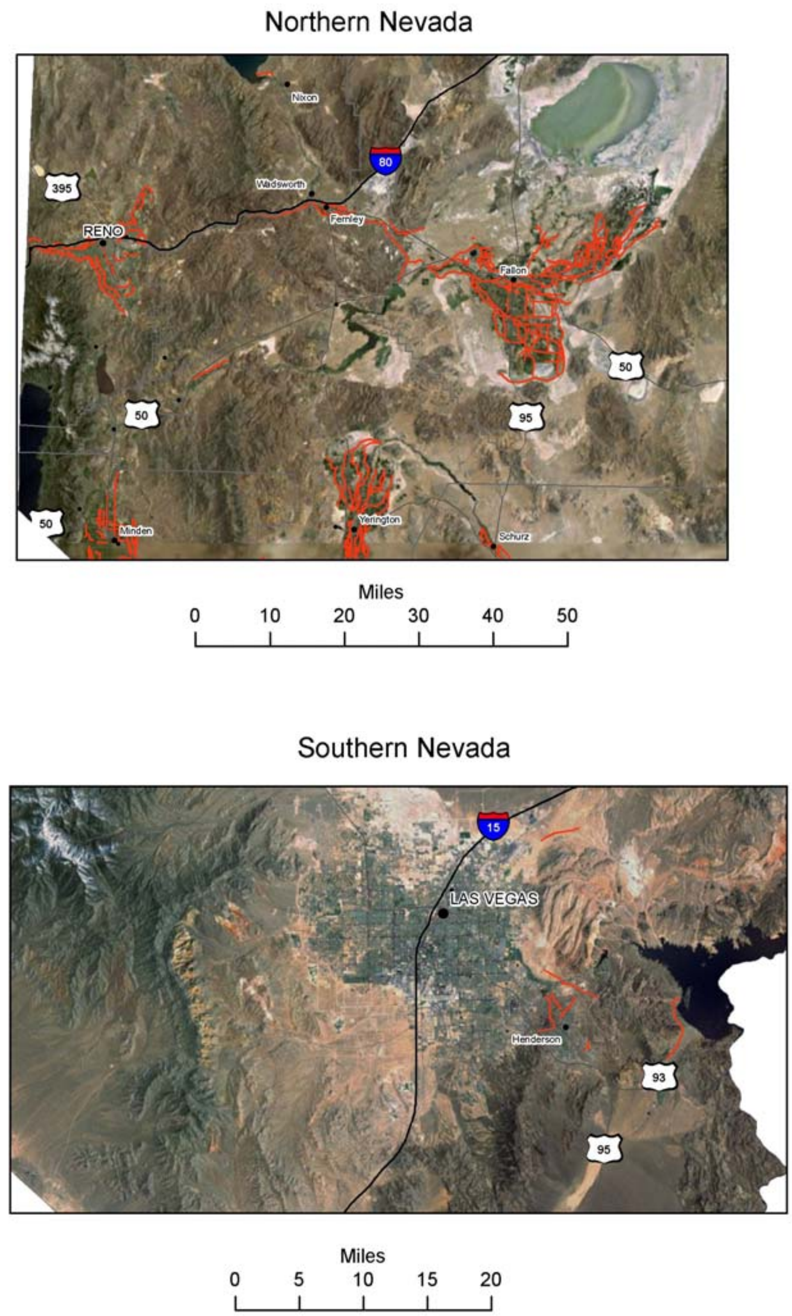
Section 3.3.7.3 on the history of flooding in Nevada provides the basis for probable location of future flooding in the state. Major river systems in Nevada along which normal alluvial flooding has occurred in the past and will likely occur again are the Carson, Truckee, Walker, Humboldt, Amargosa rivers and the lower Colorado River including its tributaries, the Virgin and Muddy Rivers. Locations of these rivers as well as the locations of major canals, cities, and towns in the state are shown in figure 3-13 and in Appendix H. Flash floods, debris flows and mudslides have also occurred in the past in the drainages described in the flood chronology tables. However, flash floods, debris flows and mudslides can occur anywhere in the state where there is unstable wet unconsolidated material located on slopes.

Figure 3-13. Major Rivers and Canals in Nevada



Source Canal and River data: USGS, 1:100,000 scale, Digital Line Graph (DLG)

Figure 3-13. Major Rivers and Canals in Nevada



Source Canal and River data: USGS, 1:100,000 scale, Digital Line Graph (DLG)

3.3.7.3.2 *Severity*

FEMA's Severe Repetitive Loss (SRL) Program was designed in 2004 to provide funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the National Flood insurance Program (NFIP).

An SRL property is defined as a **residential property** that is covered under an NFIP flood insurance policy and:

(a) That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

(b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.

Nevada has no severe repetitive loss properties.

FEMA's Repetitive Flood Claims (RFC) grant program was authorized to assist States and communities in reducing flood damages to insured properties that have had one or more claims to the National Flood Insurance Program (NFIP). Table 3-22 below is a summary of the number of repetitive loss cases and claims paid due to floods for communities in the State of Nevada.

Table 3-22. Summary of Repetitive Loss Due to Flood for Communities in the State of Nevada

Community Name	Number of Properties	Total Claims Paid
Churchill County	1	$6,997
Clark County	4	$103,087
Carson City	3	$99,799
Douglas County	4	$216,889
City of Las Vegas	3	$265,640
City of Reno	11	$2,089,412
City of Sparks	23	$5,685,185
Washoe County	8	$687,794

Note: The data contained on this report contains repetitive loss properties only. It does not include mitiaged properties. Data as of 7/31/2009

Source: NV State Flood Plain Manager

The state is working a variety of stakeholders to reduce the number of properties considered to be repetitive loss properties and to prevent severe repetitive loss properties from developing. The "Living River Plan" for the Truckee is a showcase project of cooperative action among state, county, tribal, and private non-profit entities. In the Reno-Sparks-Washoe County area along the Truckee River where the greatest number of repetitive loss properties occur, several state agencies are cooperating with the Truckee River Flood Project on their “Living River Plan” which has common goals and objectives that include achieving flood damage protection from at least a 100-year flood event on the Truckee River and developing a forward-looking flood protection management plan that is not rendered obsolete by future land use changes. State agencies involved in this consortium include the Department of Conservation and Natural Resources, Department of Wildlife, the Division of Environmental Protection, Division of State Lands and NDEM partnering together with the City of Reno, City of Sparks, the Community Coalition, Storey County, Reno-Tahoe Airport Authority, Pyramid Lake Paiute Tribe, Reno-Sparks Indian Colony, the Nature Conservancy, with Washoe County as the managing partner. The plan includes many replacement of and improvements to bridges, levees, floodwalls, as well as construction of terracing and berms. The project will also include the acquisition, elevation, and/or demolition of repetitive loss buildings.

The magnitude of flood used as the standard for floodplain management in the United States is a flood having a 1 percent probability of occurrence in any given year. This flood is also known as the 100-year flood or base flood. The 100-year floodplain boundaries for identified flood hazards are shown on Flood Insurance Rate Maps (FIRMs) that are prepared by FEMA to show areas that have the highest probability of flooding and to illustrate the extent of flood hazards in a flood-prone community. These maps are also used to determine flood insurance rates for communities participating in the National Flood Insurance Program (NFIP). FIRMs are readily available from FEMA through their web site. The areas bounded by 100-year floodplain boundaries are also referred to as Special Flood Hazard Areas (SFHAs) and are the basis for flood insurance and floodplain management requirements. The FIRMs also show floodplain boundaries for the 500-year flood, which is the flood having a 0.2 percent chance of occurrence in any given year.

Table 3-23 below summarizes the ratings for flood hazard by counties and tribal entities. These data were acquired from approved county hazard mitigation plans or from hazard mitigation surveys sent to counties and tribes in 2007 and returned to NHMP subcommittee.

Table 3-23. Flood Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County	X			
Douglas County			X	
Elko Band		X		
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County		X		
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County			X	
Lyon County				X

Table 3-23. Flood Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Mineral County				X
Nye County		X		
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley			X	
South Fork Band Tribe				X
Storey County			X	
Washoe County			X	
Washoe Tribe		X		
White Pine				X

3.3.7.4 *Vulnerability Assessment and Analysis of Potential Losses*

Flood hazards are considered to be a "High Risk" hazard in much of Nevada. Floods affect many areas developed for businesses and homes, and they can affect multiple jurisdictions, as was the case in January of 1997, when Carson City, Douglas, Lyon, Storey, and Washoe Counties were impacted by floods on the Carson, Walker, and Truckee Rivers. Based on the frequency of flooding in the past, the probability of future, damaging floods in Nevada is high.

To assess risks and vulnerability, the Nevada Bureau of Mines and Geology has run FEMA's loss-estimation model, HAZUS-MH (Patch 1, HAZUS MR4), for reaches of the Carson, Humboldt, Muddy, Truckee, Virgin, and Walker Rivers. The preliminary results using HAZUS-MR4 are summarized in Tables 3-24 and 3-25. In all cases, the HAZUS runs used floods with average 100-year return periods.

Failures of dams can cause flash floods. No specific HAZUS runs were made to simulate dam failures. Nonetheless, the 100-year return period can be used to approximate the damage that could occur from some dam failures, particularly along the Truckee River (with the Stampede, Boca, and Prosser Reservoirs along tributaries in California, upstream from Reno), Carson River (with Lahontan Reservoir upstream from Fallon), and Humboldt River (with Rye Patch Reservoir upstream from Lovelock).

Table 3-24 indicates that damage from floods could range from hundreds of thousands of dollars in sparsely populated rural areas to hundreds of millions of dollars in large urban areas. Hundreds of buildings could suffer complete destruction. Thousands of people may need public shelter. Hundreds of thousands of tons of debris may need to be cleared.

One way of assessing vulnerability is in terms of total building-related economic losses, summed for the counties affected by a flood. Using this measure, flood vulnerabilities are ranked as follows:

Highest loss from 100-year flood: Truckee River ($1.1 billion)
2nd highest: Carson River ($683 million)
3rd highest: Walker River ($184 million)
4th highest: Humboldt River ($167 million)

5th highest: Muddy River ($71+ million)
6th highest: Virgin River ($12 million)

Clearly, Nevada's northern counties, Washoe County in particular, are more at risk than its southern ones for floods along major rivers. Clark County is, however, susceptible to flash floods along streams, particularly in Las Vegas Valley.

Table 3-24. Summary of HAZUS MR4 Loss-estimation Output for 100-year Floods on Major Rivers

River	Counties	Cities	Building-Related Economic Loss ($ million)	Number of Peo Needing Public Shelter	Debris Generated (tons)
Carson	Douglas	Gardnerville, Minden	54	800	4,300
	Carson City	Carson City	39	1,200	4,400
	Lyon	Dayton, Silver Springs	39	747	9,000
	Churchill	Fallon	551	10,396	87,800
	Total		683	13,143	105,500
Humboldt	Elko	Elko, Carlin	76	1,900	16,800
	Eureka	Palisade, Beowawe	0.5	0	200
	Lander	Battle Mountain	4.4	400	1,100
	Humboldt	Winnemucca	67.9	0	7,600
	Pershing	Lovelock	18.2	300	3,900
	Churchill	*no large town*	n/a	n/a	n/a
	Total		167	2,600	29,600
Muddy*	Lincoln	Ursine, Panaca, Caliente	0.5	1	180
	Clark	Moapa. Glendale, Logandale, Overton	70	2,800	19,200
	Total		71	2,801	19,380
Truckee	Washoe	Verdi, Reno, Sparks, Wadsworth, Nixon	1,042	14,500	88,700
	Lyon	None	0	0	0
	Storey	Lockwood	26	500	10,000
	Total		1,068	15,000	98,700
Virgin	Clark	Mesquite, Bunkerville	12	350	2,000
	Total		12	350	2,000
Walker	Lyon	Wellington-Smith, Yerington	181	4,100	20,600
	Douglas	No large towns	0.24	0	60
	Mineral	Schurz, Hawthorne (protected by Walker	3	60	1,100

		Lake)			
	Total		184	4,160	21,760
* Includes Meadow Valley Wash					

Table 3-25 shows the vulnerability of buildings in each county to HAZUS MR4 100-year floods on selected rivers in Nevada, ranked both by economic loss and by loss as a percentage of exposure.

Table 3-25. Vulnerability to HAZUS MR4 100-year Floods on Selected Rivers in Nevada

River & County	Building Exposure ($ millions)	Building-Related Economic Loss ($ million)	Loss as % of exposur	Rank by Economic Lo	Rank by Loss as % of Exposure
Carson River				**2**	**1**
Douglas County	3,900	54	1.4		
Carson City County	4,000	39	1%		
Lyon County	2,100	39	2%		
Churchill County l	1,400	551	39		
Total	11,400	683	6.0		
Humboldt River				**4**	**2**
Elko County	2,612	76	3%		
Eureka County	131	0.5	0%		
Lander County	308	4.4	1%		
Humboldt County	1,027	67.9	7%		
Pershing County	318	18.2	6%		
Churchill County	n/a	n/a	n/a		
Total	4,396	167	3.8		
Muddy River *				**5**	**5**
Lincoln County	269	0.5	0.2		
Clark County	96,739	70	0.07		
Total	97,008	71	0.07		
Truckee River				**1**	**3**
Washoe County	29,200	1,042	3.6		
Lyon County	2,053	0	0.0		
Storey County	238	26	10.9		
Total	31,491	1,068	3.4		
Virgin River				**6**	**6**
Clark County	97,000	12	0.01		
Total	97,000	12	0.01		
Walker River				**3**	**4**
Lyon County	2,100	181	9%		

Table 3-25. Vulnerability to HAZUS MR4 100-year Floods on Selected Rivers in Nevada

River & County	Building Exposure ($ millions)	Building-Related Economic Loss ($ million)	Loss as % of exposur	Rank by Economic Lo	Rank by Loss as % of Exposure
Douglas County	3,900	0.24	0.01		
Mineral County	400	3	0.75		
Total	6,400	184	2.9		
* Includes Meadow Valley Wash *Source: NBMG, UNR, Open Data File 10-3*					

Table 3-25 summarizes vulnerability (or risk) from floods using two methods of ranking flood vulnerability:

(1) by building-related economic loss and
(2) by economic loss as a percentage of building exposure.

The county's building exposure, one of the factors within the HAZUS program, is a measure of the economic wealth of the county and a proxy for the ability of the county to recover from a disaster. Ranked by loss as a percentage of exposure, the most vulnerable rivers are:

Highest vulnerability: Carson River
2nd highest: Humboldt River
3rd highest: Truckee River
4th highest: Walker River
5th highest: Muddy River
6th highest: Virgin River

The complete report with all data generated by these HAZUS runs is contained in Nevada Bureau of Mines and Geology Open-File Report 10-3 entitled "Updated Assessment of Risks and Vulnerability to Flood Hazards in Nevada" by Jonathan G. Price, Gary L. Johnson, and Jordan T. Hastings. This report is available as an online document at www.nbmg.unr.edu.

Appendix H contains maps showing the extent of flooding for the 100-year flood event along each of the following river sysytems: the Carson, East Humboldt, West Humboldt, Walker, Virgin, and Muddy as well as a location map showing the location of these rivers within the state of Nevada. Colored contour areas represent the peak floodwater depth, an indicator of flooding intensity, scaled from 0 to 177 feet, depending on the river and the area flooded.

The HAZUS runs have been done along major rivers within the State. However, as population in Nevada grows and development continues to expand outward from the currently populated areas, additional buildings will likely become prone to flooding flooding in along what are normally dry alluvial fans, washes, or ephemeral streams, particularly around the periphery of Las Vegas Valley. Flooding in these areas is typically caused by intense rainfall over relatively short periods of time. The Clark County Regional Flood Control District has an aggressive program to reduce these hazards within their jurisdiction in an attempt to mitigate flood hazards along dry washes, in canyons, and on alluvial fans.

Flooding caused by dam failure is a special category described in the section below.

3.3.8 Flooding due to Dam Failure

3.3.8.1 *Nature*

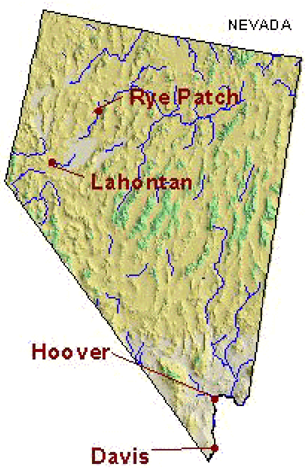


Figure 3-14. Nevada Dams. Courtesy of U.S. Department of Interior/ Bureau of Reclamation

Dam failures involve unintended releases or surges of impounded water resulting in downstream flooding. The high-velocity, debris-laden wall of water released from dam failures results in the potential for human casualties, economic loss, lifeline disruption, and environmental damage. Dam failures may involve either the total collapse of a dam, or other hazardous situations such as damaged spillways, overtopping from prolonged rainfall, or unintended consequences from normal operations. Severe storms with unusually high amounts of rainfall within a drainage basin, earthquakes, or landslides may cause or increase the severity of dam failure.

Factors causing dam failure may include natural or human-caused events, or a combination of both.

Dam failures usually occur when the spillway capacity is inadequate and water overtops the dam. Piping, when internal erosion through the dam foundation occurs, is another factor in a dam failure. Structural deficiencies from poor initial design or construction, lack of maintenance or repair, or gradual weakening from aging are factors that contribute to this hazard.

3.3.8.2 *History*

In Nevada history, there have been no incidents resulting in dam failure emergency or disaster declarations; however, the following incidents are on record:

- In 1984, the concrete liner of the Bishop Creek Dam in Elko County failed, resulting in a 25 cubic feet per second seep. The seep eventually removed approximately 800 cubic yards of material from the toe of the dam (Association of State Dam Safety Officials, 2002).
- In 1985, a mine tailings dam owned by the Olinghouse Mining Company failed from an embankment collapse due to oversaturation in Wadsworth, Nevada. Tailings were reportedly deposited up to 1.5 km downstream.

- In 2005, rainfall runoff overtopped the Schroeder Dam in Beaver Dam State Park located in eastern Nevada by one foot. The top surface of the dam was not damaged, but the downstream face of the dam was severely eroded. Erosion in several of the gullies may have reached as far as the core material. The dam was an earth-fill dam with a thirty-five foot concrete spillway on the east side. Prior to this event the dam was considered a low-hazard dam. Mitigation at this site is ongoing under declaration FEMA-NV-DR1583.

  Many dams in Nevada suffer from encroachment of development onto the potential floodplains below dams. As a result, many dams fail to pass the Inflow Design Flood (IDF) inspection commensurate with their hazard potential and size (Association of State Dam Officials, 2002).

Figure 3-15. Schroeder Dam in Beaver Dam State Park. Erosion cut into the front face of the earthen dam.

Picture courtesy of Nevada Division of Emergency Management.

3.3.8.3 Location, Severity, and Probability of Future Events

The State of Nevada has approximately 600 public and privately owned dams. Many of these dams are dry storm-water detention facilities. About 130 of these dams are rated by the State of Nevada Department of Conservation and Natural Resources as "High Hazard." This hazard classification is based on life and/or property loss potential.

A listing of existing dams by county is found in Appendix G. The listing includes the national identification number, the state identification number, name, county where it is located, legal description, height, normal storage, tributary area, owner, hazard rating, written emergency action plan (EAP), and date of last inspection. The information was obtained through the Nevada Department of Conservation and Natural Resources, Division of Water Resources website http://water.nv.gov/Engineering/Dams/Dam_Query.cfm. Hazard designations for dams are assigned based on downstream hazard potential in the event of a dam failure (NAC 535.140). A high hazard designation (H) is assigned to a dam if there is reasonable potential for loss of life and/or extreme economic loss. A significant hazard designation (S) is assigned to a dam if there is a low potential for loss of life but an appreciable economic loss. Lastly, a low hazard designation (L) is assigned to a dam if there is a vanishingly small potential for loss of life and the economic loss is minor or confined entirely to the dam owner's own property. These hazard designations are initially determined at the time dam design plans are reviewed, however, hazard designations can and do change as downstream conditions alter as a result of development and with the aging of the dams and levees.

The hazard designation is not dependent on type of dam and in no way reflects the safety or condition of the dam.

In 2007, the NHMP Subcommittee sent out a hazard mitigation survey to the counties and tribal entities to collect data on dam failure hazard. All counties except Esmeralda and Nye have at least one dam that is considered high hazard.

In its hazard mitigation plan, Esmeralda County does not list dam failure as a potential hazard of consideration. In their hazard mitigation surveys and/or county hazard mitigation plans, Eureka, Clark, and Douglas considered this hazard as low risk. Clark County has over 60 dry storm water detention facilities to help with flash floods. Churchill and Storey Counties consider the hazard of failing dams as moderate risk. Churchill County mentioned that the Lahontan Dam is aging. This dam is watched closely by Churchill County officials. Elko lists dam failure as a moderate hazard with Bishop Creek Dam as their main concern.

Washoe County, in its 2005 hazard mitigation plan, lists dam failure as a high hazard and includes inundation maps due to possible failure of the Boca and Stampede Dams on the Truckee River upstream in California.

In the tribal hazard mitigation surveys, Duck Valley Indian Reservation and the South Fork Indian Reservation consider the hazard of dam failure a low risk. On the Wildhorse Reservation, there is a 38-year old dam that is in good condition. On the South Fork Indian Reservation, there is a diversion dam for irrigation. The Elko band did not consider dam failure as a hazard to their community.

In the 2004 plan, the steering committee recognized the WMD/Terrorism threat rating to all dams (including Hoover and Davis Dams) as potential terrorist targets. The Bureau of Reclamation, Lower-Colorado Region considers the following factors in declaring an emergency at Hoover Dam:

- Structural or slope stability problems during a post-earthquake inspection
- Identification of new cracks or settlement, abnormal seepage
- Instrumentation readings outside of normal range limits
- Potential landslides in the vicinity of the dams or appurtenant structures
- A situation at Hoover Dam in which the average daily water releases exceed 19,000 cubic feet per second for 30 days or more
- A situation where Lake Mead is expected to reach elevation 1219.61 feet (top of joint use) and the National Weather Service forecasts heavy rain or runoff.
- A situation where an earthquake occurs with a magnitude of 3.9 (Richter-Scale) or greater occurs within a distance of 15 miles from the dam.
- A situation wherein a technological (man-caused) emergency occurs within the vicinity of the dam that would impact normal dam and/or power plant operations. Such emergencies could include a facility fire, explosion, terrorist incident, hostage situation or toxic spill on the highway or dam crest.
- A situation wherein Glen Canyon Dam has an unusual event that impacts the structural integrity of the Hoover dam or power plant.

Flooding due to dam failure is considered a “high hazard.” The hazard itself is difficult to quantify because dams could fail from earthquakes, excessive rainstorms, landslides, or human-induced factors. But the consequences can be severe on a local level.

At this time, the Division of Water Resources is in the process of developing emergency plans for all "high" and "significant" hazard rated dams in the State. Action items from these plans will be incorporated into this Plan upon their completion. The representatives on this subcommittee expect to increase the capability to mitigate these hazards by greater coordination between the Division of Water Resources, the Division of Emergency Management, Nevada Department of Transportation, and Nevada State Public Works. Additionally, it is anticipated that there will be greater opportunity to leverage funding from existing resources. The State of Nevada supports the Division of Water Resources efforts in mitigation action items related to this hazard.

3.3.9 Hail and Thunderstorms (Very Low Risk)

Appendix K contains a summary by county of damage-causing storm events prepared by the Nevada Climate Office with damage costs.

3.3.9.1 *Nature*

Thunderstorms are formed from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as warm and cold fronts or a mountain. A thunderstorm can produce lightning, thunder, and rainfall that may also lead to the formation of tornados, hail, downbursts, and microbursts of wind. Thunderstorms may occur singly, in clusters, or in lines. As a result, it is possible for several thunderstorms to affect one location in the course of a few hours.

Figure 3-16 Thunderstorms across the Sierra Nevada. *Picture from NASA.*

Thunder and lightning are most commonly associated with thunderstorms. Lightning occurs when the rising and descending motion of air within clouds produces a separation of positively and negatively charged particles. This separation produces an enormous electrical potential both within the cloud and between the cloud and the ground. Lightning results as the energy between the positive and negative charge areas is discharged. As the lightning channel moves through the atmosphere, heat is generated by the electrical discharge to the order of 20,000 degrees (three times the temperature of the sun). This heat compresses the surrounding clear air, producing a shock wave that decays to an acoustic wave as it moves away from the lightning channel, resulting in thunder.

In addition, hail can occur as part of a severe thunderstorm. Hail develops within a low-pressure front as warm air rises rapidly in the upper atmosphere and is subsequently cooled, leading to the formation of ice crystals. This cycle continues until the hailstone is too heavy to be lifted by the updraft winds and falls to the earth. The higher the temperature at the earth's surface, the stronger the updraft, thereby increasing the amount of time the hailstones are developed. As hailstones are suspended longer within the atmosphere, they become larger. Other factors impacting the size of hailstones include storm scale wind profile, elevation of freezing level, and the mean temperature and relative humidity of the downdraft air.

Also, downbursts and microbursts are also associated with thunderstorms. Downbursts are strong, straight-line winds created by falling rain and sinking rain that my reach speeds of 125 miles per hour (mph). Microbursts are more concentrated than downbursts, with speeds reaching up to 150 mph. Both downbursts and microbursts can typically last 5 to 7 minutes.

By far the greatest threats imposed by thunderstorms in Nevada are the associated lightning-caused wildfires and flash flooding due to cloudbursts. These risks are more completely discussed in the sections on Flooding and Wildfire.

3.3.9.2 *History*

In Nevada, thunderstorms usually occur from the spring to the fall. The most dangerous thunderstorms are during the summer due to the low humidity and high lightning potential..

Table 3-21 in the flood section shows that much of the historic flooding in Las Vegas Valley was caused by thunderstorms and cloudbursts. This is not unique to the Las Vegas Valley, but true for the entire state.

The following anecdotal news articles demonstrate the various effects that thunderstorms have had in recent years on the State of Nevada:

- **August 9, 2001:** The Federal Emergency Management Agency (FEMA) authorized the use of federal funds today to help Nevada fight the uncontrolled Antelope fire burning in Washoe County. The state's request for federal fire suppression assistance was approved immediately after it was reported that the blaze was threatening farm areas and 150 homes in the Antelope Valley subdivision located about eight miles northwest of the city of Reno. The fire, which was started by lightning yesterday, had burned 800 acres of land and forced the evacuation of 100 people at the time of the request.
- **July 12-13, 2002:** Numerous high wind and downburst reports in western NV with areas of blowing dust.
- **August 2, 2002:** Thunderstorm-induced flash floods over parts of Reno, and near Virginia City and Dayton.
- **June 26, 2006:** Elko - A lightning storm touched off at least nine fires in northeastern Nevada, forcing interstate closures and threatening a small ranching community. A wildfire about 20 miles west of Elko burned about 5,000 acres, while another blaze had scorched about 3,000 acres northeast of Elko and forced residents in nearby Elburz to evacuate. Two sections of Interstate 80 were closed Sunday night.

These anecdotal reports are not isolated unusual events but common occurrences representative of daily or weekly summer weather in Nevada. The data provided in Table 3-26 below by the State Climatologist demonstrate the severity of thunderstorms in Nevada. The complete report is contained in Appendix K.

Table 3-26. Historic Thunderstorms

County	Average number of thunderstorms per year	% Dry Thunderstorms
Carson City	No data	No data
Churchill	19	51%
Clark	26	81%
Douglas	No data	No data
Elko	38	82%
Esmeralda	No data	No data
Eureka	No data	No data
Humboldt	12	0%
Lander	23	625
Lincoln	No data	No data
Lyon	No data	No data
Mineral	No data	No data
Nye	42	66%
Pershing	10	56%
Storey	No data	No data
Washoe	20	56%
White Pine	57	67%
Source: NV State Climatologist		

3.3.9.3 *Location, Severity, and Probability of Future Events*

The location and severity are shown in the information compiled by the State Climatologist shown in Section 3.3.9.2. Based on this data, the probability of future events in all locations is high.

In the *Hazard Mitigation Surveys* and the *County Hazard Mitigation Plans,* Churchill and Storey Counties considered this hazard as low. Churchill County mentioned that this hazard could affect the river and dam.

In the *Tribal Hazard Mitigation Survey,* South Fork Band considered this hazard as low. According to the survey, this hazard is a yearly event with minor storms.

The rating for hail and thunderstorms acquired from approved hazard mitigation plans is summarized in the table below.

Table 3-27. Hail & Thunderstorm
Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County				X
Douglas County				X
Elko Band				X
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County	X			
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County		X		
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley		X		
South Fork Band Tribe				X
Storey County	X			
Washoe County	X			
Washoe Tribe		X		
White Pine				X

Hazards directly associated with hailstorms and thunderstorms were considered by the Subcomiittee to be a “Very Low Risk” hazard. Although these events are common, unless they start fires or cause floods, their consequences are usually concentrated in small areas and don't affect enough people to normally warrant a request for federal assistance.

The probability of future events for this hazard overall is high. Many if not most of Nevada's flash floods and wildfires are caused by thunderstorms throughout the State. Hailstorms are not as high a threat in the State and are generally localized.

3.3.10 Hazardous Material Events

3.3.10.1 *Nature*

Hazardous materials include thousands of substances that pose a significant risk to humans. These substances may be toxic, reactive/oxidizer, corrosive, flammable/combustible, radioactive, or explosive.

A release or spill of a hazardous material can pose a risk to any or all of the following receptors:
Human Health, Property, Environment

Incidents involving hazardous materials can result in the evacuations of a few people to entire communities, and costs associated with hazardous materials releases can easily run into millions of dollars for damages and cleanup.

Figure 3-17. Highway Map of Nevada showing major transportation routes in Nevada. *Map created using Microsoft Map Point.*

In Nevada hazardous materials fall under the category of a Hazardous Substance.

Nevada Administrative Code (NAC) 445A.3454 definition of a hazardous substance:
"Hazardous substance" includes, without limitation:

1. A contaminant as defined in NRS 445A.325;
2. A hazardous material as defined in NRS 459.7024;
3. A hazardous substance as defined in 40 C.F.R. Part 302;
4. A pollutant as defined in NRS 445A.400; and
5. A regulated substance as defined in NRS 459.448.

Nevada Revised Statutes define a Hazardous Material as any substance or combination of substances, including any hazardous material, hazardous waste, hazardous substance or marine pollutant:

1. Of a type and amount for which a vehicle transporting the substance must be placarded pursuant to 49 CFR Part 172;
2. Of a type and amount for which a uniform hazardous waste manifest is required pursuant to 40 C.F.R. Part 262; or
3. Which is transported in bulk packaging, as defined by 49 CFR § 171.8

Source: Nevada NRS and NAC as identified above.

Hazardous materials are regulated by numerous Federal, State, and local agencies including the U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), OSHA, National Fire Protection Association, FEMA, U.S. Army, International Maritime Organization, Nevada State Fire Marshals Office, Nevada State Emergency Response Commission, Nevada Division of Environmental Protection and Nevada Counties and Cities.

Applicable Federal Laws include the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, Superfund and Reauthorization Act (SARA) (amendment to CERCLA) of 1986, Resource Conservation and Recovery Act of 1976, Hazardous Materials Transportation Act (HMTA) of 1975, Occupational Safety and Health Act (OSHA) of 1970, Toxic Substances Control Act (TSCA) of 1976, Clean Air Acts of 1955-1990, Clean Water Act of 1972.

3.3.10.2 Identification of Hazards

Hazardous material releases can occur from any of the following:

- Fixed site facilities such as refineries, chemical plants, storage facilities, manufacturing facilities, warehouses, water and wastewater treatment plants, mines swimming pools, dry cleaners, automotive sales/repair sites, and gas stations.
- Highway (Figure 3-17) and rail transportation vehicles (Figure 3-18) such as tanker trucks, chemical trucks, and rail cars and tankers

The following are additional national statistics of interest compiled for the Federal Motor Carrier Safety Administration (2001):

- Hazmat shipments make up between 4 percent and 6 percent of all shipments.
- The average cost of a hazmat accident, both release and non-release, was estimated at $414,000.
- The average cost of a non-hazmat accident was estimated at $334,000.
- Class 3 shipments (flammable and combustible liquids) account for 64 percent of the en route accidents involving releases and about 52 percent of the non-release accidents.
- Class 3 and Class 8 shipments (corrosive materials) are involved in about 77 percent of all en route leaks per year.
- Class 3 and Class 8 shipments were also involved in about 84 percent of all loading and unloading incidents.

Source of statistics from "Costs of Hazmat Accidents"
http://enviro.blr.com/display.cfm/id/73049

Figure 3-18. Major railway routes in Nevada from Union Pacific Railroad website at: www.uprr.com/aboutup/usguide/nv.shtml.

- Nevada highway hazmat incidents
- Proposed nuclear transportation to Yucca Mountain
- Waste Isolation Pilot Project transportation of transuranic waste in and through Nevada
- Proposed storage of Department of Energy elemental mercury stockpile at the Hawthorne Army Base in Hawthorne Nevada.
- Air transportation such as cargo packages, also Military Air Operations
- Pipeline transportation such as liquid petroleum, natural gas, and other chemicals
- Non-terrorist-related intentional or accidental acts that result in the release of a hazardous material by private persons or groups. Examples include clandestine methamphetamine laboratories and hazardous materials released in private and public settings.
- Historic Release sites. Examples include the Sparks solvent fuel site in Washoe County, BMI Complex in Clark County, tetrachloroethylene (PCE) plumes in Washoe and Clark counties, and the Hawthorne Army Depot in Mineral County.

- ***Superfund (CERCLA/***SARA National Priority Listed Site) Carson River Mercury Site.

3.3.10.3 *History*

Hazardous material events are no longer a rare event in Nevada. See Table 3-28 and Table 3-29 for an enumeration of hazardous material event spill calls from 2000 through July 2010. This type of event should be planned for due to the amount of hazardous materials located in and shipped through the State. Additionally, the nuclear waste facility in Yucca Mountain, the transportation of transuranic waste into and through the State and the potential transportation and storage of elemental mercury are additional reasons for the State of Nevada to prepare for hazardous material events as these materials are delivered via rail and motor carrier into the State.

Table 3-28. Nevada Spill Calls By Year

Year	Total Spill Reports
2000	520
2001	447
2002	439
2003	465
2004	533
2005	639
2006	640
2007	650
2008	628
2009	487
July 2010	273
Total	**5093**

Table 3-29. Nevada Spill Calls by County

County	Spill Reports 2000-2010
CARSON CITY	159
CHURCHILL	193
CLARK	2273
DOUGLAS	167
ELKO	282
ESMERALDA	17
EUREKA	253
HUMBOLDT	249
LANDER	99
LINCOLN	39
LYON	264
MINERAL	62
NYE	276
PERSHING	54
STOREY	39

WASHOE	1001
WHITE PINE	93

The following hazardous material events occurred in the State of Nevada. These events were chosen to represent the various types of hazardous materials incidents which have occurred in Nevada. These events help illustrate the hazards Nevada may face in the future. This list is not intended to be comprehensive.

In addition, these events have been divided into two types:

Discovery events: A historic, or otherwise unobserved, release that can be inferred to have occurred based on the discovery of contaminated soil or groundwater. Reporting determinations are based on the magnitude and extent of discovered contamination, and
Contemporaneous events: A release that occurs in real-time and is observable or measurable such that a reporting determination can be made based on the volume or quantity of the hazardous substance released.
Source: http://ndep.nv.gov/bca/cem/cover.htm

Discovery Event Releases:

Carson River Mercury Site/Superfund Act Site

Mining and milling operations commenced in the Carson River drainage basin associated with Storey and Lyon Counties in approximately 1850 when placer gold deposits were discovered near Dayton at the mouth of Gold Canyon. Throughout the 1850s, mining consisted of working placer deposits for gold in Gold Canyon and Sixmile Canyon. These ore deposits became known as the Comstock Lode. Prior to 1900, the primary method of retrieving gold from ore was accomplished by amalgamating the gold with elemental mercury. Over 200 mill sites used the mercury amalgamation process during the Comstock era, which resulted in the release of mercury into the creeks, canyons and river system associated with the area. Elevated mercury levels were discovered in the Carson River in the early 1970s. The Carson River Mercury Site (CRMS) was added to the National Priority List (NPL) in August of 1990 under CERCLA (Superfund Act). The CRMS is Nevada's only NPL site under direct control of the Environmental Protection Agency (EPA). It has been estimated that as much as 15,000,000 pounds of mercury was released to the environment in the Carson River drainage.

Assessment and mitigation of specific areas within the CRMS were completed by the EPA in the late 1990s. Mercury-impacted soil above the action limit of 80 parts per million was removed in select locations from the ground surface to a depth of two feet to lower the risk of exposure to humans. New housing and business developments in moderate to high risk areas within the CRMS are responsible for assessing the mercury levels in soil prior to development. The Nevada Division of Environmental Protection (NDEP) is responsible for working with the developer to lower the risk of mercury exposure through sampling and analysis plans and mitigation, if necessary.

The Carson River Mercury Site has been divided into two Operable Units.

Operable Unit 1 is defined as the impacted areas in Storey and Lyon Counties upstream from where Sixmile Canyon enters the Carson River. Mercury-impacted soil to two feet below the ground surface was removed in six areas in the town of Dayton and one area in Silver City. The EPA and its contractors conducted soil mitigation from August 1998 to December 1999. The Operable Unit 1 cleanup dealt only with the highly impacted soils identified in and around existing residences.

Operable Unit 2 is defined as the impacted areas downstream from where Sixmile Canyon enters the Carson River, which includes the bed and banks of the Carson River to Lahontan Dam, and the area beyond Lahontan Dam extending to the Carson Sink. Studies on Operable Unit 2 are currently on-going and will include the effects of mercury impacts on the biota and ecosystem in the Carson River basin. Included in these studies are the plants, fish and birds native to Lahontan Reservoir, and migratory bird populations that pass through the area on an annual basis.

Many areas within the CRMS have yet to be characterized. EPA, in cooperation with State and local governments, require the collection of baseline environmental data prior to the development of the land. NDEP provides guidance to property owners or developers on how to conduct such an assessment. The results of these assessments allow for educated decisions to be made with regard to the need for clean-up of the site to protect future users of the property.

BMI Complex

Starting in 1941 when the federal government leased 5,000 acres of vacant desert in the southeastern part of the Las Vegas Valley in what is now Henderson to a magnesium manufacturer, the site now know as the BMI Complex was home to a number of various industrial, government and business entities primarily involved in the production of chemicals and products containing chemicals.
During the years these facilities operated, these plants produced a variety of industrial and municipal effluents that were historically disposed of on-site in unlined evaporation ponds, transported off-site via ditches, or disposed of on the land surface. A long term clean-up of the site under the direction of NDEP has been underway since 1979.

Source: http://ndep.nv.gov/bca

Central Truckee Meadows Remediation District and Clark County PCE-

In the 1980s, the United States Environmental Protection Agency (EPA) identified PCE as a possible human carcinogen and required municipal water systems nationwide to initiate systematic monitoring for PCE. Locally, the first sampling of drinking water wells in 1987 showed that five of the municipal water supply wells located in the central Truckee Meadows had PCE concentrations exceeding the drinking water quality standard. PCE was used extensively from the 1940s through the 1980s as a product in chemical manufacturing, as a cleaner/degreaser by automotive repair shops, paint shops, machine shops, and dry cleaning businesses. It was later determined that approximately 16 square miles of the Truckee Meadows ground water system is affected and other drinking water wells are threatened. In addition, in Clark County, PCE contamination has also been identified at multiple sites. Assessment and remediation of many of these sites are still in progress with oversight provided by NDEP.

Source: http://ndep.nv.gov/bca

Sparks Solvent Fuel Site

The Sparks Solvent/Fuel Site (SSFS) is a rail yard and fuel terminal tank farm located in Sparks, Nevada. Industrial activities at the site over the past century led to contamination of groundwater and soils by gasoline, solvents, diesel fuels, and other petroleum products. The rail yard was constructed in the late 1800s and has served as a major east-west thoroughfare for railroad traffic since its construction. The site has been used as a refueling and service area for Southern Pacific Railroad since about 1907 and has been a fuel storage and distribution facility since 1957. Current and past operations at the terminal include the storage, distribution, and loading of gasoline, heating oil, diesel fuels, military fuels, and fuel additives.

In mid-1987 the NDEP was informed of the presence of soil and ground water contamination at the fuel terminal tank farm located just south of Interstate 80 in Sparks, Nevada. In November 1988, petroleum hydrocarbon contamination was noted in the Helms Gravel Pit located approximately 4200 feet east of the fuel terminal. It was determined that the contamination in the gravel pit was from the terminal. In 1989, the NDEP issued an order to Santa Fe Pacific Pipeline Partners (now known as Kinder Morgan Energy Partners) to investigate contamination.

In 1991, the terminal and rail yard landowners and tenants began coordinated environmental investigations at the site through the Vista Canyon Group (VCG). Investigation of soil and groundwater at the SSFS has been ongoing since 1991. Active site-wide remediation began in 1995. Free-phase petroleum product is no longer present at the site. Currently, the primary chemicals of concern are benzene, methyl tert-butyl ether (MTBE), trichloroethylene (TCE), and PCE. From 1995 to 2009, approximately 4.8 billion gallons of groundwater have been extracted and treated on site.

Source: http://ndep.nv.gov/bca

Contemporaneous Releases

Table 3-30 below provides data on the contemporaneous HAZMAT releases recorded in Nevada since 1988.

Table 3-30. Historical HAZMAT Events in NV

Date	Location	Details and Damages
1988	Henderson	The PEPCON facility exploded due to its production of a component for rocket fuel. The explosion resulted in two deaths, 372 injuries and damage to 7,000 homes and businesses. Damages estimated at 100 million dollars.
May 1988	Las Vegas	Union Pacific Railroad Company found a leak from a tank car filled with sulfuric acid from the Kennecott Corporation in Garfield, Utah. Due to this incident, Union Pacific incorporated a hazmat reporting structure for their officers and employees.
May	Henderson	A massive leak of liquefied chlorine at Pioneer Chlor-Alkali

Table 3-30. Historical HAZMAT Events in NV

Date	Location	Details and Damages
1991		Company created a cloud of poisonous gas over the city of Henderson, Nevada. Over 200 persons were examined at a local hospital for respiratory distress caused by inhalation of the chlorine and approximately 30 were admitted for treatment. Approximately 700 individuals were taken to shelters. It is estimated that from 2,000 to 7,000 individuals were taken elsewhere.
January 1998	Kean Canyon 10 miles east of Reno	January 7, 1998, two massive explosions just seconds apart destroyed the Sierra Chemical Company's Kean Canyon explosives manufacturing plant ten miles east of Reno, Washoe County, Nevada, killing four workers and injuring six others See U.S. Chemical & Safety Hazard Investigation Board report on Sierra Chemical Company explosion at http://www.csb.gov/completed_investigations/docs/CSB_Sierra.pdf …
July 2000	Dayton	An explosion of hydrogen trifluoride gas seriously damaged an industrial plant in Dayton, Lyon County, Nevada.
April 2002	Interstate 80 at the California and Nevada Border	A twenty-one car pileup on I-80 at Union Mills Grade just east of the California Highway Patrol scales. Six big rigs were involved spreading metal debris, gas, and furniture across both lanes of eastbound I-80 traffic.
January 2004	Fernley	An evacuation of Fernley's Nevada Pacific Industrial Park, in Lyon County, due to a strange vapor emanating from a disposal bin. The smoke-like vapor was found nontoxic; however, PSC chemicals recycles and sold liquid acid, alkaline, cyanide, and battery waste. This could have been a dangerous situation.
January 2004	Gardnerville	Pau Wa Lu Middle School. Student brought approximately one pound of elemental mercury to the school and shared it with his classmates. 60 students were decontaminated and the School was closed for 14 days while a cleanup was conducted.
June 2004	Interstate 80 California/Nevada	June 2004: Tractor trailer veers off road five miles east of Truckee, California. The cab of the tractor-trailer engulfed in flames killing the driver and passenger. The trailer portion ruptured, spilling insulating material along the interstate. While this event occurred outside of Nevada's border, it posed a threat to Nevada due to the location of the highway adjacent to the Truckee River. This river is a major supplier of Washoe County's water supply.
February 2006	Southern Nevada Transportation Corridors	A tanker transporting 4,500 of wastewater from the San Onofre Power Plant leaked while en route to the disposal site in Utah. This particular tanker's route was through Las Vegas, Nevada. According to the driver, he was unaware of the leak until he stopped at Parowan, Utah.
February 2007:	Fernley	A mobile methamphetamine (meth) lab in a suitcase was found off the side of the road in Fernley. There was no danger to the homes 100 to 150 yards away. The DEA hazmat team disposed of the suitcase and its contents. Clandestine drug labs producing mostly methamphetamine continue to be discovered in locations

Table 3-30. Historical HAZMAT Events in NV

Date	Location	Details and Damages
		throughout Nevada. These labs have been found in everything from a suitcase (as described above) to homes in upscale neighborhoods and hotel rooms. The chemicals used in the production of meth can be toxic, flammable/explosive and corrosive. These chemicals pose a risk to people and property both during production and even after the lab has been vacated due to chemical residues and discarded waste products.
April 2007	Carson City	The Carson City Fire, Sheriff Office and the Quad County Hazmat Team responded to All Metals Plating facility for the report of an orange gas cloud coming from the facility. A chemical mixing mistake caused a chemical reaction occurred that produced an orange plume of acid vapors that migrated out of the facility. The Plating Shop and adjacent businesses to were evacuated. One employee from the Plating Shop was taken to the Hospital for possible exposure to the vapors. NDEP and EPA Region 9 mobilized to the incident to provide assistance to the Incident Commander. The Quad-County Haz Mat Team set up a decontamination corridor and performed an entry into the Plating Shop to collect a sample of the waste mixture to be able to identify the substances involved. An Environmental contractor worked with the responders to stabilize the hazardous waste for disposal.
August: 2007	Las Vegas	A Rail Tanker containing chlorine gas escaped from the Arden Train Yard outside of Las Vegas. Reaching a speed of approximately 50 mph the tanker traveled through populated areas of Las Vegas and North Las Vegas. No release occurred. However, this incident outlines the danger involved in the transport of an extremely hazardous material through a metropolitan area.
October, 2007	Reno/Sparks	Breach in the high pressure fuel pipeline, 35'X100' impact area with puddles of Jet-A fuel reported. Site is 1,000 feet from the Truckee River. Estimated release amount was 500 gallons.
January 2008	Fernley	On January 5 a canal bank gave way flooding a residential portion of the City of Fernley. Local, State and Federal Disasters were declared. Potentially damaged household hazardous material was identified as a potential threat to the community. NDEP, EPA Region IX, the United States Coast Guard and FEMA cooperated to hold a household hazardous Waste collection event for the flood impacted residents.
August, 2009	Douglas County	On August 19-20, 2009- South east shore of Lake Tahoe. NDEP mobilized to a report of a Contractor setting blasting charges in boulders in the lake without a blasting permit. Tahoe Douglas Bomb Squad and Fire Department personnel deemed the situation “unsecure” due to safety reasons to be left over night. With permission from the property manager the charges were detonated. The charges were detonated inside a “substantial”

Table 3-30. Historical HAZMAT Events in NV

Date	Location	Details and Damages
		boulder breakwater area. The Tahoe Regional Planning Agency and the Tahoe Douglas Fire Department provided follow up actions.
June and July 2010	Elko County	Elko County-Two tanker truck accidents. June, 2010-A tanker truck driver turned too tight around a locomotive, the tanker was breached in the middle and 3,500-4,000 of diesel was released to the ground. July, 2010- a two trailer tanker truck rear tank trailer overturned, caught fire and exploded on Highway 93 causing the closure of the Highway. Approximately 4,500 gallons of gasoline was released to the soil.

Table 3-31 below provides the HAZMAT incidents from 2007-2009 on Nevada highways as recorded by NDOT.

Table 3-31. Nevada Highway HAZMAT Incidents from 2007 to 2009

Crash Date	County	Primary Street Name	Hazmat Release
24-Oct-2007	CHURCHILL	SOUTH TAYLOR ST	
22-Feb-2007	CLARK	FLAMINGO RD	
9-Mar-2007	CLARK	IR15N	
5-Jan-2007	LANDER	IR80	
8-Jan-2007	EUREKA	FR403	
24-Jan-2007	LANDER	INTERSTATE 80	
24-Jan-2007	ELKO	IR 80 136 MILES WEST OF WENDOVER	
5-Feb-2007	HUMBOLDT	INTERSTATE 80	
23-Feb-2007	CLARK	STATE ROUTE 160	
8-Apr-2007	CLARK	SR604	
12-Apr-2007	ELKO	SR535	
27-Apr-2007	CLARK	CRAIG	
10-May-2007	CLARK	I15	
12-May-2007	CLARK	US95JONES INTERCHANGE RAMP3	
12-Jul-2007	CLARK	IR15	
5-Aug-2007	ELKO	IR 80	
8-Aug-2007	LYON	US95A	Y
26-Aug-2007	WASHOE	IR 80	
30-Aug-2007	EUREKA	IR80	
27-Sep-2007	ELKO	SR225	

Table 3-31. Nevada Highway HAZMAT Incidents from 2007 to 2009

Crash Date	County	Primary Street Name	Hazmat Release
28-Sep-2007	WASHOE	US 395	Y
6-Oct-2007	LANDER	SR806	
9-Oct-2007	CLARK	IR15SILVERADO RANCH BLVD INTERCHANGE RAMP 2	
9-Oct-2007	HUMBOLDT	IR80	
12-Oct-2007	HUMBOLDT	I80	
24-Oct-2007	NYE	US 6	
2-Nov-2007	NYE	SR379	Y
5-Nov-2007	CLARK	IR15	
29-Nov-2007	CHURCHILL	US 95	
11-Dec-2007	LANDER	STATE ROUTE 305	
14-Dec-2007	WHITE PINE	US6	
17-Dec-2007	CLARK	SR160	
28-Dec-2007	CLARK	INTERSATE 15	Y
4-Nov-2007	CLARK	FLYING J 1000 WEST CHEYENNE	
6-Jul-2007	CLARK	DECATUR	
26-Feb-2007	CLARK	CHEYENNE	
29-Jan-2008	CLARK	LAS VEGAS BLVD	
12-Apr-2008	CLARK	SPRING MOUNTAIN RD	
1-Aug-2008	CLARK	NELLIS BLVD	
26-Sep-2008	CLARK	HIGHLAND DR	
9-Dec-2008	CLARK	NELLIS BLVD	
19-Dec-2008	CLARK	SILVERADO RANCH BLVD	
3-Jan-2008	WASHOE	IR580	
4-Jan-2008	PERSHING	INTERSTATE 80	
5-Jan-2008	WASHOE	IR80 WB W OF PATRICK	Y
30-Jan-2008	CLARK	SOUTHBOUND US95	
7-Feb-2008	CLARK	US95	
22-Feb-2008	CLARK	IR15	
26-Feb-2008	WHITE PINE	US6	
28-Feb-2008	WASHOE	US395	
2-Mar-2008	NYE	US95	
7-Mar-2008	WASHOE	I80	
13-Mar-2008	ELKO	US93A	Y
20-Mar-2008	WASHOE	US395	
26-Mar-2008	CLARK	IR15	
8-May-2008	DOUGLAS	US 395	
22-Jun-2008	WHITE PINE	US 6	

Table 3-31. Nevada Highway HAZMAT Incidents from 2007 to 2009

Crash Date	County	Primary Street Name	Hazmat Release
23-Jun-2008	CLARK	US95	
2-Aug-2008	CLARK	CHARLESTON AVE	
4-Aug-2008	WASHOE	IR80	
5-Aug-2008	WASHOE	I80 EASTBOUND SPARKS ON RAMP	Y
13-Aug-2008	NYE	US95	
16-Aug-2008	WASHOE	IR80	
21-Aug-2008	CLARK	US95	
4-Sep-2008	LYON	US50A	Y
10-Sep-2008	CLARK	IR15SR160 INTERCHANGE RAMP 3	
16-Sep-2008	WASHOE	IR580MOANA OFF RAMP	
23-Sep-2008	EUREKA	IR80	
9-Oct-2008	EUREKA	SR278	
19-Oct-2008	CLARK	I15	
22-Oct-2008	EUREKA	I80	
8-Nov-2008	PERSHING	IR 80	
24-Nov-2008	CLARK	US95	
2-Dec-2008	CLARK	I15	
22-Dec-2008	ELKO	IR80	Y
7-May-2008	CLARK	CAREY	
16-May-2008	CLARK	LOSEE RD	
22-Sep-2008	CLARK	LAKE MEAD BLVD	Y
24-Mar-2008	CLARK	LAS VEGAS BLVD	
9-Apr-2008	CLARK	EL CAMPO GRANDE AVE	
12-Aug-2008	WASHOE	LEMMON DR	Y
5-Jan-2009	CLARK	CAMBRIDGE ST	
8-Jan-2009	CLARK	SUNSET RD	
25-Feb-2009	CLARK	CHARLESTON BLVD	
26-Feb-2009	CLARK	WYOMING AVE	
6-Mar-2009	CLARK	WARM SPRINGS RD	
17-Mar-2009	CLARK	SMOKE RANCH RD	
18-Mar-2009	CLARK	CHRISTY LN	
8-Apr-2009	CLARK	RAINBOW BLVD	
14-May-2009	CLARK	LAS VEGAS BLVD	
19-May-2009	CLARK	CHARLESTON BLVD	
24-May-2009	CLARK	WYNN RD	
14-Jun-2009	CLARK	RUSSELL RD	Y
3-Jul-2009	CLARK	LAS VEGAS BLVD	

Table 3-31. Nevada Highway HAZMAT Incidents from 2007 to 2009

Crash Date	County	Primary Street Name	Hazmat Release
12-Jul-2009	CLARK	DESERT INN RD	
20-Jul-2009	CLARK	EASTERN AVE	
25-Jul-2009	CLARK	KOVAL LN	
26-Aug-2009	CLARK	MARION DR	
1-Sep-2009	CLARK	KAREN AVE	
24-Nov-2009	CLARK	RAINBOW BLVD	
3-Jan-2009	CLARK	US95	
12-Jan-2009	CLARK	US95	
16-Jan-2009	EUREKA	SR766	
26-Jan-2009	CLARK	CHARLESTON BLVD	
7-Feb-2009	MINERAL	SR360	
7-Feb-2009	CLARK	I 15	Y
8-Feb-2009	CLARK	ANN RD	
9-Feb-2009	CLARK	US95 SOUTH	
16-Feb-2009	CLARK	I-15	Y
21-Feb-2009	PERSHING	IR80	
10-Mar-2009	CLARK	US95 / MARTIN LUTHER KING SOUTHBOUND ONRAMP	
11-Mar-2009	CLARK	IR 15	Y
29-Mar-2009	CLARK	IR15	
31-Mar-2009	CLARK	CR215	
5-Apr-2009	WASHOE	IR580	
6-Apr-2009	CLARK	US95	
22-Apr-2009	CLARK	IR 15	
25-Apr-2009	NYE	US 6 NYE	
9-May-2009	CLARK	Interstate Route 15 (IR 15)	
9-May-2009	CLARK	MLK	
12-May-2009	HUMBOLDT	i-80	
13-May-2009	CLARK	IR215	
20-May-2009	LYON	US50	
27-May-2009	CLARK	I15	
3-Jun-2009	CLARK	N/B USS95-LAS VEGAS (SR604) ON RAMP	
8-Jun-2009	WASHOE	Bi-State Propane, Sparks NV	
13-Jun-2009	WASHOE	IR-80	
14-Jun-2009	CLARK	US95 LAKE MEAD OFFRAMP	
26-Jun-2009	WHITE PINE	US 50	Y
28-Jun-2009	NYE	US6	

Table 3-31. Nevada Highway HAZMAT Incidents from 2007 to 2009

Crash Date	County	Primary Street Name	Hazmat Release
30-Jun-2009	CLARK	US95	
7-Jul-2009	CLARK	IR 15	
14-Jul-2009	PERSHING	IR80	
20-Jul-2009	CLARK	US95	Y
21-Jul-2009	CLARK	us 95	Y
31-Jul-2009	LYON	US95 ALTERNATE	
31-Jul-2009	CLARK	EASTERN AVE	
4-Aug-2009	NYE	BUNKER 2 ROAD	Y
17-Aug-2009	WASHOE	IR80	
19-Aug-2009	ELKO	I 80 W	
25-Aug-2009	WASHOE	IR80	
30-Aug-2009	WASHOE	US395	
31-Aug-2009	ELKO	IR80	
1-Sep-2009	ELKO	US93	
2-Sep-2009	ELKO	IR80	
10-Sep-2009	WASHOE	IR80	
23-Sep-2009	ELKO	IR80	
8-Oct-2009	NYE	SR-160	
12-Oct-2009	CLARK	IR 15	
16-Oct-2009	ELKO	US93 ALTERNATE	
20-Oct-2009	CLARK	IR 15	Y
21-Oct-2009	CLARK	IR 15	
12-Nov-2009	CLARK	US95	
13-Nov-2009	CLARK	US95 SOUTHBOUND/CHARLESTON ON RAMP	
28-Nov-2009	NYE	US 6	Y
Source: NDOT			

3.3.10.4 Location, Severity, and Probability of Future Events

The probability of future events for this category is considered high for a variety of reasons:

1) As previously mentioned, the U.S. Environmental Protection placed the Carson River on the Superfund National Priority List. As of July 2010 the Carson River Mercury Site is the only site in Nevada under this listing. Mitigation of this site and other “Historic” release sites are often complex and may take many years to complete. In addition, due to historic hazardous materials practices prior to Federal, State and Local regulations and ordinances, future “Discovery” events in Nevada are probable.

2) The use of State routes and Rail routes and to transport hazardous materials cannot be avoided. The Waste Isolation Pilot Program (WIPP) transports transuranic waste through Nevada highway corridors en route to other locations in the country In addition, the Nevada Test site located in Nye County has received a total of 48 shipments at the Nevada Test Site according to the Department of Energy website, www.wipp.energy.gov/shipments.htm .

3) Air transportation of hazardous materials across Nevada cannot be avoided.

4) Approximately 84% of the territory in Nevada is Federally owned. Federal land stewardship can present a challenge to the enforcement of state and local laws.

5) Natural hazards like earthquakes and flooding are unpredictable and may not only cause a release of a hazardous substance, but could severely complicate response activities.

6) Terrorist acts present an unpredictable threat and could be especially catastrophic due to the locations of facilities that store, transport or manufacture a hazardous substance.

7) The specific hazard posed to water supplies for the two major population centers, Reno-Sparks (Truckee River) and Las Vegas (Colorado River-Lake Mead) by possible hazardous materials contamination which might actually originate out of state in California for the Truckee, Carson and Walker Rivers, and out of Arizona for the Colorado River.

8) Hazardous materials releases at natural resource sites. The minerals industry is important in hazardous materials transportation, production and use in Nevada. As of 2009, the University of Nevada Reno, Bureau of Mines and Geology reported 118 active mines, 15 oil fields and 12 geothermal plants statewide.

Source: http://www.nbmg.unr.edu/dox/e49.pdf or http://www.nbmg.unr.edu/dox/mi/05.pdf

9) The volume of hazardous substances stored and manufactured in Nevada communities along with the transport of these substances in, and through the State, are factors that help determine the potential release and community exposure to these substances. These factors are variable and make the probability of future releases difficult to predict. However, Facilities that store, manufacture and transport hazardous substances are likely to increase in coming years as the population of the State increases and more businesses locate to Nevada. Therefore, the potential of a release of hazardous materials is likely to increase.

Local Hazard Mitigation Plans:

The Hazardous Materials portions of Local Hazard Mitigation Plans were reviewed for various counties in Nevada. The plans reviewed include those for Carson City, Churchill, Clark, Douglas, Elko, Esmeralda, Lincoln, Nye, Storey and Washoe counties.

Common concerns for hazardous materials events exist within the local plans: The plans relate continuing concerns for transportation accidents involving hazardous materials on transportation corridors, fuel pipeline leaks, and accidental releases at fixed facilities that store and manufacture highly hazardous and extremely hazardous substances.

In addition, the plans mentioned concerns of releases of hazardous materials due to earthquakes and terrorism. Earthquakes of significant magnitude in Nevada are likely to occur in the future. Hazardous materials releases due to terrorism were identified as a major threat by some counties due to the location of the hazardous materials facilities, transport routes and the frequently limited antiterrorism security at these facilities. Table 3-32 lists the number of facilities at risk for HHS or EHS materials events in each county. Areas identified most at risk for HHS and EHS materials events are within a one-mile radius of the facility or transportation corridor.

Table 3-32. Facilities at Risk for HHS or EHS Materials Events

County	EPCRA* & SFM* Facilities	Chemical Accident Prevention Program (CAPP) Facilities
CARSON CITY	281	1
CHURCHILL	137	5
CLARK	2567	23
DOUGLAS	180	1
ELKO	310	1
ESMERALDA	10	1
EUREKA	40	0
HUMBOLDT	152	2
LANDER	77	2
LINCOLN	46	0
LYON	239	2
MINERAL	38	1
NYE	148	1
PERSHING	41	0
STOREY	56	2
WASHOE	1498	7
WHITE PINE	69	0
Total	**5823**	**49**

*Emergency Planning & Community Right-to-Know Act (*EPCRA*) State Fire Marshal (SFM)
Source: Nevada SERC Web Site July, 2010

Hazardous materials events are considered as hazards in a “special risk category.” The rating for hazardous materials acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in the table below.

Table 3-33. Hazardous Materials
Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County				X
Douglas County				X
Elko Band			X	
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County		X		
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County			X	
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County		X		
Washoe County			X	
Washoe Tribe		X		
White Pine				X

3.3.10.5 Current Hazardous Materials Release Mitigation Efforts

Unless exempted, facilities that use, manufacture, or store hazardous materials in the United States fall under the regulatory requirements of the Emergency Planning and Community Right to Know Act (EPCRA) of 1986, enacted as Title III of the Federal Superfund Amendments and Reauthorization Act (42 USC 11001-11040; 1988). Under EPCRA regulations, hazardous materials that pose the greatest risk for causing catastrophic emergencies are identified as Extremely Hazardous Substances (EHS). These chemicals are identified by the EPA in the *List of Lists – Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112 of the Clean Air Act.*

Releases of EHS can occur during transport to and from fixed site facilities.

Transportation-related releases are generally more troublesome because they may occur anywhere, including close to human populations, critical facilities, or sensitive environmental areas. Transportation-related EHS releases are also more difficult to mitigate due to the variability of locations and distance from response resources.

In addition to accidental human-caused hazardous material events, natural hazards may cause the release of hazardous materials and complicate response activities. The impact of earthquakes on fixed facilities may be particularly serious due to the impairment or failure of the physical integrity of containment facilities. The threat of any hazardous material event may be magnified due to restricted access, reduced fire suppression and spill containment, and even complete cut-off of response personnel and equipment. In addition, the risk of terrorism involving hazardous materials is considered a major threat due to the location of hazardous material facilities and transport routes throughout communities.

On behalf of several Federal agencies including the EPA and DOT, the National Response Center (NRC) serves as the point of contact for reporting oil, chemical, radiological, biological, and etiological discharges into the environment within the United States.

In Nevada, the Department of Conservation and Natural Resources, Division of Environmental Protection (NDEP), the State Fire Marshal's Office and the State Emergency Response Commission (SERC) share responsibility for regulating hazardous materials. The State Fire Marshal and the SERC have a combined data base storing data about fixed facilities with hazardous materials meeting: a) the most current International Fire Code, and/or b) the EPCRA requirements. The total number of permitted/reported fixed facilities in Nevada is 4,457. The EPCRA facilities with highly hazardous/extremely hazardous substances total 1,242. Fees are imposed on EPCRA fixed facilities for planning, training and equipment of first responders. The funding is managed by the SERC who provides grants to the local emergency planning committees (LEPCs). Each LEPC develops and annually reviews a hazardous materials response plan and provides updates. The plans and updates are reviewed by the SERC's standing Planning and Training Subcommittee every year. This plan must be approved in order to receive operating funds and grants from SERC. NDEP is the responsible state agency for the maintenance of the State Hazardous Materials Response Plan as well as for the response to hazardous materials spills.

The Nevada Division of Environmental Protection (NDEP) operates and maintains a 24 hour Spill Reporting Hot Line. Hundreds of calls are received every year. Most of the reports received are routine in nature and are addressed during business hours by the appropriate oversight agency. Reports of releases requiring more immediate action are referred to an Environmental Assistance Coordinator who can provide technical information to responders and represent the State on-scene, when necessary. Clean up oversight of chemical-impacted sites are handled by NDEP Case Officers.

In addition, NDEP oversees the Chemical Accident Prevention Plan (CAPP). CAPP applies in facilities that have select, highly hazardous substances in quantities above defined thresholds. These highly hazardous substances are distinguished from numerous other agency-regulated substances in that they will cause acute health impacts, that is, serious heath impacts from a relatively short-term, low concentration exposure.

CAPP is a proactive program in that it stresses hazard identification and accident prevention. The intent is to predict what could possibly go wrong and take appropriate measures to minimize the possibility of an accident occurring.

CAPP requirements fall into one of three categories: accident prevention, emergency response or public right-to-know. Through the accident prevention program, facilities are required to: evaluate and mitigate hazards, understand the design parameters of their processes and operate within the appropriate design limits, prepare comprehensive operating procedures, thoroughly train operators in those procedures and maintain the facility equipment and instruments to prevent premature failure.

Through the emergency response program, facilities are required to develop an action plan for dealing with potential emergency situations and they are further required to coordinate emergency response activities with local responders, to ensure that the responders are prepared to deal with the emergencies appropriately. Through the public right-to-know aspect of CAPP, all information disseminated by the facilities is available to the public, as are all site inspection reports generated by CAPP staff.

Also, NDEP was the lead in developing the Carson River Geographic Response Plan (CRGRP), and a contributing partner in developing the Truckee River, Walker River and the Lake Tahoe Geographic Response Plans. In addition, NDEP is currently working on developing the Lower Colorado River Geographic Response Plan. Each of these response plans is developed through a collaborative effort between the local, State, Tribal and Federal government agencies. The Geographic Response Plans mentioned above cover portions of the States of Arizona, California, Nevada and their associated counties which border the surface water resource.

Additional opportunities for the mitigation for hazardous materials:

Brownfields Program:
Brownfields are real property that may be complicated by the presence of hazardous substances, pollutants, or contaminants, yet such properties may be eligible for redevelopment and reuse. The Nevada Brownfields Program currently operates a $2 million dollar revolving loan fund intended to help property owners or developers cover the costs associated with the cleanup of sites with environmental contamination. Secured loans can be provided at below-market rates and with flexible repayment options at those sites, which are undergoing cleanup, under the State's "corrective action" regulations.

Federal Brownfields Funding:
Like the state's Targeted Site Assessment program, US EPA Region IX may provide assessment services with their federal monies for Brownfields projects in the State of Nevada.

Nevada Petroleum Fund:
The Petroleum Fund was initially implemented in 1989 by state legislation to assist owners and operators of regulated underground storage tanks in meeting the federal

requirement for financial responsibility pursuant to Code of Federal Regulations (CFR) 40 CFR 280.90 through 280.99.

The Fund also allows voluntary enrollment of non-regulated petroleum storage tanks and automatically covers releases from residential heating oil tanks. The Fund provides reimbursement to the qualified storage tank owner/operators for corrective action costs associated with cleaning up petroleum product releases.

Nevada Voluntary Cleanup Program

This program provides relief from liability to owners who undertake cleanups of contaminated properties under the oversight of the NDEP. Sites requiring cleanup are usually identified through property transfer assessments or reports of contamination from the owners of a property or the general public. The owners of the property are required to remediate the property to State cleanup standards until the State determines that no further action will be required. The no further action determination does not, however, provide the owner of the property any legal relief from liability regarding environmental issues which may arise as a result of site conditions discovered in the future.

The VCP law was passed to provide a means of giving permanent relief of liability to owners of property where a cleanup is conducted under the oversight of NDEP staff.

3.3.11 **Infestations** (Very Low Risk)

3.3.11.1 Nature

An "invasive species" is defined as a species that is:

1) non-native (or alien) to the ecosystem under consideration and
2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Invasive species can be plants, animals (including aquatic species) and other organisms (e.g., microbes). Source: United States Dept. of Agriculture, National Agriculture Library (10/5/2007)

Infestations impact Nevada's economy through the destruction of crops and natural resources which also impacts tourism. Some of the plant infestations are highly flammable and assist in the spread of wildfires. Human actions are the primary means of introduction and spread of invasive species.

3.3.11.2 *History*

The Nevada Department of Agriculture monitors the introduction and spread of noxious weeds in the state. They have developed a categorization scheme for control of noxious weeds with Category “C” being the most widespread and subject to active eradication. Below is the Nevada Department of Agriculture’s Nevada Noxious Weed List as designated by application of NRS 555.

NEVADA NOXIOUS WEED LIST

NRS 555.130 Designation of noxious weeds. The State Quarantine Officer may declare by regulation the weeds of the state that are noxious weeds, but a weed must not be designated as noxious which is already introduced and established in the State to such an extent as to make its control or eradication impracticable in the judgment of the State Quarantine Officer.

NAC 555.010 Designation and categorization of noxious weeds. (NRS 555.130)

The plants listed below are designated noxious weeds and categorized as follows:

- **Category A weeds** are generally not found in or limited in distribution throughout the State. Such weeds are subject to active exclusion from the State and active eradication wherever found and active eradication from the premises of a dealer of nursery stock.
- **Category B weeds** are generally established in scattered populations in some counties of the State. Such weeds are subject to active exclusion where possible and active eradication from the premises of a dealer of nursery stock.
- **Category C weeds** are generally established and widespread in many counties of the State and are subject to active eradication from the premises of a dealer of nursery stock.

Table 3-34. Noxious Weeds

Category A Weeds:			
African rue	(*Peganum harmala*)	Iberian starthistle	(*Centaurea iberica*)
Austrian fieldcress	(*Rorippa austriaca*)	Malta starthistle	(*Centaurea melitensis*)
Black henbane	(*Hyoscyamus niger*)	Mayweed chamomile	(*Anthemis cotula*)
Camelthorn	(*Alhagi pseudalhagi*)	Mediterranean sage	(*Salvia aethiopis*)
Common crupina	(*Crupina vulgaris*)	Perennial sowthistle	(*Sonchus arvensis*)
Common St. Johnswort Crimson fountain grass	(*Hypericum perforatum*) (*Pennisetum setaceum*)	Purple loosestrife	(*Lythrum salicaria, L. virgatum* & cultivars)
Dalmatian toadflax	(*Linaria dalmatica*)	Purple starthistle	(*Centaurea calcitrapa*)
Dyer's woad	(*Isatis tinctoria*)	Rush skeletonweed	(*Chondrilla juncea*)
Eurasian watermilfoil	(*Myriophyllum spicatum*)	Spotted knapweed	(*Centaurea maculosa*)
Giant reed	(*Arundo donax*)	Squarrose knapweed	(*Centaurea virgata*)
Giant salvinia	(*Salvinia molesta*)	Sulfur cinquefoil	(*Potentilla recta*)
Goatsrue	(*Galega officinalis*)	Swainsonpea	(*Sphaerophysa salsula*)
Houndstongue	(*Cynoglossum officinale*)	Syrian beancaper	(*Zygophyllum fabago*)
Hydrilla	(*Hydrilla verticillata*)	Yellow starthistle	(*Centaurea solstitialis*)
		Yellow toadflax	(*Linaria vulgaris*)

Category B Weeds:			**Category C Weeds:**	
African mustard	(*Brassica tournefortii*)		Canada thistle	(*Cirsium arvense*)
Diffuse knapweed	(*Centaurea diffusa*)		Hoary cress	(*Cardaria draba*)
Horsenettle	(*Solanum*		Johnsongrass	(*Sorghum*

	carolinense)			*halepense*)
Leafy spurge	(*Euphorbia esula*)		Perennial pepperweed	(*Lepidium latifolium*)
Medusahead	(*Taeniatherum caput-medusae*)		Poison-hemlock	(*Conium maculatum*)
Musk thistle	(*Carduus nutans*)		Puncturevine	(*Tribulus terrestris*)
Russian knapweed	(*Acroptilon repens*)		Salt cedar (tamarisk)	(*Tamarix* spp.)
Scotch thistle	(*Onopordum acanthium*)		Spotted water hemlock	(*Cicuta maculata*)
Silverleaf nightshade	(*Solanum elaeagnifolium*)			

Other invasive plants that are too widely distributed in Nevada to be included in the noxious weed list but present problems in Nevada are listed below:

- *Bromus tectorum* L. or *Cheatgrass* is an annual grass that forms tufts up to 2 feet tall. The leaves and sheathes are covered in short soft hairs. The flowers occur as drooping, open, terminal clusters that can have a greenish, red, or purple hue. These annual plants will germinate in fall or spring (fall is more common) and senescence usually occurs in summer. Cheatgrass invades rangelands, pastures, prairies, and other open areas. Cheatgrass has the potential to completely alter the ecosystems it invades. It can completely replace native vegetation and change fire regimes. It occurs throughout the United States and Canada, but is most problematic in areas of the western United States with lower precipitation levels such as Nevada. Cheatgrass is native to Europe and parts of Africa and Asia. It was first introduced into the United States accidentally in the mid 1800s.

- *Bromus rubens L*. or *Red brome:* In the North American region red brome is reported to be invasive because it faces low herbaceous competition. Once established, it has the potential to compete with other grasses. The accumulation of litter and necromass has the potential to increase fire frequency in the desert. Red brome-fueled fires result in the loss of native perennial species in invaded areas, resulting in disturbed areas that are ideal for increased growth of red brome.

Animal infestations - Insects

The following is a list of invasive insect species infestations currently affecting Nevada:

- *Africanized honey bees:* Imported and bred with European honey bees to increase honey production in South America. The Africanized honey bees are more aggressive than European honeybees with a negative impact on the honey production industry.
- *Scolytus schevyrewi or Bark Beetle* came from Asia. It was first collected in insect traps in Aurora Colorado. The beetle infests and breeds in elm trees stressed by drought.
- *Solenopsis Invicta or Fire Ants:* About 1930, the light fire ant was introduced from South America into the Mobile area, and has since spread to its current range. The ants nest in the soil of open areas, pastures and agronomic fields, but are found occasionally in wooded areas. Mounds are generally dome-shaped in contrast to those of other fire ant species, and the sting, characterized by an intense burning sensation, is more severe. A pustule (not seen in the sting of other species) is formed at the sting site in a day or so, which may become infected. Sensitive individuals can swell up as a result of stings and occasionally die. The ants have a serious impact on agriculture since the hardened mounds interfere with the mechanical cultivation of fields and the ants' painful stings interfere with livestock grazing and the harvesting of crops by farm workers.

Figure 3-19. Fire ant attacking larva. Photo courtesy of USDA/ARS

Mormon crickets are flightless, ground dwelling insects native to the western United States. They eat native, herbaceous perennials (forbs), grasses, shrubs, and cultivated forage crops, reducing feed for grazing wildlife and livestock. In large numbers, their feeding can contribute to soil erosion, poor water quality, nutrient depleted soils, and potentially cause damage to range and cropland ecosystems. Drought encourages Mormon cricket outbreaks, which may last several years (historically 5 to 21 years) and cause substantial economic losses to rangeland, cropland, and home gardens.

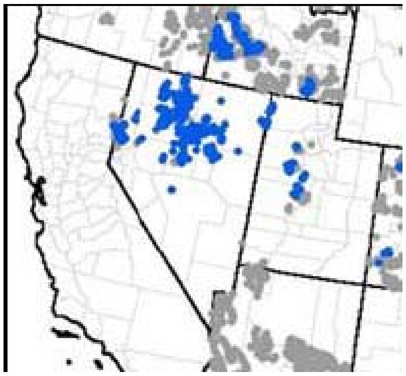


Figure 3-20. Regional Distribution of Mormon Crickets, August 2005

(blue = high density, gray =low density)

Source: University of Nevada, Cooperative Extension – Identification and Management of Mormon Crickets fact sheet 06-16

Animal infestations – aquatic species

Aquatic species that have become a particular concern in Nevada in recent years are: zebra mussels, quagga mussels, Asian clams, and New Zealand mud snails.

Zebra mussels were first found at Lake Mead in 2004 and quagga mussels were found there in 2007. Since that time, the population has exploded, now numbering in the trillions. Both mussels are nuisance invasive species that reproducing quickly and in large numbers. They are biofoulers that obstruct pipes in municipal and industrial raw-water systems, requiring millions of dollars annually to maintain. They produce microscopic larvae that float freely in the water column, and thus can pass by screens installed to exclude them. Monitoring and control of these mussels cost millions of dollars annually. As filter feeders, zebra and quagga mussels remove suspended material from the habitat in which they live. This includes the planktonic algae that are the primary base of the food web. Thus these mussels may completely alter the ecology of water bodies in which they invade. As yet no quagga or zebra mussels have been found in Lake Tahoe or any other northern Nevada lakes and reservoirs but zebra mussels have been found in a northern California reservoir southeast of San Francisco, and a UNR reaearcher has determined that Lake Tahoe water can support these species. Proactive measures are being taken by a number of groups to prevent the spread of these species into Lake Tahoe and the Truckee watershed.

For the past two years the Tahoe Resource Conservation District's invasive species program has included a boat inspection effort in the Tahoe Basin to prevent the introduction of quagga and zebra mussels into the area.

The Truckee Meadows Water Authority is funding a new program with more than $231,000 from the Truckee River Fund, money collected from utility bills to pay for projects and protect the Truckee River. In spring 2010 the program efforts will include monitoring lakes and reservoirs within the Truckee River system for the presence of adult or juvenile mussels. A program to inspect boats launching into at least one lake, such as Boca Reservoir, should also begin this spring and will later be expanded.

The Asian clam is a relatively new aquatic invasive species that is becoming established in Lake Tahoe. Asian clams can impact Lake Tahoe's environment by:

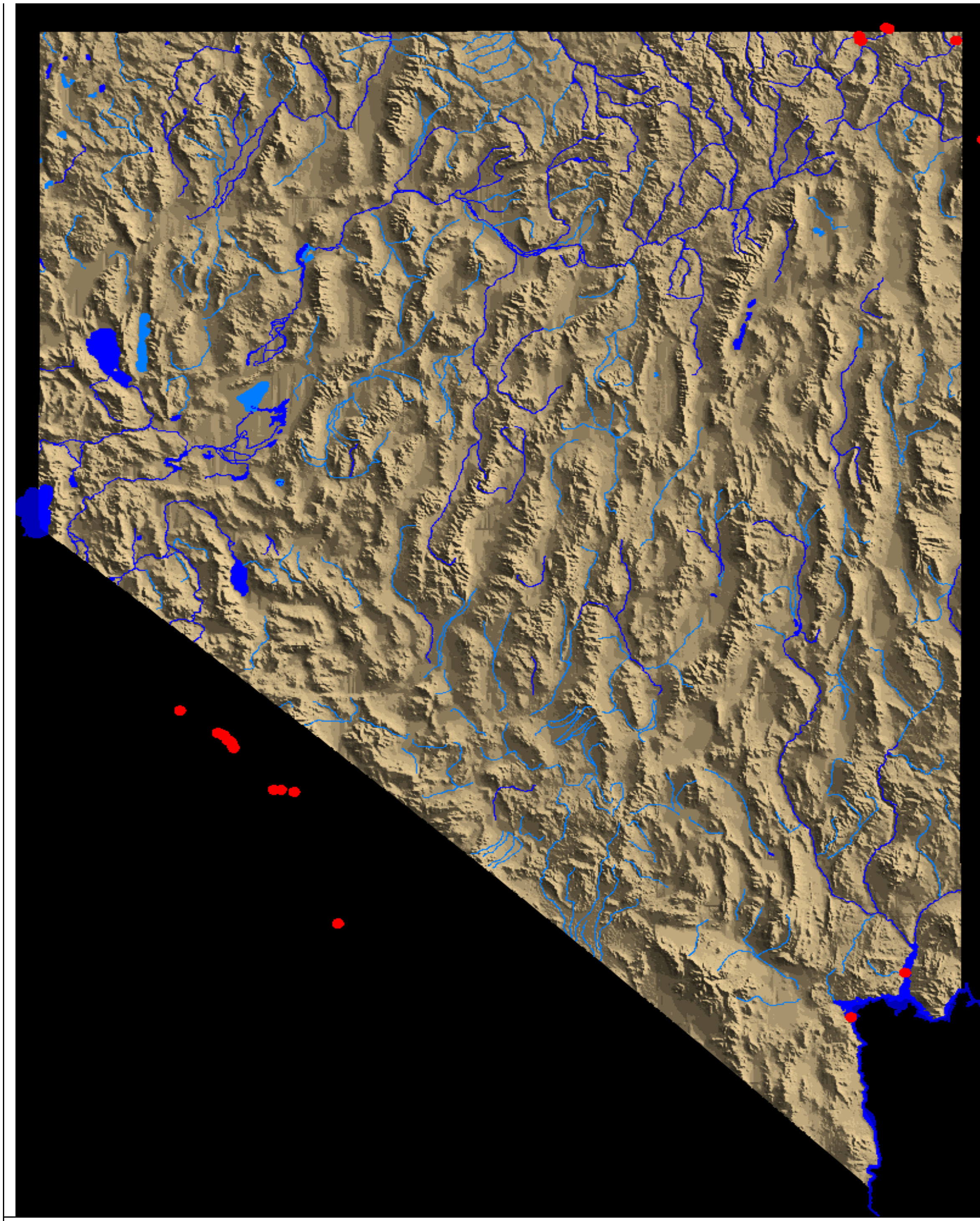
- Releasing nitrogen and phosphorus to the lake, resulting in algal blooms.
- Negatively impacting drinking water by clogging intake pipes.
- Littering beaches with their sharp shells, negatively impacting recreation.

There is an ongoing current project in 2010 by the Tahoe Resource Conservation District to physically remove Asian clams from south shore areas of Lake Tahoe and install large plastic bottom barrier sheets to cover and terminate Asian clam populations by reducing oxygen and food availability.

New Zealand Mudsnail *Potamopyrgus antipodarum*

The New Zealand mudsnail is a nuisance aquatic species now reported in a few Nevada streams along the periphery of the state (see map in Figure 3-21). It is reported in all western states, except New Mexico and is listed as an invasive species in California. It reproduces rapidly and competes for food with native gastropods and other species and is detrimental to trout populations because of its lack of nutritional value. It is not yet a huge problem but is being monitored in the state and may become more of a problem in the future.

Figure 3-21. Dot map showing reported occurrences of New Zealand mudsnails in Nevada and adjacent ares of California.



Source: Montana State University, http://www.esg.montana.edu/aim/mollusca/nzms/

3.3.11.3 *Location, Severity, and Probability of Future Events*

Appendix L contains maps showing locations of occurrences of currently identified noxious weeds in the State of Nevada as mapped by the Nevada Natural Heritage Program in 2009. The severity of noxious weed infestations is continuously monitored by the State Department of Agriculture's A, B, C categorization of noxious weeds described in the previous section. Locations of infestations of some other insects and aquatic species are described ain the previouis section

The Nevada Hazard Mitigation Planning Subcommittee agreed that plant, insect, and aquatic organism infestations will continue to occur throughout the state as recreation and commerce continue to move people and property across state lines. Cooperative efforts are necessary among state, federal, agencies and other interested regional groups to implement programs to control and mitigate the effects of infestations on all aspects of the state's environment and economy.

The rating for infestation acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in the list below.

Table 3-35. Infestation Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City				X
Churchill County				X
Clark County				X
Douglas County				X
Elko Band				X
Elko County				X
Ely Shoshone Tribe				X
Esmeralda County				X
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County				X
Washoe County				X
Washoe Tribe	X			
White Pine				X

3.3.12 Land Subsidence and Ground Failure (Very Low Risk)

3.3.12.1 *Nature*

In the southwestern United States, agricultural and urban areas that depend on aquifer groundwater pumping are prone to land subsidence. Non-recoverable land subsidence occurs when declining water table levels lead to inelastic compaction of the solid particles in the aquifer (particularly clay minerals). A lesser amount of subsidence occurs with the recoverable compression of coarse-grained sand and gravel deposits. Earth fissures commonly accompany subsidence; these are tension cracks in the sediment above the water table.

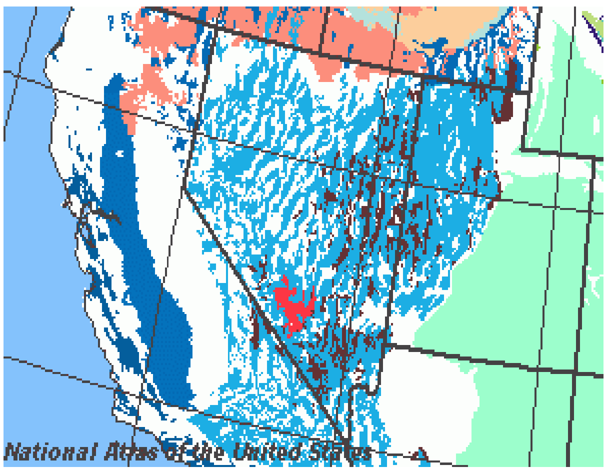


Figure 3-22. Nevada Aquifer Map from USGS and the National Atlas of the United States

Map Key: Turquoise: Alluvial aquifers, Dark Brown: Carbonate aquifers; Red: Igneous and metamorphic-rock aquifer; White: Other rock that is permeable (bedrock).

Aquifers in Nevada are composed primarily of three major hydrogeologic units. One is the alluvial aquifer, which is the material that makes up the valleys between mountain ranges. Alluvial aquifers mostly consist of gravels, sands, silts, and clays. Another aquifer in Nevada is a carbonate aquifer, which is mainly made up of limestone and dolomite. These rocks comprise many mountain ranges in eastern and southern Nevada and underlie the alluvial aquifer in places. The third major aquifer type in Nevada consists of volcanic rocks and makes up many mountain ridges and underlies the alluvial aquifer in much of western and northern Nevada.

The major aquifer under Las Vegas Valley is an alluvial aquifer. Below the alluvial aquifer, at least in the western side of the valley, is the carbonate aquifer. Over-pumping (taking more water out than is naturally recharged from snow melt and rainwater) of the alluvial aquifer has caused subsidence problems in Las Vegas and Pahrump Valleys. To help mitigate this hazard, the Clark County building department has, as part of its building code, a requirement to conduct special geotechnical investigations near any earth fissures and faults to avoid building directly over these features.

The following link from the Nevada Division of Water Resources contains a map of "Designated Groundwater Basins of Nevada":

http://water.nv.gov/WaterPlanning/wat-plan/PDFs/fig-s3-7.pdf

3.3.12.2 *History*

Most subsidence problems in Nevada have developed in the Las Vegas Valley; however, this hazard is now recognized in other parts of Nevada. In the Nevada Hazard Mitigation Survey, Douglas, Nye, Storey, and Washoe Counties recognized that land subsidence is a risk. Evidence of groundwater-withdrawal-related land subsidence and local fissures has been recognized near some of the large open-pit mining areas in Humboldt, Lander, Eureka, and Elko Counties. Sections of Interstate 80 west of Battle Mountain have been repaired because earth fissures developed near one of the mines.

Figure 3-23 shows that land subsidence can be caused by actions other than overdrafting of water. Mining, hydrocompaction, and underground fluid withdrawal (water, oil, or other fluid) can cause this hazard and result in land surface displacements and fissures. Hydrocompaction means that water absorbed on and within clay minerals is removed by withdrawal or drying, and the clays shrink. Shrinkage of clays results in less volume, so the surface will subside as the clays become more tightly compacted.

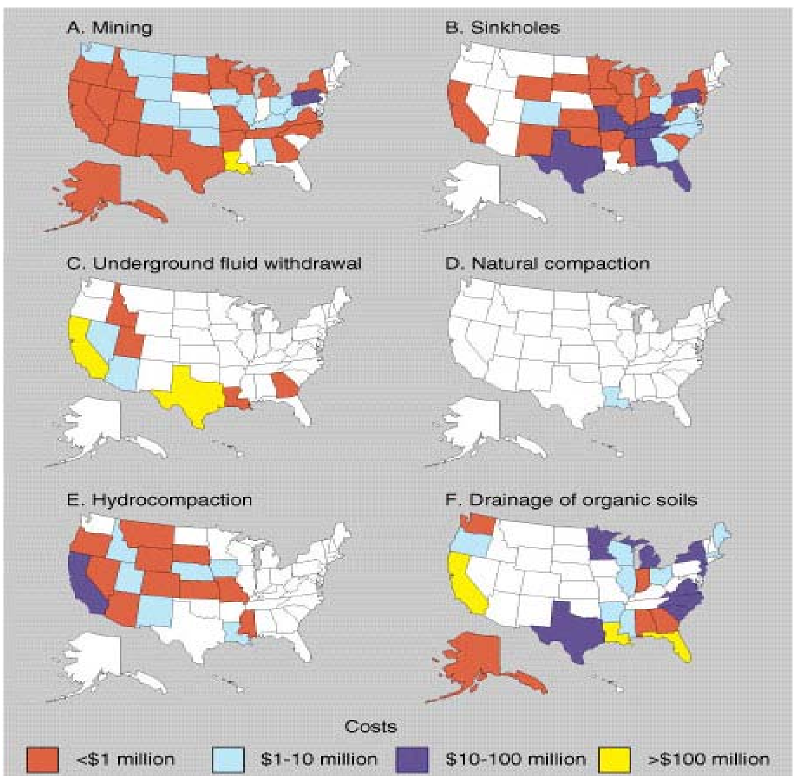


Figure 1. Distribution of subsidence problems in the United States estimated by the National Academy of Sciences (1991). Damage costs are conservative estimates for an unspecified period and are intended to show only relative magnitudes for state-by-state comparisons. The estimates do not reflect annual costs to control or mitigate damage from subsidence.

Figure 3-23. Distribution of subsidence problems in the U.S.

The primary problem in Storey County is one of collapse into excavations related to old mines on the Comstock Lode in Virginia City. This phenomenon is unrelated to groundwater withdrawal and is a human-caused hazard similar to sinkholes that develop in areas with natural caverns near the surface. Officials in Storey County are well aware of the mine-collapse hazard and have records of collapses and repairs to roads that have occurred in recent years. At a meeting on 25 March 2010, Storey County officials discussed the problem with representatives of the Nevada Division of Emergency Management, Nevada Seismological Laboratory, and Nevada Bureau of Mines and Geology. Maps and models of old workings on the Comstock Lode can be used to locate areas of potential mine collapse. Seismometers that could be located in Virginia City may be able to detect small earthquakes related to pending collapse.

3.3.12.3 *Location, Severity, and Probability of Future Events*

As mentioned in the history section, Clark, Douglas, Nye, Storey, and Washoe Counties have problems with this hazard.

Las Vegas Valley in Clark County has more dramatic problems which include vertical aquifer-system deformation, land subsidence, and earth fissuring that have caused millions of dollars of damage and might have altered boundaries of flood-prone areas.

Land subsidence is considered by the Subcommittee to be a “Very Low Risk” hazard. Unlike the rapid occurrences of fires, earthquakes, and floods, land subsidence generally occurs slowly, developing over periods of weeks, months, and years and affects localized areas.

Mine-collapse in Storey County is also considered to be “Very Low Risk” from the State’s perspective, because it will likely only affect localized areas and because recent mining in the area has indicated that most of the stopes (large openings) along the Comstock Lode have been filled by clay and weak rock, characteristic of the wall rock of the Comstock Lode, over the years since mining ceased. Nonetheless, the mine-collapse hazard is a serious consideration for officials, businesses, and residents in Virginia City.

The rating for land subsidence acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in Table 3-36 below.

Table 3-36. Land Subsidence
Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City	X			
Churchill County				X
Clark County				X
Douglas County	X			
Elko Band		X		
Elko County	X			
Ely Shoshone Tribe				X
Esmeralda County	X			

Table 3-36. Land Subsidence
Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County			X	
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley	X			
South Fork Band Tribe				X
Storey County	X			
Washoe County	X			
Washoe Tribe		X		
White Pine				X

Due to Nevada's history of new development and pressures on water systems, the state will most likely see more subsidence problems. However, mitigation may be achievable through education programs; revision of building codes; artificial recharging of ground water and geotechnical investigation of the land prior to building.

3.3.13 Landslide *(Very Low Risk)*

3.3.13.1. *Nature*

A landslide is the movement of rock and soil that may take place either gradually over a small area or more rapidly and involving a huge area, such as the landslides that have been documented on Slide Mountain between Reno and Carson City. Landslides may also be initiated by removal, or absence, of soil-retaining vegetation, from causes such as range fires or changes in agricultural practices. Removal of material at the base of slopes may result in an unstable condition. Heavy building structures, road fill and mine dumps may add enough stress to initiate landslide movement in otherwise stable conditions.

Earthquakes and extreme rainfall events commonly initiate landslides. Debris flows, which are moving masses of rock fragments, soil, and mud, with more than half of the particles being larger than sand size, are considered a type of landslide in this risk assessment. Flash floods can initiate debris flows. In addition, wildfires often burn off vegetation that helps to trap moisture and soil; therefore, wildfires often leave ground vulnerable to debris flows that are initiated by extreme rainfall events (including flash floods).

3.3.13.2. *History*

Landslides in Nevada include rock falls. Some rock falls occur where sedimentary rocks are capped by volcanic rocks (lava flows and other layered volcanic rocks). When the sedimentary rock weathers and erodes, it undermines the lava cap and a rock fall results.

Another type of landslide in Nevada occurs in areas cut by perennial streams. An example of this type of slide occurs at Mogul, on the Truckee River, west of Reno. As floodwaters erode its channel banks, the river has undercut clay-rich sedimentary rocks along its south bank, thereby destabilizing the ground and causing the ground above it to slide. Landslides in Nevada tend to be localized; therefore they tend to have less damaging economic impact than those of a widespread nature. Landslides can occur with earthquakes, major storms, floods, and melting ice and snow.

Figure 3-24. Photo of the aftermath of Slide Mountain landslide/Ophir Creek debris flow from NOAA

The largest recorded event of this type in Nevada's recent history happened May 30, 1983 on the eastern slope of Slide Mountain. A massive rockslide off Slide Mountain hit Upper Price Lake, initiating a debris flow/flash flood along Ophir Creek that killed one man, destroyed one house, and caused $2 million damage to the area. The fact that similar events have occurred many times in the past is documented on the geologic map of the area published by the Nevada Bureau of Mines and Geology in 1975 (Map 5Ag of the Washoe City Quadrangle). Patrick Glancy, a hydrologist with the U.S. Geological Survey (USGS) has conducted extensive research on the Ophir Creek rockslide and flood.

The USGS reports that there are other dangers of similar slides south of Kingsbury Grade (Douglas County) and along Second Creek where the neighborhoods of Incline Village exist today.

3.3.13.3 *Location, Severity, and Probability of Future Events*

In the Nevada Hazard Mitigation Survey, Douglas, Storey, and Washoe Counties reported landslides as a danger with the following areas particularly vulnerable: Slide Mountain, Kingsbury Grade, and Incline Village areas in Washoe County.

In the Carson City Hazard Mitigation Plan, it was mentioned that the burned-over Waterfall fire area in the foothills west of Carson City would be prone to landslides unless the area were revegetated.

Landslides are considered a "low risk hazard" in Nevada primarily because Nevada is drier (in terms of average annual precipitation) than other states, and few people live in steep terrains or on rocks and soils that typically move in landslides. However, as development encroaches on areas that are higher in elevation than the valley floors, such as alluvial fans, where most new development and building are occurring, it is likely that landslides and debris flows will become more significant hazards. Furthermore, most landslides are initiated by either major rainfall events (associated with floods) or by earthquakes, such that land-mitigation efforts, including avoiding building on hazardous areas, can undermine those efforts.

Due to the limited geographic extent of this hazard, management and mitigation are best handled at the local level. Support and technical assistance to local entities is available from state agencies in response to this type of hazard.

3.3.14 **Severe Winter Storm and Extreme Snowfall** (Medium Risk)

3.3.14.1 *Nature*

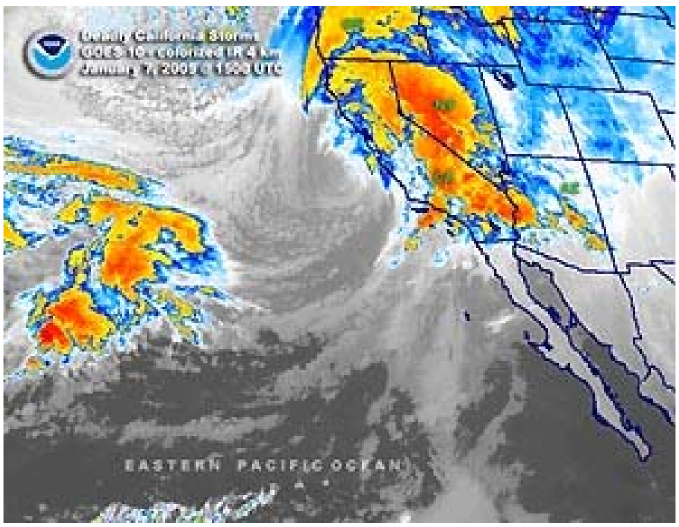


Figure 3-25. January 2005 Storm System. Courtesy of NOAA

Winter storms can bring heavy rain or snow, high winds, extreme cold, and ice storms. In Nevada, winter storms begin with cyclonic weather systems in the North Pacific Ocean or the Aleutian Islands that can cause massive low-pressure storm systems to sweep across the western states. Winter storms plunge southward from artic regions and drop heavy amounts of snow and ice. The severity of winter storms is generally minor. However, a heavy accumulation of snow and ice can create hazardous conditions. Additionally, a large winter storm event can also cause exceptionally high rainfall that persists for days, resulting in heavy flooding.

3.3.14.2 *History*

During winter months, Nevada's higher elevations regularly experience rain, snow and freezing rain. Although less common, these conditions may also be experienced in lower elevations of the State.

Nevada's Basin and Range topography provides the necessary conditions for down-slope winds on the leeward (east) side of the ranges and into the valleys. North-South transportation routes can become obscured by blowing dust or snow during extreme wind conditions. Appendix K contains a Nevada Climate Office storm event summary by county with damage costs

Following is a list of a few severe winter storms in Nevada:

- 1889-90 - Winter season known as the "White Winter" when nearly 100 inches of snow fell in northern Nevada - the heaviest snowfall in northern Nevada history. An estimated 90-95% of the state's livestock died during that winter.

- 1909 – December: Although severe winter storms are generally thought to affect mainly northern Nevada, a snow storm left twelve inches of snow on Las Vegas and in 1937, the Caliente Herald reported they were having the "coldest weather spell in memory for the past five days", with temperatures down to 10° above to 31° below zero, with 18 inches of snow.
- 2004 - February**:** Severe winter storm. Gusts on the ridges were up to 110 mph. There were white-out conditions in Tahoe area. Several minor accidents were caused by the storm.
- December 29, 2004 through January 2, 2005 and January 6-10 2005**:** FEMA designated 15 counties (Carson City, Churchill, Clark, Douglas, Elko, Eureka, Humboldt, Lander, Lincoln, Lyon, Mineral, Nye, Storey, Washoe, and White Pine) eligible for federal funding to pay part of the cost for emergency protective measures undertaken as a result of the snowstorm on December 29 through January 2. Shortly thereafter, FEMA designated these counties plus Pershing County eligible for federal funding as a result of another snowstorm on January 6-10.

Additionally, National Oceanic and Atmospheric Administration (NOAA) compiled the following data for the top 25 periods of excessive snow (15.0 inches or greater of total snowfall)

Inclusive Dates	**Snowfall / Daily Amt. (Date)**
Jan. 10 – 14, 1911	37.9 / 19.7 (Jan. 12)
Dec. 1 – 5, 1919	33.6 / 11.5 (Dec. 3)
Jan. 31 – Feb. 6, 1901	28.4 / 10.1 (Feb. 5)
Feb. 9 – 11, 1922	27.4 / 12.6 (Feb. 10)
Jan. 17 – 18, 1916	25.5 / 22.5 (Jan. 17)
Dec. 29, 2004 – Jan. 1, 2005	22.2 / 16.4 (Dec. 30)
Feb. 16 – 21, 1897	22.1 / 10.0 (Feb. 16)
Feb. 10 – 12, 1959	21.9 / 13.2 (Feb. 10)
Feb. 16 – 18, 1990	21.1 / 18.0 (Feb. 16)
Dec. 23 – 29, 1941	20.0 / 6.5 (Dec. 27)
Jan. 15 – 20, 1933	19.1 / 10.5 (Jan. 19)
Jan. 15 – 16, 1913	19.0 / 10.0 (Jan. 16)
Jan. 24 – 27, 1956	17.8 / 11.0 (Jan. 25)
Feb. 23 – 26, 1969	17.3 / 8.0 (Feb. 24)
March 14 – 15, 1952	17.1 / 13.6 (March 14)
Jan. 28 – 30, 1937	17.0 / 10.1 (Jan. 30)
Feb. 23 – 26, 1969	17.3 / 8.0 (Feb. 24)
March 14 – 15, 1952	17.1 / 13.6 (March 14)
Jan. 28 – 30, 1937	17.0 / 10.1 (Jan. 30)
Jan. 22 – 25, 1923	16.5 / 9.2 (Jan. 24)
Jan. 7 – 8, 2005	16.4 / 10.5 (Jan. 8)
Nov. 8 – 12, 1985	16.3 / 15.2 (Nov. 10)
Jan. 31 – Feb. 4, 1938	15.6 / 8.6 (Feb. 3)
Feb. 4 – 9, 1976	15.1 / 5.1 (Feb. 4)
March 1 – 3, 1902	15.5 / 14.4 (March 1)

The State Climatologist prepared a report on extreme snowfall averages in each county based on historical records. These data are available in Appendix K. A summary of the data is presented in a table showing the average number of days per year with extreme snowfall for representative sites in each county. Extreme snowfall is defined as that above the 15th percentile for that county. The data is will assist each county in its preparedness and response planning for extreme snowfall events.

3.3.14.3 *Location, Severity, and Probability of Future Events*

The rating for severe winter storm acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in Table 3-37 below.

Table 3-37. Severe Winter Storm
Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County				X
Douglas County		X		
Elko Band			X	
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County	X			
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County	X			
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley		X		
South Fork Band Tribe				X
Storey County			X	
Washoe County		X		
Washoe Tribe		X		
White Pine				X

Severe winter storms are considered to be “moderate risk hazards.” They occur frequently and can cause significant damage to structures that have not been built to meet current building codes. The most damaging effects, however, are related to the floods that can be caused when the storms bring large amounts of rain or warm rain on top of already heavy snow packs.

Because snowstorms occur yearly in Nevada, most local and state jurisdictions are able to manage this type of event. Only when the storms are severe and repeated that there is a probability of this hazard causing damage. Accordingly, more research is necessary to determine and prioritize actions that will mitigate this hazard. The Subcommittee will assist in the development of strategies to mitigate this hazard as new data become available.

3.3.15 **Terrorism** (Very High Risk)

3.3.15.1 Nature

The Department of Justice (DOJ) Federal Bureau of Investigation (FBI) defines terrorism as the unlawful use of force or violence against persons or property to intimidate or coerce a government and/or the civilian population in furtherance of political or social objectives. Weapons of Mass Destruction (WMD) associated with terrorism are defined as nuclear, biological and chemical in origin. Technological terrorism is defined as the intentional disruption of the nation's data control systems. Attacks on financial, business, and governmental computer networks are considered as technological terrorist-related acts.

The FBI is the primary investigatory agency for domestic terrorism. The Central Intelligence Agency (CIA) monitors potential security threats from foreign sources. The DOJ through the FBI will coordinate the domestic preparedness programs and activities of this nation to address the threat posed by terrorists and the use of weapons of mass destruction.

Acts of terrorism may originate from a single person, special interest groups, or acts sponsored by a foreign government. Terrorist acts include the use of arson, hostile takeovers, shootings, biological agents (such as anthrax, plague, botulism and others), chemical agents (such as hydrogen cyanide, sulfur mustard, sarin and chlorine), and hostage taking. The most popular method used in recent events in the United States has been terrorism by bombing. Terrorism goals are mass casualties, loss of critical resources, disruption of vital services, disruption of the economy, and individual and mass panic.

Table 3-38. Indicators of a Terrorist Attack

Type	Indicator
Environmental	Sick or dead animals, fish, or birds
	Unscheduled spraying
	Vapor clouds or mists
	Absence of crops, wildlife, or insects
	Out of place and unattended packages, boxes, or vehicles
	Packages that are leaking
	Unusual materials or equipment
	Small explosions that disperse liquids, mists, or gases
	Unusual odors or tastes
Physical	Many casualties without signs of obvious trauma
	Victims who are exhibiting similar symptoms
	Large numbers seeking medical attention

Conventional Explosive Devices

The easiest to obtain and use of all weapons is still a conventional explosive device, or improvised bomb, which may be used to cause massive local destruction or to disperse chemical, biological, or radiological agents. The components are readily available, as are detailed instructions to construct such a device. Improvised explosive devices are categorized as being explosive or incendiary, employing high or low filler explosive materials to explode and/or cause fires.

Bombs and firebombs are cheap and easily constructed, involve low technology, and are the terrorist weapon most likely to be encountered. Large, powerful devices can be outfitted with timed or remotely triggered detonators and can be designed to be activated by light, pressure, movement, or radio transmission. The potential exists for single or multiple bombing incidents in single or multiple municipalities. Historically, less than five percent of actual or attempted bombings have been preceded by a threat. Explosive materials can be employed covertly with little signature, and are not readily detectable. Secondary devices may be targeted against responders to an initial explosion.

Nuclear Weapon/Radiological Agent Use

The difficulty of responding to a nuclear or radiological incident is compounded by the nature of radiation itself. In an explosion, the fact that radioactive material was involved may or may not be obvious, depending upon the nature of the explosive device used. Unless confirmed by radiological detection equipment, the presence of a radiation hazard is difficult to ascertain. Although many detection devices exist, most are designed to detect specific types and levels of radiation and may not be appropriate for measuring or ruling out the presence of radiological hazards. Listed below are some indicators of a radiological release:

• A stated threat to deploy a nuclear or radiological device
• The presence of nuclear or radiological equipment (e.g., spent fuel canisters or nuclear transport vehicles)
• Nuclear placards or warning materials along with otherwise unexplained casualties

The scenarios constituting an intentional nuclear/radiological emergency include the following:

1. Use of an **Improvised Nuclear Device (IND)** includes any explosive device designed to cause a nuclear yield. Depending on the type of trigger device used, either uranium or plutonium isotopes can fuel these devices. While “weapons-grade” material increases the efficiency of a given device, materials of less-than-weapon-grade can still be used.

2. Use of a **Radiological Dispersal Device (RDD)** includes any explosive device utilized to spread radioactive material upon detonation. Any improvised explosive device could be used by placing it in close proximity to radioactive material.

3. Use of a **Simple RDD** that spreads radiological material without the use of an explosive. Any nuclear material (including medical isotopes or waste) can be used in this manner.

Biological Agents

An identified terrorist tactic or weapon is the use of toxic biological agents in an attempt to harm or intimidate the public. Anthrax, *Yersinia pestis* (plague), and small pox are examples of this type of threat. Anthrax is found naturally in the soil in some of the old ranch areas in Nevada. UNR and the Nevada State Agriculture labs maintain a vigilant watch of these threats.

According to information from the Nevada State Health Division, most biological agents are naturally occurring in various parts of the world. They can be weaponized to enhance their virulence in humans and make them resistant to vaccines and antibiotics. Weaponization of biological agents usually involves using selective reproduction pressure or recombinant engineering to mutate or modify the genetic composition of the agent. Terrorist may choose to use biological weapons to achieve their goals because a very small amount can harm many people. It is reported that many of these agents would be relatively easy to prepare and easy to hide. The actual or threatened use of bio-weapons can have tremendous psychological impact on the population.

The CIA currently lists 15 animal pathogens as having potential Biological Weapons application that could potentially be used in a terrorist act:

- African swine fever
- Avian influenza
- Bluetongue
- Foot and Mouth Disease
- Goat Pox
- Monkey Pox
- Pseudo-rabies
- Hog cholera
- Lyssa virus
- Newcastle disease
- Pest des petits
- Swine vesicular disease
- Rinderpest
- Sheep pox
- Porcine enteroviral encephalomyelitis
- Vesicular stomatitis

Yersinia pestis when used in an aerosol attack can cause a pneumonic form of plague. One to six days after becoming infected with the bacteria, people would develop pneumonic plague. Once people have the disease, the bacteria can spread to others who have close contact with them. Because of the delay between being exposed to the bacteria and becoming sick, people could travel over a large area before becoming contagious and possibly infecting others. Controlling the disease would then be more difficult. A biological weapon carrying *Y. pestis* is possible because the bacterium occurs in nature and could be isolated and grown in quantity in a laboratory. Even so, manufacturing an effective weapon using *Y. pestis* would require advanced knowledge and technology.

Smallpox is caused by the *variola* virus that emerged in human populations thousands of years ago. Except for laboratory stockpiles, the *variola* virus has been eliminated. However, in the aftermath of the events of September and October, 2001, there is heightened concern that the *variola* virus might be used as an agent of bioterrorism. For this reason, the U.S. government is taking precautions for dealing with a smallpox outbreak.

Unless the agent is disseminated in an airborne or other mass contaminant methodology, the exposures will be limited in nature. Mass-distributed biologic agents could require mass contamination and isolation. Medical responders and facilities would be stressed. Infrastructure such as drinking water could be affected. Some critical buildings could be closed and sealed pending decontamination if possible. Economic losses could be incurred due to lack of tourism or if major gaming establishments were affected.

According to USDA-ARS Arthropod-Borne Animal Diseases Research Laboratory (ABADRL) at the present time, the most economically important arthropod-borne disease of U.S. livestock is Bluetongue Disease (BLU). As articulated in the Journal of American Veterinary Medical Association article, *Biological Terrorism and Veterinary Medicine in the United States*, "Although recent reports have emphasized the need for improving the ability to detect a biological terrorist attack on human populations, the use of veterinary services in this effort and the potential for the targeting of livestock (e.g., horses, cattle, sheep, goats, swine, and poultry) have been addressed only briefly. Improving surveillance for biological terrorist attacks that target livestock and improving detection and reporting of livestock, pet, and wild animal morbidity and mortality are important components of preparedness for a covert biological terrorist attack."

Chemical Agents

Table 3-39 below lists those chemical agents that might be used in a terrorist attack and categorizes them by effect.

Table 3-39. Hazardous Chemical Agents Potentially Used in Terrorist Act

Effects	Chemical Agent
Blood (Blister/Vesicants)	Arsine (SA)
	Cyanogen Chloride (CK)
	Hydrogen Chloride
	Hydrogen Cyanide (AC)
Choking/Lung/Pulmonary Damaging	
	Chlorine (CL)
	Diphosgene (DP)
	Cyanide
	Nitrogen Oxide (NO)
	Perfluroisobutylene (PHIB)
	Phosgene (CG)
	Red Phosphorous (RP)
	Sulfur Trioxide-Chlorosulfonic Acid (FS)

Table 3-39. Hazardous Chemical Agents Potentially Used in Terrorist Act

Effects	Chemical Agent
	Teflon and Perfluroisobutylene (PHIB)
	Titanium Tetrachloride (FM)
	Zinc Oxide (HC)
Incapacitating (Nerve, Riot Control/Tear Gas)	Bromobenzylcyanide (CA)
	Chloroacetophenone (CN)
	Chloropicrin (PS)
	CNB – (CN in Benzene and Carbon Tetrachloride)
	CNS – (CN and Chloropicrin in Chloroform)
	CR
	CS
Vomiting	
	Adamsite (DM)
	Diphenylchloroarsine(DA)
	Diphenylcyanoarsine (DC)

The State of Nevada is comprised of diverse populations that include members of nationwide militia organizations. The Federal government has continually released terrorism warnings since 1998 that state most communities in the United States are vulnerable to terrorist attack. The State of Nevada Standard Multi-Hazard Mitigation Plan currently lists nine domestic terrorism groups with representatives and offices in Nevada. Those groups are included in this plan to give local governments information of their existence and their geographical location. See Table 3-40 below.

Table 3-40. Identified Hate Groups and Patriot Groups, Nevada

Type	Group	Location
Domestic Terrorism Groups		
	World Church of the Creator	Carson City
	Hammerskin Nation	Las Vegas
	Nation of Islam	Las Vegas
	National Alliance	Las Vegas
	National Socialist Movement	Las Vegas
	Aryan Nations/Aryan National Alliance	Reno
	National Alliance	Reno
	Aryan Nations/Aryan National Alliance	Wellington
Patriot Groups		
	Center for Action	Sandy Valley

3.3.15.2 *History*

Terrorism activity is not new. The attention given to terrorist activities in the United States has grown as a result of the terrorist attacks on September 11, 2001. The following examples are but a few incidents of terrorist activity demonstrating a long history of the use of terrorism to influence political systems and populations.

Table 3-41. History of Terroism

Year	Place	Result
1767	French-Indian War , US	British soldiers used smallpox blankets to initiate an outbreak among American Indians
1915	Belgium	Germany uses chlorine/phosgene gas against British troops
1984	The Dalles, Oregon, US	Most significant biological attack in U.S. in which Salmonella was sprayed on 8 local salad bars and 751 citizens were affected in an attempt to manipulate a local election.
February 26, 1993	World Trade Center Parking Structure New York, NV, US	6 people Dead and injuring thousands, Blast caused a hole 150 feet in diameter and five floors deep
March 20, 1995	Subway, Tokyo, Japan	Sarin gas attach, 11 people dead, 5,500 injured
April 19, 1995	Murrah Federal building, Oklahoma City, OK	168 people dead and thousands injured Domestic terrorist – ANFO Bomb
September 11, 2001	World Trade Center, New York, NY, US	Hit by two planes, Pentagon hit by one plane, Another hijacked plane went down in Pennsylvania Worst Terror attack on American soil
March 2004	Commuter Train, Madrid, Spain	Bomb kills 191 people and injures 1,800 days before an election

Acts of terrorism may originate from a single person, special interest groups, or acts sponsored by a foreign government. The most popular method used in recent events in the United States has been terrorism by bombing. Terrorist acts include the use of arson, hostile takeovers, shootings, biological agents (such as anthrax, plague, botulism and others); chemical agents (such as hydrogen cyanide, sulfur mustard, sarin and chlorine), and hostage taking.

3.3.15.3 *Location, Extent, Probability of Future Events*

One of the special considerations in dealing with terrorist activity is that terrorist activity is difficult to predict because of the diversity in terrorist groups both foreign and domestic. Terrorists have different goals and capabilities, but for the purposes of mitigation two things are clear: the terrorist weapons of choice are bombs and the greatest potential for destruction is from WMDs.

Worldwide there were 457 terrorist incidents or planned acts during the period 1980-1999. Of these 135 were international and 322 were domestic terrorism. The majority of these incidents (321) have been bombings. There is, however, concern about the potential for use of Weapons of Mass Destruction in future terrorist events. The use of Weapons of Mass Destruction increases the potential for mass casualties and damages.

The more populated areas of Nevada are potentially susceptible to the impacts of terrorism, with risk comparatively higher for Las Vegas, Reno, Carson City, and state and federal military facilities. Additionally susceptible are special events drawing 5,000 to 40,000 individuals per day; above-ground fuel tank farms; above-ground gas utility pipes; and sewage plants. Sewage plant use chlorine to disinfect treated wastewater before discharge into an adjacent waterway. The chlorine is housed in chlorine tankers located in on-site buildings for this purpose. Additional targets in the State of Nevada**:**

- The “World Famous Strip”, Las Vegas Nevada
- Fremont Street, Las Vegas Nevada
- Hoover Dam
- Individual casinos and/or convention centers
- Las Vegas Convention Center
- Nellis Air Force Base
- Creech Air Force Base
- Davis Dam
- Reno, NV -“The Biggest Little City in the World”,
- Government-occupied facilities
- Transportation networks
- Airports

Standard models are available for estimating the effects of a nuclear, chemical, or biological release, including the area affected and consequences to population, resources, and infrastructure. Some of these models include databases on infrastructure that can be useful in preparing the TIA. A good source of information on available Federal government models is the *Directory of Atmospheric Transport and Diffusion Consequence Assessment Models*, published by the Office of the Federal Coordinator for Meteorology (OFCM).

The overall magnitude and potential severity of the impacts of terrorism and weapons of mass destruction are considered high in Nevada. Assessment of the probability of future terrorism events in Nevada is gauged primarily on speculation, as no terrorism or events involving weapons of mass destruction have previously occurred in the planning area. Based on the Homeland Security Threatened Level System, it is anticipated that terrorism will remain a high threat into the foreseeable future. Because terrorism events typically are focused on a single high payoff area or facility, estimated damage is less than one percent damage to facilities in Nevada.

The rating for terrorism acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in Table 3-42 below.

Table 3-42. Terrorism Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County				X
Douglas County				X
Elko Band				X
Elko County				X
Ely Shoshone Tribe				X
Esmeralda County		X		

Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County		X		
Washoe County			X	
Washoe Tribe	X			
White Pine				X

3.3.16 **Tornado** (Very Low Risk)

3.3.16.1 ***Nature***

Figure 3-26. Oldest Tornado Photograph, Howard, South Dakota. Courtesy of NOAA/ Dept. of Commerce

Tornadoes are one of nature's most violent storms. A tornado is defined as a rapidly rotating column of air extending from the base of a thunderstorm to the ground. In an average year, approximately 1,000 tornadoes are reported across the United States, resulting in an average of 80 deaths and over 1,500 injuries. The most violent tornadoes, with wind speeds of 250 mph or more, are capable of tremendous destruction. Damage paths can be more than 1 mile wide and 50 miles long. Tornadoes can occur anywhere in the United States, but they are most common in the Great Plains region that includes parts of Texas, Oklahoma, Kansas, and Nebraska. Tornadoes are responsible for the greatest number of wind-related deaths each year in the United States.

Tornadoes come in all shapes and sizes. In the southern states, peak tornado season is March through May; peak months in the northern states are during the summer. Tornadoes can also occur in thunderstorms that develop in warm, moist air masses in advance of eastward-moving cold fronts. These thunderstorms often produce large hail and strong winds, in addition to tornadoes. During the spring in the central plains, thunderstorms frequently develop along a "dryline," which separates warm, moist air to the east from hot, dry air to the west. Tornado-producing thunderstorms may form as the dryline moves east during the afternoon hours. Along the front range of the Rocky Mountains, in the Texas panhandle, and in the southern high plains, thunderstorms frequently form as air near the ground flows "upslope" toward higher terrain. If other favorable conditions exist, these thunderstorms can produce tornadoes.

3.3.16.2 *History*

Although tornadoes are rare in Nevada, they do occur. Nevada ranks 44th out of 50 states with only one touchdown incident recorded in an average year. Texas ranks first with an average of 123 confirmed tornadoes every year. Between 1947 and 1973 in Nevada and the Sierra, thirteen confirmed touchdowns were recorded with thirty-three confirmed funnel clouds.

The tornado project online http://www.tornadoproject.com/alltorns/worststs.htm has a list of the worst tornadoes in every state. The following is a list of tornadoes in Nevada that have caused injury or property damage. All were ranked at F0 on a scale of F0 to F5.

Table 3-43. Nevada Tornado History

Date	Injuries/damage	Description/location
May 26, 1964 2:45 p.m.	0 dead 1 injured	A small tornado damaged outbuildings on a ranch near Yerington. One man was struck by flying debris
July 16, 1973 12:23 p.m	0 dead 1 injured	A small tornado touched down six miles north of Reno.
March 30, 1992 11:45 a.m.	0 dead 0 injured	One home was shifted and other partially unroofed at the extreme south edge of Las Vegas.
June 24, 2004 4 p.m.	No injuries or damage	Two off duty NWS employees saw a small rope-like tornado approximately 5 miles north of the town of Lamoille, Elko County, moving slowly towards the south.
June 25, 2004 4:15 p.m	No injuries or damage	Trained weather spotter reported a rope-like tornado at Paradise Valley, Humboldt County
June 25, 2004 4:25 p.m	No injuries or damage	Trained weather spotter observed tornado on the west side of the Sonoma range. Winnemucca, Humboldt County
June 27, 2004 1:15 p.m	No injuries or damage	Trained weather spotter observed a tornado near Winnemucca, in Humboldt County:
July 24, 2004 2:30 p.m.	No injuries or damage	A tornado was spotted in Cold Springs, north of Reno. No damage was reported. The weak tornado lasted less than 2 minutes

April 27, 2005 5:30 p.m.	No injuries or damage	A tornado was reported near the Carson-Tahoe Hospital in Carson City.
June 9, 2006, 11:05 a.m	No injuries or damage	A rope-like tornado was observed and photographed over open country about 1 mile west of the Eureka Airport, Eureka County.

- According to the National Oceanic & Atmospheric Administration, Nevada has had seven tornadoes from 2004 to 2006. Tornado severity is measured with the Fujita Scale (ranging from F0 to F5). The Nevada tornadoes listed are all F0. In the original scale, F0 stood for winds estimated at less than 73 miles per hour with typically light damage (some damage to chimneys, branches broken off trees, shallowly rooted trees pushed over, and sign boards damaged); in the Enhanced F Scale, which was implemented in the U.S. in 2007, three-second wind gusts estimated based on damage are in the 65 to 85 mile-per-hour range.

3.3.16.3 *Location, Severity, and Probability of Future Events*

Appendix K contains a summary of damage-causing storm events by county prepared by the Nevada Climate Office. There were 84 tornadoes reported in Nevada between the years 1959 and 2006. According to the data from the NOAA site, fifteen of the seventeen counties in Nevada have had one or more tornadoes since 1880. As new developments continue to be built, this hazard may become more evident.

Tornadoes are considered a “Very Low Risk” hazard in Nevada because few are reported each year anywhere in the State, the ones that do occur tend to be low in intensity, and they usually occur in unpopulated areas. Emergency response is likely to be handled without federal or State assistance. Structures built to modern building codes should be able to withstand the gusts of an F0 tornado.

Figure 3-27. June 9th Tornado in Diamond Valley near Eureka, NV. Photo Courtesy of Cheryl Morrison from Sheriff’s Office in Eureka.

The rating for tornado acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in Table 3-44 below.

Table 3-44. Tornado Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City	X			
Churchill County				X
Clark County				X
Douglas County				X
Elko Band		X		
Elko County				X
Ely Shoshone Tribe				X
Esmeralda County				X
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County				X
Washoe County	X			
Washoe Tribe				X
White Pine				X

3.3.17 **Tsunami/Seiche** (Low Risk)

3.3.17.1 ***Nature***

Tsunamis (pronounced soo-ná-mees), also known as seismic sea waves (mistakenly called “tidal waves”), are a series of enormous waves created by an underwater disturbance such as an earthquake, landslide, volcanic eruption, or by meteorite impact. A tsunami can move hundreds of miles per hour in the open ocean and smash into land with waves as high as 100 feet or more. A seiche is an oscillating wave on the surface of a lake or semi-enclosed basin, generally initiated by winds, earthquakes, or changes in atmospheric pressure. Seiches rarely exceed heights of a few meters.

From the area where the tsunami originates, waves travel outward in all directions. Once the wave approaches the shore, it builds in height. The topography of the coastline and the ocean floor will influence the size of the wave. There may be more than one wave and the succeeding one may be larger than the one before. A small tsunami at one beach can be a giant wave a few miles away.

All tsunamis are potentially dangerous, even though they may not damage every coastline they strike. A tsunami can strike anywhere along most of the U.S. coastline. The most destructive tsunamis have occurred along the coasts of California, Oregon, Washington, Alaska, and Hawaii.

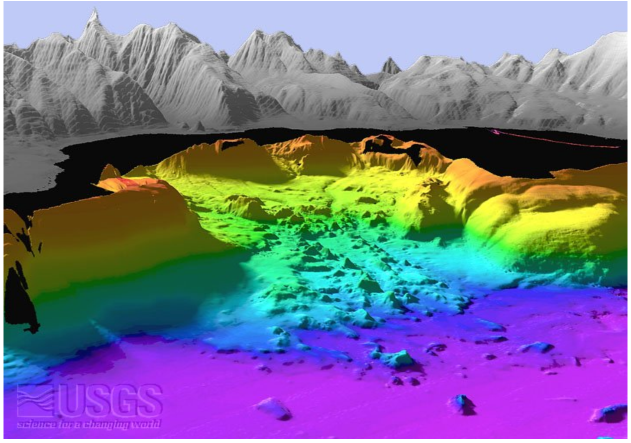


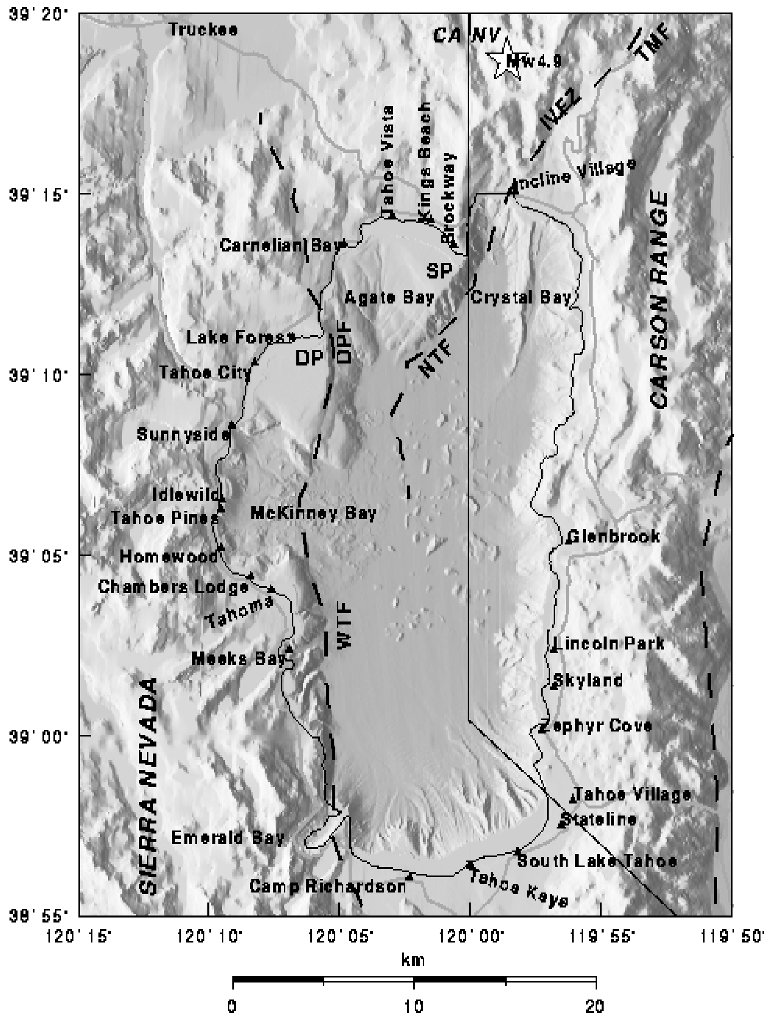
Figure 3-28. USGS bathymetric view of western Lake Tahoe, McKinney Bay.

Earthquake-induced movement of the ocean floor most often generates tsunamis. If a major earthquake or landslide occurs close to shore, the first wave in a series could reach the beach in a few minutes, even before a warning is issued. Areas are at greater risk if they are less than 25 feet above sea level and within a mile of the shoreline. Drowning is the most common cause of death associated with a tsunami. Tsunami waves and the receding water are very destructive to structures in the run-up zone. Other hazards include flooding, contamination of drinking water, and fires from gas lines or ruptured tanks.

Although Nevada is landlocked, a study by Santa Clara University, U.S. Geological Survey, and the University of Nevada, Reno shows that a tsunami or seiche induced by an earthquake and landslide occurred at Lake Tahoe about 20,000 years ago. Although this incident is rare, this research shows that if a body of water is large enough with the right factors, then a tsunami/seiche can happen.

3.3.17.2 *History*

In 1999, Gene A. Ichinose, Kenji Satake, John G. Anderson, Rich A. Schweickert, and Mary M. Lahren from The Nevada Seismological Laboratory, Earthquake Research Department, and Department of Geological Sciences conducted a study to determine if an earthquake magnitude of 7 could generate a tsunami or seiche wave, which could pose a hazard to shoreline communities of the Lake Tahoe Basin, California-Nevada. They concluded from their scenarios that a wave as small as 3m and as large as 10m in amplitude could threaten shoreline communities.



A more recent study published in November 2006 showed evidence of a tsunami triggered by an earthquake and massive underwater landslide that deposited ridges of glacial boulders and smaller volcanic rocks on the "Tahoe City Shelf," a triangular region fifty feet below the eastern shore of the lake and twelve miles from the "McKinney Bay slide" which undermined the western shore (Figure 3-29).

In 2007, this team of scientists returned to Lake Tahoe to analyze the strength and stability of steep rock walls along the lake, which could collapse and cause another seiche wave.

Figure 3-29. Lake Tahoe Fault Map. SP Stateline Point), NTF (North Tahoe fault line), IVFZ (Incline Village Fault Zone), TMF (Truckee Meadows Fault), WTF (West Tahoe Fault), DPF (Dollar Point Fault)

3.3.17.3 *Location, Severity, and Probability of Future Events*

There is a tsunami hazard at Lake Tahoe primarily because faults occur below the lake. These are dip-slip faults (ones in which one side goes down relative to the other), which could cause displacement in the water column above the fault rupture. If the displacement is large enough, a damaging tsunami could be generated. A large, rapid landslide, either underwater within the lake or into the lake from the side, could also generate a tsunami; such a landslide could also be induced by an earthquake.

Nevada also has strike-slip faults (ones in which one side moves horizontally relative to the other side), but this motion is not likely to create significant vertical displacements in the water column. Although strike-slip faults do occur near or underneath Pyramid Lake and Lake Mead, geological evidence at this time does not indicate the presence of active normal faults capable of producing tsunamis in these or other large lakes in Nevada (other than Lake Tahoe). There is good bathymetric evidence of a major landslide that spread large blocks from McKinney Bay across the floor of Lake Tahoe (Figures 3-28 and 3-29). It appears that similarly large landslides have not occurred at the other large lakes in Nevada

Tsunamis are considered a low-risk hazard in Nevada primarily because the earthquakes that would likely cause sizeable tsunamis on Lake Tahoe, either directly by fault displacement or indirectly by a large landslide, appear to occur only once every few thousand to few tens of thousands of years. If a tsunami does happen, most of the near-shore parts of communities surrounding Lake Tahoe would be at risk. There would be little or no warning, other than perhaps feeling the ground shake from the earthquake before the first wave of water hits. As is the case along the Pacific Northwest coast, the most effective tsunami-hazard mitigation may be training people to run to high ground as soon as possible, if they feel strong shaking from an earthquake. It must be noted that this is a very limited exposure event, specifically to shore line residents of Lake Tahoe – very limited population, although the property damage value could be extensive. Only Carson City and Washoe County listed this as a risk in the Hazard Mitigation Plan.

Table 3-45. Tsunami/Seiche
Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City	X			
Churchill County				X
Clark County				X
Douglas County				X
Elko Band				X
Elko County				X
Ely Shoshone Tribe				X
Esmeralda County				X
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County				X
Washoe County	X			
Washoe Tribe				X
White Pine				X

3.3.18 **Volcano** (Very Low Risk)

3.3.18.1 *Nature*

Volcanoes are created when internal forces in the earth cause heated, melted rock (magma) to rise to the surface. First collecting in magma chambers, some of the magma pushes upward through cracks and eventually vents to the Earth's surface. As the magma reaches the surface, it can erupt violently due to escaping gases (e.g., Mount St. Helens in 1980), it can erupt less spectacularly as a lava flow (e.g., Hawaii), or it can expand slowly as a lava dome (similar to the filling of the crater of Mount St. Helens in recent years).

Figure 3-30. Mount St. Helens 1980 Eruption - USGS Photograph by Austin Post

Volcanoes have varied shapes and sizes, but are divided into three main kinds depending on the type of material that reaches the surface and the type of eruption that ensues.

1. *Composite or Stratovolcanoes*

Composite volcanoes (stratovolcanoes) develop from repeated explosive and non-explosive eruptions of tephra (airborne lava fragments that can range in size from tiny particles of ash to house-size boulders) and lava that build up layer by layer. These volcanoes are the largest and form symmetrical cones with steep sides. Mount Shasta, Mount Rainier, and Mount St. Helens are examples of stratovolcanoes.

2. *Shield Volcanoes*

Shield volcanoes form from "gentle" or non-explosive eruptions of flowing lava. The lava spreads out and builds up volcanoes with broad, gently sloping sides. The low-profile shape resembles a warrior's shield. Currently active volcanoes of this type are found in the Hawaiian Islands.

3. *Cinder Cones*

Cinder cones build from lava that is blown violently into the air and breaks into fragments. As the lava pieces fall back to the ground, they cool and harden into cinders (lava fragments about ½ inch in diameter) that pile up around the volcano's vent. Cinder cones are the smallest volcanoes and are cone-shaped. Cinder cones are found in many areas, including Nevada.

4. Phreatic eruptions occur when rising magma contacts ground or surface water. The extreme temperature of the magma (anywhere from 600 °C to 1,170 °C (1110–2140 °F)) causes near-instantaneous evaporation to steam resulting in an explosion of steam, water, ash, rock, and volcanic bombs. A less intense geothermal event may result in a mud volcano. This kind of activity is also described as steam-blast eruptions. Phreatic eruptions typically include steam and rock fragments and seldom erupt lava. The temperature of the fragments can range from cold to hundreds of degrees centigrade. If molten material is included, the term phreato-magmatic may be used. These eruptions occasionally create broad, low-relief craters called maars. Phreatic explosions can be accompanied by carbon dioxide or hydrogen sulfide gas emissions. The former can asphyxiate at sufficient concentration; the latter is a broad spectrum poison. A 1979 phreatic eruption on the island of Java killed 149 people, most of whom were overcome by poisonous gases.

3.3.18.2 *History*

Nevada Volcanic Hazards

The most likely volcanic hazard for Nevada is an eruption from the Mono Craters area near Lee Vining and Mono Lake in eastern California. Small eruptions from these volcanoes have sent ash into Nevada as recently as about 260 years ago. Other volcanoes that could deposit ash in Nevada include Mount Lassen, Mount Shasta and the Long Valley Caldera in California and volcanoes in the Cascade Mountains in Oregon. The biggest threat for Nevada from eruptions in California and Oregon is damage to flying aircraft.

A massive eruption from the Long Valley Caldera near Mammoth Lakes, California about 760,000 years ago devastated a considerable area in Owens Valley when thick, hot flows of ash were deposited as far south as Bishop. Air-fall ash from these eruptions did collect as thick piles of ash in parts of Nevada, and some of the ash may have been hot enough or thick enough to devastate the landscape locally. Scientists would expect to see strong indications from seismographs before another eruption of this magnitude. The U.S. Geological Survey continues to monitor the area around Mammoth Lakes, and will issue warnings prior to any subsurface changes that could precede a major eruption.

Seismic and geodetic data at the north end of Lake Tahoe have been interpreted by researchers at the University of Nevada, Reno (K.D. Smith and others, 2004, Evidence for deep magma injection beneath Lake Tahoe, Nevada-California: Science, v. 305, p. 1277-1280) to indicate active magma at a depth of approximately 30 kilometers. There does not appear to be a near-term threat of volcanic eruption from this area, in part because the last documented eruption in the area was approximately one million years ago. It is likely that seismic instruments will detect any imminent eruption in time to warn people to avoid the hazard. Our ability to monitor small tremors associated with magma at depth is limited by the currently small number of seismographs that are operated in Nevada. The Nevada Seismological Laboratory and the U.S. Geological Survey have joint responsibilities for earthquake monitoring and warnings. The Advanced National Seismic System, which is authorized by Congress but currently has been funded at only a fraction of its intended size, will help to monitor for earthquakes and pending volcanic eruptions.

The Soda Lake and Little Soda Lake (near Fallon in Churchill County) maars (volcanoes that form by explosions when magma rises near the surface of the earth and boils the groundwater) are probably the youngest volcanoes within the borders of the State. They have not erupted in recorded history, although they definitely are younger then the last high stand of Lake Lahontan, about 13,000 years ago, because deposits from these volcanoes overlie sediments deposited in the lake. On the basis of preliminary helium isotopic studies (Thure Cerling, University of Utah, personal communication, 1997), the eruption at Soda Lake may be younger then 1,500 years before present. Phreatic eruptions such as the one that caused Soda Lakes to form pose a risk of asphyxiation from volcanic gases released. Somewhat similar phreatic events, but without magma, have occurred at Steamboat geothermal area just south of Reno. The youngest volcanic rocks exposed at the Earth's surface in the Steamboat area are approximately one million years old.

Other relatively young volcanoes occur in the Crater Flat – Lunar Crater zone, Nye County, which includes basaltic volcanoes ranging in age from about 38,000 to 1 million years old (Smith, E.I. Keenan, D.L., Plank, T. 2002, Episodic volcanism and hot mantle: implications for volcanic hazard studies at the proposed nuclear waste repository at Yucca Mountain, Nevada: GSA Today, v.12, no.4, p. 4-10); in Clayton Valley, near Silver Peak in Esmeralda County; near Winnemucca in Humboldt County; and near Reno in Storey County. Most of these are basaltic volcanoes, which typically form small cinder cones and small lava flows. There are also some one million-year-old rhyolitic lava flows in the Reno area near Steamboat Hot Springs, but volcanoes in this area are thought to be extinct.

Although geothermal power plants in many parts of the world are associated with active volcanoes, the 15 geothermal power plants in northern Nevada do not appear to be associated with magma. With the possible exception of the Steamboat geothermal system at the south end of Reno, the geothermal areas in Nevada appear to be derive their heat from deep circulation of groundwater rather than direct connections with magma or cooling igneous rock. A hazard that is recognized in the Steamboat area is violent eruption of steam, mud, and rock from geysers. As indicated on the geologic map of the Mt. Rose NE Quadrangle (Nevada Bureau of Mines and Geology Map 4Bg), such eruptions have occurred during the Quaternary Period near the Mount Rose Highway (Nevada Route 431), west of the intersection with U.S. Highway 395, and could occur again there or in other parts of the Steamboat area. The hazard from such eruptions is a local feature that would not be likely to require federal assistance.

3.3.18.3 *Location, Severity, and Probability of Future Events*

There is clearly some potential for ash from the Mono Craters and Inyo Craters to affect airplanes, air quality, and highway driving in Nevada, particularly in near-downwind areas of Esmeralda, Mineral, and Nye Counties. Similarly, there is some potential for ash from Cascade volcanoes in northern California (Lassen Peak and Mt. Shasta areas) and Oregon to affect airplanes, air quality, and highway driving in northern Nevada, particularly Washoe, Humboldt, Pershing, and Elko Counties. Geologic evidence of past eruptions from these volcanoes, recognized as ash deposits of particular ages and distinct chemical compositions, is abundant in Nevada. Volcanic gases associated with phreatic eruptions could pose a localized threat of asphyxiation to humans in poorly ventilated spaces in the immediate vicinity of these vents. Several CO_2 deaths occurred at Mammoth Mountain, California when a skier and rescuers became trapped in a snow pocket that was filled with gas. However, it is noted that the ski resorts in that region are located in close proximity to volcanoes.

Volcanoes are considered a "Very Low Risk" hazard in Nevada in part because the consequences are likely to be minimal for the types of eruptions that would affect Nevada. The probability for this hazard is low. Mitigation actions are limited to public awareness and evacuation procedures at the local level.

The rating for volcano acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in Table 3-46 below.

Table 3-46. Volcano Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City	X			
Churchill County				X
Clark County				X
Douglas County				X
Elko Band				X
Elko County				X
Ely Shoshone Tribe				X
Esmeralda County				X
Eureka County				X
Humboldt County				X
Lander County				X
Lincoln County				X
Lyon County				X
Mineral County				X
Nye County				X
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley				X
South Fork Band Tribe				X
Storey County				X
Washoe County	X			
Washoe Tribe	X			
White Pine				X

3.3.19 **Wildfire** (High Risk)

Figure 3-31. Wildland Urban Interface fire outside of Pioche, NV

3.3.19.1 ***Nature***

A wildfire is a type of fire that spreads by consumption of vegetation. It often begins unnoticed, spreads quickly, and is usually signaled by dense smoke that may be visible from miles around. Wildfires can be caused by human activities such as arson or campfires or by natural events such as lightning. Wildfires are not confined to forests but can easily ignite in other areas with ample vegetation such as sagebrush or cheatgrass. Additionally, wildfires can be classified as urban fires, interface or intermix fires, and prescribed fires.

Nevada is susceptible to weather that may range from prolonged periods of drought to periods that are marked by above average precipitation. The result of these weather ranges produces millions of acres of dead or dying vegetation, which rapidly dries out under normal summer weather conditions. The dry, hot conditions and windy weather patterns characteristic of Nevada's summers combine with vegetation conditions that fuel fast-moving, high intensity wild land fires.

The following three factors contribute significantly to wildfire behavior and can be used to identify wildfire hazard areas.

- **Topography:** Topography is the configuration of the earth's surface, including its relief and the position of its natural and man-made features. Topography has a direct bearing on fire behavior. As slope increases, the rate of wildfire spread increases. A slope's aspect correlates with the amount of moisture, quantity and type of vegetation. As slope increases, the rate of wildfire spread increases. South-facing slopes are also subject to more solar radiation, making them drier, thereby intensifying wildfire behavior. However, ridge-tops may mark the end of wildfire spread, since fire spreads more slowly or may even be unable to spread downhill.
- **Fuel:** Fuel characteristics determine the potential fire intensity, and influence the rate of spread. The type and condition of vegetation plays a significant role in the occurrence and spread of wildfires. Certain types of plants are more susceptible to burning or burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. The risk of fire is increased significantly during periods of prolonged drought, as the moisture content of both living and dead plant matter decreases. The fuel's continuity, both horizontally and vertically, is also an important factor.
- **Weather:** The most variable factor affecting wildfire behavior is weather. Temperature, humidity, wind, and lightning can affect both the chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildfire activity. By contrast, cooling and higher humidity often signal reduced wildfire occurrence and easier containment. Wind has the greatest impact on fire behavior of any of the weather factors. The passage of a warm front will usually bring a wind direction shift of 45 to 90 degrees. The passage of a cold front will shift wind direction from less than 45 degrees to as much as 180 degrees. Great Basin heating causes downslope winds in Nevada. As the winds flow downslope in the atmosphere it is compressed, becoming warmer and dryer. This causes the fuels to dry out. As the temperature increases, wind speed may reach 50 to 70 miles per hour. Another extreme weather condition that Nevada faces is thunderstorms. A thunderstorms effect may extend 25 to 30 miles from the actual storm. Downbursts are caused by thunderstorms collapsing. When this happens, cool air is released in a downward direction. When this occurs, it will adversely affect fire behavior and fire suppression efforts.

The frequency and severity of wildfires also depends on other hazards, such as lightning, drought, and infestations. If not promptly controlled, wildfires may grow into an emergency or disaster. Fires that break out immediately following earthquakes can be particularly devastating, because the earthquake may have impaired the ability to reach or combat an urban or urban interface fire. Even small fires can threaten or destroy lives, resources, improved properties. In addition to affecting people, wildfires may severely affect wildlife, livestock, and pets. Such events may require emergency watering/feeding, evacuation, and shelter. After the wildfire season of 2006, Elko issued a second hunting season to reduce the population of wildlife that was dying from the lack of vegetation.

The indirect effects of wildfires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, increasing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards.

3.3.19.2 *History*

In Nevada, particularly in Northern Nevada, wildfires are a common yearly event. Nevada's fire season starts in May and ends in October, but wildfires can occur at any time of the year depending on fire and weather conditions.

Nevada's fire regime is outside the range of historical variation which means that wildland fires have become larger, more destructive, and more frequent. In the past fifty years there have been eight large fire seasons in Nevada. Five of these fire seasons have occurred in the past eight years. Since the record fire season of 1999, over five million acres of Nevada's forest, watersheds and rangelands have burned. These fires have devastated ranches, watersheds and wildlife habitat. With each fire more native plant communities are lost, causing cheatgrass and red brome to spread. The spread of these invasive annual plants perpetuates the cycle of destructive fires and the loss of native plant communities.

Out of the ten worst fire seasons since 1960 in terms of acres burned, five of those have occurred from 1999 to 2006. The 2006 fire season had 1,274 wildfires that burned 1,348,871 acres in the State of Nevada. These fires threatened not only homes, but plant and animal species.

Table 3-47 presents a brief history of some of the most destructive Nevada wildfires in the last 6 years.

Table 3-47. Wildfire History

Place	Date	Description
Washoe County	2004	Verdi Fire Complex: This fire was located west and northwest of Reno. The blaze burned 1,094 acres west of Peavine Peak and cost $980,000 to fight.
Carson City	2004	Waterfall Fire: This fire was located in Kings Canyon near Carson City. This fire burned more than 300 acres, threatened 350 homes and exhibited extreme behavior. About 200 personnel responded to the fire that caused evacuation of 50 homes closest to the flames.
Clark County	2004	Robbers Fire: This fire burned near Mount Charleston in Clark County. The 1,000-acre Robbers fire resulted in the evacuation of about eight residential structures and Camp Stimpson, a Girl Scout camp, and the Spring

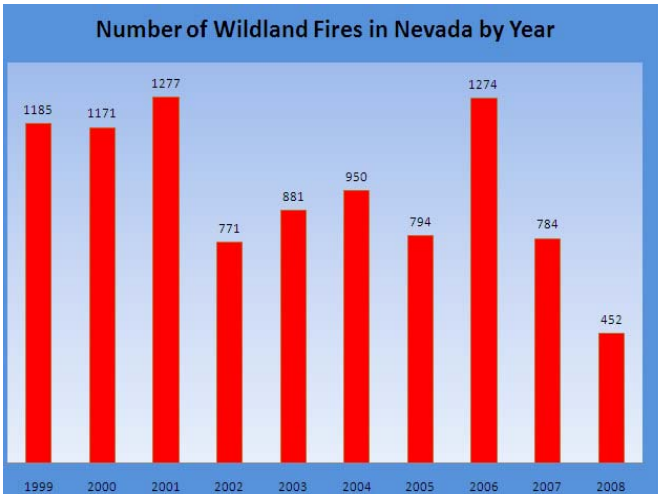
Table 3-47. Wildfire History

Place	Date	Description
		Mountain Youth Camp, a juvenile detention center. In addition, 400 homes were under voluntary evacuation near an area known as Kyle Canyon.
Carson City, Washoe Co.	2004	Andrew Fire: The fire was located between Carson City and Reno. At the time the FEMA money was approved, the fire had burned more than 1,000 acres and a few residences. The fire threatened hundreds of homes in the town of Pleasant Valley. An estimated 300 people were evacuated.
Clark County	2005	Goodsprings Fire: This fire burned 31,600 acres of land near Las Vegas. It threatened Red Rock Conservation area, Mountain Springs, and Mt. Potosi area. It was started by lightning.
Elko County	2005	Vor-McCarty Fire: This fire burning near Elko, in the northeastern part of the state threatened the Upper Ten Mile subdivision. It consumed more than 500 acres and threatened several historical structures.
Elko County	2005	Chance Fire: The fire, which started August 28, had consumed more than 6,000 acres. It resulted in the voluntary evacuation of approximate 200 residents. The fire burned near the communities of Ryndon, Osino and Elburz in Elko County.
Elko County	2006	Suzie Fire: This fire burned more than 78,300 acres about five miles from Elko. This fire threatened rangelands, homes, and highways. A five-member strike team from California, composed of personnel and engines from fire departments in Sacramento, Placer and Nevada counties was involved in fighting this fire.
Humboldt	2006	Oregon Fire: This fire burned more than 160 square miles of Nevada rangeland near the Oregon border. Also, this fire on the Oregon side threatened the major transmission lines that carry power between California and the Pacific Northwest.
Washoe County, Carson City	2006	Linehan Fire Complex: This fire burned about 8,000 acres, threatening homes in Carson City. One federal Type I incident response team moved in to battle the 8,000-acre Sierra-Tahoe complex of fires in western Nevada near Reno and Carson City.
Washoe County	2006	The Verdi Fire burned 6000 acres west of Reno, Nevada threatening the Somersett home subdivsions area. It significantly depleted the winter food for the deer in this area.
Elko County	2006	The Mud Fire burning more than 3,000 acres on the outskirts of Elko. It was a human–caused fire that

Table 3-47. Wildfire History

Place	Date	Description
		threatened businesses and a number of state and Federal facilities. A Fire Management Assistance Grant (FMAG) was approved August 23, 2006. At the time of the grant, the Mud Fire threatened 300 homes and had forced mandatory evacuations of about 1,000 persons.
Washoe County	2006	The Pine Haven Fire: This fire was caused by power lines and windy conditions. Firefighters held the blaze to approximately 300 acres with wildland fire engines, structure fire engines, water tenders, several hand crews and other equipment. Although the fire briefly threatened homes near Caughlin Ranch near Reno, no structures were damaged or lost during the fire.
Washoe County	2007	The Hawkens Fire was caused by construction crews working in the Caughlin Ranch subdivision near Reno. The fire burned 2,710 acres in the wildland urban interface and threatened numerous homes and structures.
Elko County	2007	The Red House Complex of multiple fires in Elko County burned 71,340 acres total.
Humboldt County	2007	The Kelly Creek fire burned 18,806 acres and threatened several rural ranches in the Humboldt County area.
Elko County	2007	The West Basin Fire burned 61,070 acres and threatened several local ranches in the area.
Elko County	2007	The Eccles Fire burned 19,959 acres and threatened several ranches and structures.
Elko County	2007	The Murphy Complex, the Wine Cup Complex, and the Highway 93 Complex fires together burned 648,154 acres. Resources in the surrounding area and around the state were at maximum drawdown.
Nye County	2008	The Elkhorn fire burned 6,198 acres.
Washoe County	2008	Gooseberry fire burned 3,042 acres and threatened several outbuildings.
Elko County	2008	The East Slike Rock Ridge fire burned 40,937 acres and threatened the town of Jarbidge.
Washoe County	2009	The Redrock Fire burned 10,549 acres and threatened several subdivisions in the Redrock community.
Churchill County	2009	The Hoyt Fire burned 10,670 acres. There was one pilot fatality on this fire.

Additionally, large fires generate an increase in the spread of invasive species like cheatgrass and red brome. In many cases these invasive species are more fire prone than native species and fuel larger, more intense fires. In recent years this fire-invasive-fire cycle is accelerating and posing serious threats to the health of some Nevada ecosystems.



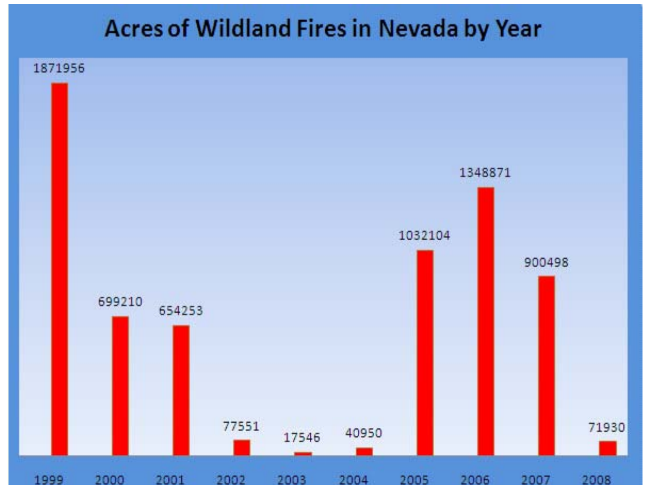


Figure 3-32. Wildfire Acreage Burned in Nevada - Contributed by Mike Dondero, Fire Management Officer
Source information from Western Great Basin Geographic Area Coordination Center
http://gacc.nifc.gov/egbc/predictive/intelligence/intelligence.htm

3.3.19.3 *Location, Severity, and Probability of Future Events*

The entire State of Nevada is at risk to wildfires due to fuel loading, ignition risk, weather, and topography. No specific area of the State is immune to this risk. The State of Nevada Division of Forestry is the lead agency for wild-land urban interface fire planning, mitigation, and response. The agency's mission is to provide professional natural resource and fire services to Nevada's citizens to enhance and protect forest, rangeland, and watershed values; conserve endangered plants and other native flora; and provide effective statewide fire protection and emergency management.

In a collaborative effort, government agencies at all levels, tribes, communities, volunteers, and a variety of other participants have reduced the threats posed by wildland fire since adoption of the Western Governor Association's A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment - *10-Year Strategy, Implementation Plan*.

The revision of the *10-Year Strategy* in December of 2006 gives direction for a collaborative framework that crosses agency jurisdictions and program boundaries. It strongly emphasizes the following:

- Information sharing and monitoring of accomplishments and forest conditions to improve transparency
- Long term commitment to maintaining the essential resources for project implementation
- Landscape-level approach to the restoration of fire adapted ecosystems

- Use of fire as a management tool (wildland fire use, prescribed fire)
- Improve collaboration on all levels consistent with the *10-Year Strategy,* the *Implementation Plan*, and individual agency goals and objectives.

The severity of wildfires in the State of Nevada has been determined by the Nevada Hazard Mitigation Planning Committee (NHMPC) using a hazard ranking system and vulnerability rating explained in section 3.2.1 and 3.2.2.

The rating for wildfires in Nevada is a "High Risk" hazard.

Nevada's Extreme Wildfire Hazard Communities A key element of the **Healthy Forests Initiative** announced by the White House in 2002 is the implementation of core components of the ***National Fire Plan Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment 10- year Comprehensive Strategy***. Federal agencies and western state governors adopted the Plan in the spring of 2002 in collaboration with county commissioners, state foresters, and tribal officials. The Plan calls for more active forest and rangeland management to reduce the threat of wildfire in the wildland urban interface.

The Healthy Forest Restoration Act (H.R. 1904) was signed into law in December of 2003. The act creates provisions for expanding the activities outlined in the National Fire Plan. During this year the Nevada Fire Safe Council received National Fire Plan funding through the Department of Interior Bureau of Land Management to conduct a Community Risk/Hazard Assessment in at-risk communities across Nevada. The communities to be assessed are among those named in the 2001 Federal Register list of Communities-at-Risk within the vicinity of Federal lands (66 FR 160). The list identifies Nevada communities adjacent to Federal lands that are most vulnerable to wildfire threat in Nevada.

During 2004, field teams comprised of fire behavior specialists, foresters, rangeland fuels specialists, and field technicians visited over 250 communities in Nevada's seventeen counties to assess both the risk of ignition and the potential fire behavior hazard. With the use of procedures accepted by Nevada's wildland fire agencies, these specialists focused their analysis on the wildland urban interface areas where homes and wildlands meet. This effort is known as the Nevada Community Wildfire Risk/Hazard Assessment Project. The reports generated by the Nevada Community Wildfire Risk/Hazard Assessment Project for each of the 17 counties in Nevada, as well as two reports for Lake Tahoe communities may all be viewed on the website below:

http://www.rci-nv.com/home/rci-reports/

Upon completion of the Community Wildfire Protection Plans (CWPP), the plans are approved by County Commissioners, local fire chiefs, and the State Forester. These plans serve as the basis for risk assessment ratings and development of wildfire mitigation strategies for the assessed communities.

Specific goals of the Nevada Community Risk/Hazard Assessment Project in developing the CWPPs are the following:

- Reduce the threat of wildland fire to the communities.

- Raise the level of public awareness about ignition risk factors and fire safe practices in the wildland urban interface.
- Improve local coordination for suppression activities.
- Identify and pursue firefighting resource needs (equipment and infrastructure).
- Describe proposed risk and hazard mitigation projects in enough detail to aid communities in applying for future implementation funds.

Source: *Nevada Community Wildfire Risk / Hazard Assessment Project*, Resource Concepts, Inc., 1.0 Introduction

The Community Risk/Hazard Assessments were conducted systematically. The assessment teams observed and recorded the factors that significantly influence the risk of wildfire ignition along the wildland-urban interface, and inventoried features that can influence hazardous conditions in the event of a wildfire. Interviews with local fire agency and emergency response personnel were completed to assess the availability of suppression resources and identify opportunities for increased community preparedness. A description of the existing fuel hazard and fire behavior potential was discussed and presented with photos for each community.

Four primary factors that affect potential fire hazard were assessed to arrive at the community hazard assessment score:

1. community design,
2. structure survivability,
3. availability of fire suppression resources, and
4. physical conditions such as the vegetative fuel load and topography.

An ignition risk rating of low, moderate, or high was assigned to each community. The rating was based upon historical ignition patterns, interviews with local fire personnel, field visits to each community, and professional judgment based on experience with wildland fire ignitions in the Great Basin.

The results of each community assessment are formatted to facilitate ease of reference and reproduction for individual communities. Each community is mapped and recommendations to improve fire safety are described and summarized in table form. Summary sheets highlighting important aspects of Defensible Space and Homeowner Responsibilities are formatted for widespread distribution. These tools will aid local, state and federal agencies in strategic planning, raising public awareness, and seeking funding for future risk and hazard reduction projects. Mitigating the risks and hazards identified by these assessments is not only crucial to the long term goals of the National Fire Plan, but also to the short and long-term viability of Nevada's communities, natural resources, infrastructures, and watersheds. As of June 2007, twelve of the seventeen counties have signed and approved their plans as Community Wildfire Protection Plans (CWPPs).

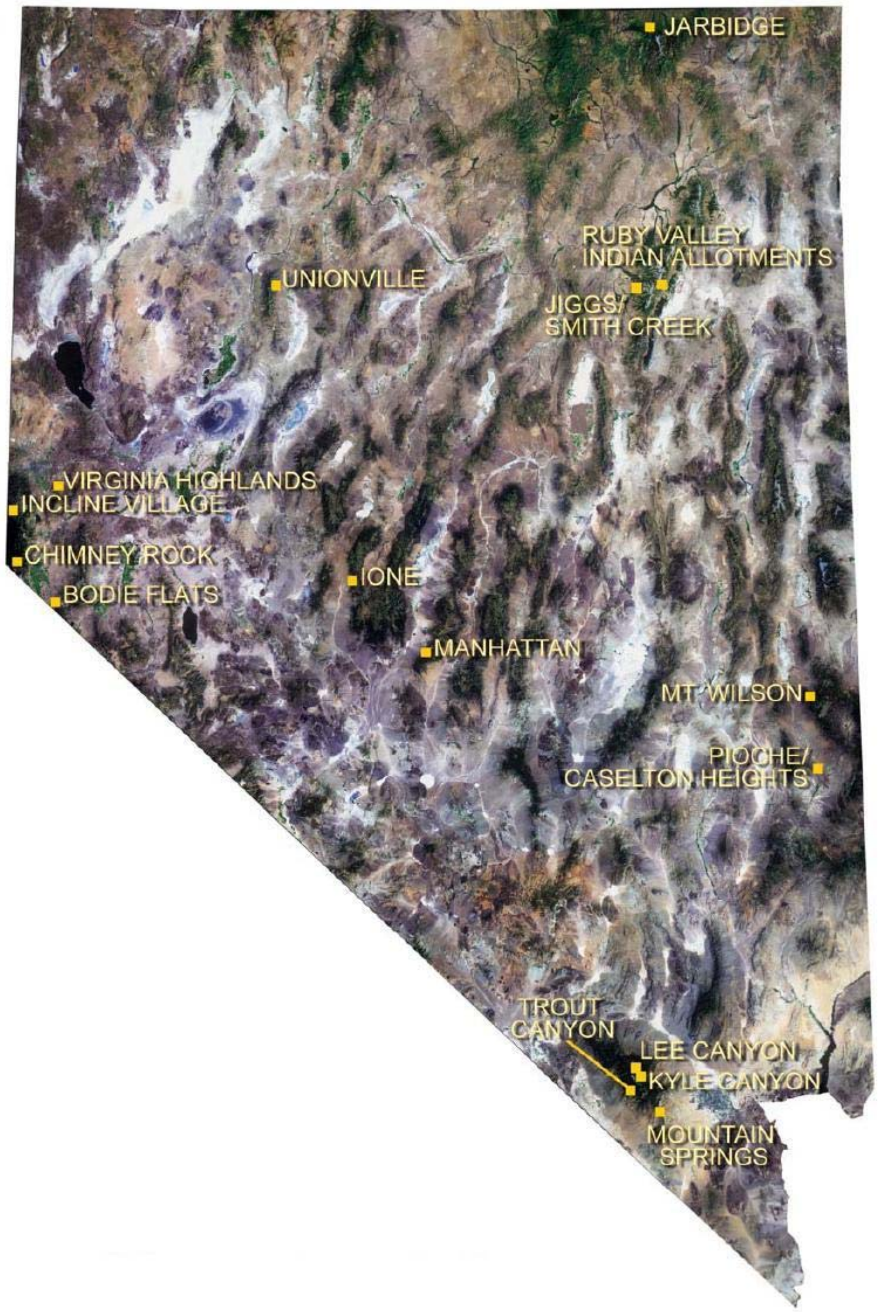
The initial CWPP assessment covered communities at risk defined in the 2001 Federal Register in the interface, intermix and occluded conditions. This assessment simply represented a snapshot in time of the conditions in the identified communities. However, wildland fire conditions continue to change and new and existing communities are impacting the wildland environment causing the need for ongoing collaborative review and updating of the original assessments as well as creating new assessments. Currently, the Bureau of Land Management has contracted with a company to conduct the second assessment, the scope of which will cover the rural condition as well as areas of the state that were not included in the first assessment.

A part of the State of Nevada Division of Forestry's fire planning, mitigation, and response is the preparation of Community Wildfire Protection Plans (CWPP) for each county in the State. Ed Smith and Sonya Sistare from the University of Nevada Cooperative Extension reviewed the CWPPs and prepared a report, *Course of Study Reports for Nevada's Extreme Wildfire Hazard Communities,* outlining the risk factors that identify communities with wildfire risks. The factors used to rate the State of Nevada's communities are the following:

1. Contributing factors
    a. History of lightning strikes
    b. Camping activities
    c. High level of visitors/recreational activities
    d. Under-story provides receptive fuel bed for ignition
    e. Thick brush/trees provide receptive fuel bed for ignition
    f. Improperly maintained power line corridors
    g. High fuel loads
    h. High winds
2. Community Design
    a. Wildland-Urban Interface Condition
    b. Number of homes
    c. Ingress/Egress
    d. Width of Road
    e. Accessibility
    f. Secondary Roads
    g. Visible Street Signs
    h. Visible address
    i. Utilities-ignition risk
3. Construction Materials
    a. Non-combustible roof
    b. Non-combustible siding
    c. Unenclosed structures
4. Defensible Space
    a. Lot size
    b. Defensible Space
5. Fire Behavior
    a. Fuels
    b. Fire Behavior
    c. Slope
    d. Aspect
6. Suppression Capability
    a. Available water source
    b. Fire protection
    c. Primary fire protection service
    d. Supporting fire protection service
    e. Additional support

7. Additional Factors Chapter
    a. Existing Fire Safe Council

Figure 3-33. Map showing the communities designated as having extreme wildfire hazard risk, using the factors listed above.



The following table lists all the communities that were rated using the information provided by the CWPPs, grouped by county, and the hazard rating for each community.

Table 3-48. Wildfire Hazard Rating for Nevada Communities by County

County/Community	Elev_ Ft	hazard rating
Carson City		
Ash Canyon-WNCC		Moderate
C-Hill		Moderate
Carson Colony-Voltaire Canyon		High
Clear Creek		Extreme
Edmonds-Prison Hill		High
Kings Canyon-Lower		Low
Kings Canyon-Upper		High
Lakeview		High
Mexican Dam	4600	High
North Carson		High
Pinion Hills		High
Stewart-South Carson		Moderate
Timberline		Moderate
Churchill		
Cold Springs	5565	Moderate
Eastgate	5100	High
Fallon	3963	Low
Fallon Naval Air Station		Low
Fallon Outskirts		Low
Middlegate	4605	Moderate
Clark		
Arden	2491	Low
Blue Diamond	3400	Low
Boulder City	2501	Low
Bunkerville	1529	Low
Cactus Springs	3230	Moderate
Cal-Nev-Ari	2570	Low
Cold Creek (not geocoded)		High
Cottonwood Cove (not geocoded)		Low
Glendale	1526	Low
Goodsprings	3718	Moderate
Henderson	1881	Low
Indian Springs	3160	Low
Kyle Canyon Summer Home Area	7627	Extreme
Las Vegas	2000	Low
Laughlin	535	Low
Lee Canyon Summer Home Area	8300	Extreme
Logandale	1362	Low
Mesquite	1608	Low
Moapa Valley	1329	Moderate
Mountain Springs	5413	Extreme
Nelson	2954	High
North Las Vegas	1845	Low
Overton	1263	Low
Palm Garden Estates (not geocoded)		Low
Primm	2625	Low
Sandy Valley	2641	Moderate
Searchlight	3470	Moderate
Sloan	2830	Low
Torino Ranch (not geocoded)		High
Trout Canyon (not geocoded)		Extreme
Douglas		
Alpine View (not geocoded)		Moderate
Bodie Flats (not geocoded)		Extreme
Chimney Rock (not geocoded)		Extreme
China Springs (not geocoded)		High
Double Springs (historical)/Spring Valley	5952	High
Dresslerville	4892	Moderate
East Valley (not geocoded)		Low
Elk Point/Zephyr Heights/Round Hill	6280	High
Fish Springs (not geocoded)		High
Gardnerville	4746	Low
Gardnerville Ranchos	4863	Low

County/Community	Elev_ Ft	hazard rating
Genoa	4788	High
Glenbrook	6260	High
Holbrook Junction	5400	High
Indian Hills/Jacks Valley	4740	Moderate
Johnson Lane	4818	Moderate
Kingsbury	6800	High
Job's Peak Ranch (not geocoded)		High
Logan Shoals (not geocoded)		High
Minden	4721	Low
North Foothill Road Corridor (not geocoded)		High
Pine Nut Creek (not geocoded)		High
Ruhenstroth (not geocoded)		Moderate
Sheridan	4806	High
Skyland/Cave Rock	6260	High
Stateline	6260	Moderate
Topaz Lake	5080	Moderate
Topaz Ranch Estates		High
Elko		
Adobe Heights (not geocoded)		High
Adobe Ranchos (not geocoded)		High
Carlin	4900	Moderate
Charleston	5947	Rural
Clover Valley		Rural
Contact	5560	High
Currie	5800	Moderate
Deeth/Starr Valley	5335	High
Elburz	5210	Moderate
Elko	5067	Moderate
Gold Creek- moderate		Moderate
Goose Creek- rural (not geocoded)		
Hidden Valley/Coal Mine (not geocoded)		Moderate
Humboldt Ranchettes (not geocoded)		Moderate
Independence Valley (not geocoded)		Rural

County/Community	Elev_ Ft	hazard rating
Jackpot	5240	Low
Jarbidge	6218	Extreme
Jiggs/Smith Creek	5482	Extreme
Lamoille	5887	High
Lee/South Fork Indian Reservation	5760	High
Lucky Nugget I & II (not geocoded)		High
Midas	5745	High
Montello	4880	Low
Mountain City	5620	High
North Fork	6140	Moderate
Oasis	5865	Moderate
Osino	5134	High
Owyhee	5397	Moderate
Plot Valley (not geocoded)		Moderate
Ruby Valley	5920	Moderate
Ruby Valley Indian Reservation	5920	Extreme
Ruby Lake Estates	5920	High
Ruby Lake National Wildlife Refuge & Hatchery	5920	Moderate
Ryndon	5170	Moderate
Spring Creek	5700	Moderate
Ten Mile (not geocoded)		High
Tuscarora	6118	High
Wells	5630	Low
West Wendover	4450	Low
Wild Horse Estates- (not geocoded)		Moderate
Esmeralda		
Dyer/Fish Lake Valley	4886	Low
Gold Point	5388	Moderate
Goldfield	5689	Moderate
Lida	6161	Moderate
Silver Peak	4320	Moderate
Eureka		
Beowawe	4690	Moderate
Crescent Valley	4812	Low
Dunphy	4630	Low
Eureka	6481	High
Shoshone	4629	
Humboldt		
Denio	4200	Moderate

County/Community	Elev_ Ft	hazard rating
Denio Junction	4218	Low
Golconda	4400	Moderate
McDermitt	4424	High
Paradise Hill/Paradise Ranchos	4482	Low
Paradise Valley	4530	Moderate
Quinn River Crossing	4080	Rural
Valmy	4492	Moderate
Winnemucca	4299	Moderate
Lander		
Austin	6527	High
Battle Mountain	4512	Low
Battle Mountain		Low
Grass Valley	5900	Rural
Hilltop	6600	Low
Kingston	5940	High
Lincoln		
Alamo	3449	Moderate
Ash Springs	3630	Rural
Caliente	4395	Moderate
Hiko	3869	Rural
Panaca	4738	Moderate
Pioche/Caselton Heights	6064	Extreme
Rachel	4830	Moderate
Ursine/Eagle Valley	5585	High
Lyon		
Dayton	4440	Moderate
Fernley	4153	Low
Mark Twain Estates	4400	Moderate
Mason Valley	4423	Moderate
Mound House (historical)	4960	Moderate
Silver City	5060	High
Silver Springs	4209	Low
Smith Valley	4726	Moderate
Stagecoach	4304	Low
Wabuska	4299	Moderate
Weed Heights	4640	Moderate
Weeks (historical)/Fort Churchill	4205	Moderate
Yerington	4390	Low
Mineral		
Hawthorne	4330	Low
Luning	4680	Moderate
Marietta	4940	High
Mina	4546	Moderate
Schurz	4120	Moderate
Walker Lake	4120	Moderate
Nye		
Amargosa Valley	2655	Moderate
Beatty	3308	Moderate
Belmont	7440	High
Carvers	5625	Moderate
Gabbs	4597	Moderate
Hadley/Round Mountain	5757	Low
Ione	6800	Extreme
Manhattan	7000	Extreme
Pahrump	2690	Low
Tonopah	6030	Low
Pershing		
Humboldt	4225	High
Imlay	4195	Moderate
Lovelock	3975	Moderate
Mill City	4220	Moderate
Oreana	4158	Moderate
Rye Patch	4252	Moderate
Unionville	5050	Extreme
Storey		
Gold Hill	5820	High
Lockwood	4640	Moderate
Virginia City	6220	High
Virginia City Highlands	5990	Extreme
Washoe		
Anderson Acres (not geocoded)		Moderate
Antelope Valley (not geocoded)		High
Cold Springs	5055	Moderate
Crystal Bay	6360	Extreme
Empire	4040	Low
Galena (not geocoded)		Moderate
Gerlach	3951	Moderate
Golden Valley	5095	Moderate
Incline Village	6420	Extreme
Lemmon Valley	4951	Moderate
Mogul/I-80 Corridor West	4701	Moderate
Nixon	3938	Moderate
Palomino Valley (not geocoded)		Moderate
Pleasant Valley	4775	Moderate
Rancho Haven (not geocoded)		High

County/Community	Elev_ Ft	hazard rating
Red Rock (not geocoded)		High
Reno	4498	Moderate
Reno Northwest		Moderate
Reno Southeast		Moderate
Reno Southwest		Low
Reno-Stead	5010	Low
Silver Knolls (not geocoded)		Moderate
Spanish Springs	4534	Moderate
Sparks	4410	Low
Steamboat	4600	Moderate
Sun Valley	4720	Moderate
Sutcliffe	3900	Moderate
Verdi	4905	Moderate
Wadsworth	4076	Low
Warm Springs Valley (not geocoded)		High
Washoe City	5060	Moderate
Washoe Valley East		Moderate
White Pine		
Baker	5310	Moderate
Cherry Creek	6119	High
Ely	6427	Moderate
Lund	5560	Moderate
McGill	6210	Moderate
Pleasant Valley (historical)	6270	Moderate
Preston	5630	Moderate
Ruth	6870	Moderate
Shoshone	5785	Rural
Strawberry (historical)	5940	Rural

Total Number of Communities Rated	**230**
Number of Communities Rated Extreme Wildfire Hazard	**17**
Number of Communities Rated High Wildfire Hazard	**55**
Number of Communities Rated Moderate Wildfire Hazard	**98**
Number of Communities Rated Low Wildfire Hazard	**51**
Rural Communities (not rated but assessed)	**9**

The University of Nevada—Reno (UNR) Cooperative Extension coordinated a WUI summit in September 2007. The purpose of the meeting was to bring State, local and federal agencies together to provide information to communities that are rated as extreme risks. By promoting awareness, the intent was to stimulate the community's desire to mitigate the wildfire risk through a grassroots level approach. The members at the summit agreed to support the WUI and make it an annual event.

The U.S BLM is conducting a statewide wildland fire risk assessment for lands not covered by current CWPPs. There is also a partnership of state and federal agencies including the U.S. Forest Service and the Nevada State Forester to conduct a risk assessment of wildland fire hazard in 17 western states.

Due to Nevada's geography and environment, wildland fires will continue to occur. Increased public awareness, risk management, and control of new land development at the local level are necessary to mitigate this risk.

3.3.19.4 Vulnerability and Analysis of Potential Losses

Table 3-49 below presents an assessment of wildfire vulnerability and potential losses of due to wildfire in Nevada counties and tribal lands and the current status of their hazard mitigation plans. Eight counties and three tribes have plans represented on the table. Churchill and Lyon Counties are currently in the process of completing their planning efforts. Applications for funding to begin the development of two regional hazard mitigation plans will be submitted, one of which will consist of Eureka, and White Pine Counties, and a second plan which will include Humboldt, Lander, and Pershing Counties as participants. Mineral County will submit a request for funding to develop its own single jurisdictional hazard mitigation plan, as its geographical location does not allow it to participate in either of the two regional plans beung developed.

To assist the communities without a wildfire vulnerability assessment for the current iteration of this plan, the state will request funding to work with Nevada Division of Forestry and the local county assessors to gather building stock value and number data resulting in a GIS-based vulnerability analysis that will be available to those communities on a user-friendly website.

Table 3-49. Wildfire Vulnerability Assessment of Nevada Counties and Tribal Lands

County/Tribal Hazard Mitigation Plan	Hazard Rating	Population affected	Building Inventory Affected				No. of Critical Facilities affected		Total by Rating	Total Losses in ($ x1000)
			Residential		Non-Residential					
			Number	Value in ($x1000)	Number	Value in ($ x1000)	Number	Value in ($x1000)		
Carson City	Extreme								0	
	High	11,632	2,423	705,611	504	613,275	15	900	1,319,786	
	Moderate								0	1,319,786
Churchill County	Extreme								0	
	High	NYA							0	
	Moderate								0	
Clark County	Extreme								0	
	High								0	
	Moderate								0	0
Douglas County	Extreme	25,693	11,657	2,115,700	297	777,777	28	53,400	2,946,877	
	High								0	
	Moderate								0	2,946,877
Duck Valley Indian Reservation	Extreme								0	
	High	1,268	449	39,695	8	1,287	131		40,982	
	Moderate								0	40,982
Elko County	Extreme	0	0				0	0	0	
	High	3	2	188	0	0	2	1,947	2,135	
	Moderate	14,679	3,501	6,993	42	2,779	84	69,191	78,963	81,098
Elko Band	Extreme								0	
	High								0	
	Moderate	729	267	30,884	15	44,797	6	4,565	80,246	80,246
Esmeralda County	Extreme								0	
	High								0	
	Moderate	971	629	32,554	10	1,391	35	6,500	40,445	40,445
Eureka County	Extreme								0	

Table 3-49. Wildfire Vulnerability Assessment of Nevada Counties and Tribal Lands

			Building Inventory Affected							
	High	NYA							0	
	Moderate								0	0
Humboldt County	Extreme								0	
	High	NYA							0	
	Moderate									0
Lander County	Extreme								0	
	High	NYA							0	
	Moderate								0	0
Lincoln County	Extreme	890							0	
	High	60							0	
	Moderate	1,123	378	45,426	6	17,919			63,345	63,345
Mineral County	Extreme								0	
	High	NYA							0	
	Moderate								0	0
Nye County	Extreme	103	75	71	5,840	2	5,400		73	
	High	63	75	6,169	0	0	0	0	6,169	
	Moderate								0	6,242
Pershing County	Extreme								0	
	High	NYA							0	
	Moderate								0	0
Storey County	Extreme	2	1	65	0	9	0	0	74	
	High	256	94	6,875	1	964	2	1,078	8,917	
	Moderate	1,882	739	509,789	2	8,717	44	39,883	558,389	567,380
Washoe County	Extreme	3,590	9,082	892,574	562	1,027,232	49	Not available	1,919,806	
	High	3,484	8,814	880,653	1,233	880,653	39	Not available	1,761,306	
	Moderate	18,068	45,711	3,425,043	5,308	3,425,043			6,850,086	10,531,198

Table 3-49. Wildfire Vulnerability Assessment of Nevada Counties and Tribal Lands

			Building Inventory Affected							
Reno-Sparks Indian Colony	Extreme									
	High									
	Moderate	Not available			2	183				
Pyramid Lake Paiute Tribe	Extreme									
	High	Not available	6	128	2	324				
	Moderate	Not available	6	128	2	324				
Washoe Tribe	Extreme								0	
	High	Not available			Not avaible	15,007			15,007	
	Moderate								0	15,007
White Pine	Extreme								0	
	High	NYA							0	
	Moderate								0	0
State Total	Extreme	30,278	20,815	3,008,410	6,699	1,805,020	5,477	53,400	4,866,830	
	High	16,766	11,857	1,639,191	1,746	1,496,179	189	3,925	3,139,295	
	Moderate	36,723	50,958	4,019,805	5,368	3,455,849	163	115,574	7,591,228	15,597,353

Clark County	*No data for losses was provided in Clark County Plan*
Elko County	*No building stock was found within the extreme wildland fire area*
Esmeralda County	*All people, critical facilities and structures are equally vunlerable to this hazard*
Lincoln County	*The missing building stock exposed to wildland fire will be available in the 2010 iteration of this plan*
Nye County	*No critical facilities were found vulnerable to wildland fire in th 2005 LHMP iteration*
Washoe County	*Amounts reflect entire area including Reno-Sparks Indian Colony and Pyramid Lake Paiute Tribe*
	Current rating for wildfire hazard

Table 3-49. Wildfire Vulnerability Assessment of Nevada Counties and Tribal Lands

			Building Inventory Affected			

NYA = Not Yet Available/plan not completed

3.3.20 Windstorm-Severe *(Low Risk)*

3.3.20.1 *Nature*

Figure 3-34. Windstorm damage in Gabbs, Nevada, 1998. Photo courtesy of NOAA.

Winds are horizontal flows of air that blow from areas of high pressure to areas of low pressure. Wind strength depends on the difference between the high- and low-pressure systems and the distance between them. Therefore, a steep pressure gradient causing strong winds can result from a large pressure difference or a short distance between a high- and low-pressure system, or a combination of these factors.

Strong and/or severe winds often precede or follow frontal activity, including cold fronts, warm fronts, and drylines. Generally, in the southwestern United States, frontal winds can remain at 20-30 mph for several hours and reach peak speeds of more than 60 mph. Severe winds are defined as those greater than or equal to 58 mph.

In addition to strong and/or severe winds caused by large regional frontal systems, local thermal winds are caused by the differential heating and cooling of the regional topography. In a valley/mountain system, as the rising ground air warms, it continues upslope as wind and is replaced by inflow from outside the valley. The intensity of the resulting wind depends on a number of factors, including the shape of the valley, amount of sunlight, and presence of a prevailing wind.

3.3.20.2 *History*

Wind and windstorms are common events in Nevada, especially during the winter and spring months. An example of high winds is the nighttime down-slope wind that blows out into the Reese River Valley at Austin. At times, when there is a large pressure change over a short distance, these winds become strong causing extensive damage.

Mobile homes, power lines, billboards, airplanes, vehicles, roofs and other structures have been damaged by severe winds. Due to the high incidence of damage to mobile homes, insurance companies, in Nevada have adopted policies that require tie downs. The Nevada Department of Commerce enforces regulations requiring mobile homes to be securely anchored (NRS 289.280).

The following list describes some extreme wind events recorded in Nevada.

- In the late 1860s a small smelter and mill were built in Dry Valley, not far from Echo Canyon in Echo State Park in Lincoln County. The small tent camp was called Moodyville and boasted a population of 60 in 1872. A severe windstorm destroyed the camp in 1873 and nothing remains of the site. While it is noted that this was a tent camp, it is interesting that this is the only recorded event where a windstorm erased an entire community.

- On February 3, 1998 a down-slope windstorm occurred along the western side of the Paradise Range in northwestern Nye County, producing sustained winds estimated at 70-80 mph with gusts approaching 100 mph in Gabbs located 90 miles southeast of Reno. Several mobile homes were either overturned or blown off their moorings and numerous mature trees were uprooted. Also, there was widespread structural damage to small buildings around the mining facility.
- On December 14, 2002, a record breaking windstorm howled through northern Nevada. Winds clocked at 82 mph in Reno causing widespread roof, tree, and fence damage. Approximately 140,000 customers in the Reno-Sparks area were without power after the storm.
- In December 2004, 15 miles south of Reno, a trailer southbound on Old Highway 395 was blown into the pathway of incoming traffic. The trailer was shredded. Another truck that had stopped for the collision was overturned by the winds. At least four other big rigs were toppled by gale-force winds that socked Washoe Valley.
- On September 16, 2006, a windstorm toppled the cranes on the Hoover Dam bypass project. The windstorm also knocked down 2,300 foot strands of steel cable. A construction site cleanup had to be completed before the engineers could continue the project. Highway 93 was closed for two days because of falling debris.
- December 26-27, 2006, Post-Christmas Windstorm: The strongest wind in over four years blasted across much of eastern California and western Nevada. Widespread gusts of 60-80 mph, with ridge top gusts over 160 mph along the Sierra Crest, resulted in many trees and some power lines blown down, especially in portions of the Lake Tahoe basin. In Washoe Valley, trucks overturned where a peak gust of 91 mph was measured. Isolated roof and fence damage occurred, and downed power lines sparked a few brush fires, which spread by the strong winds.
- December 27, 2006, Strong winds: A separate period of strong winds near Walker Lake during the early morning overturned two tractor trailers on Highway 95.
- April 27, 2010, Sustained winds up to 63 mph were reported with gusts to 107 mph just south of Reno on U.S. Highway 395, and gusts hit 125 mph at the Mount Rose Ski Resort between Reno and Lake Tahoe. The winds caused power outages to about 5,000 homes and businesses, ripped shingles off roofs, toppled fences, overturned vehicles, and uprooted hundreds of trees, and caused over a dozen flights to be canceled at Reno-Tahoe International Airport. Wind-whipped power lines may have caused a fire at an apartment complex in Stead just north of Reno.

3.3.20.3 *Location, Severity, and Probability of Future Events*

In the *Hazard Risk Assessment Survey* and *County Hazard Mitigation Plans,* Carson City reported that high winds caused severe damage to mobile home structures. Churchill, Douglas, and Lincoln Counties reported that windstorms were a problem. Eureka County reported that there was significant damage to antennas and communication sites.

Washoe Valley, north of Carson City, reports frequent damaging winds in major transportation corridors, especially near the center of the valley along U.S. Highway 395. DEM has records from December, 2006 showing wind damage to Storey County's public and private infrastructure totaling $12,800. DEM also has records reflecting $92,900 in damages to Lyon County's public and private infrastructure.

In the *Tribal Hazard Mitigation Survey,* Shoshone-Paiute Tribes of Duck Valley considered this hazard as low. This tribal entity mentioned that there was some light structural damage due to this hazard.

The State Climatologist prepared data about severe wind events in each county, defined as those in excess of 58 miles per hour, which is presented in Appendix K. The data is not relevant to state declarations but will assist each county in its preparedness and response planning. Wind event data for Storey and Lyon Counties was not found.

Overall, windstorms are considered moderate-risk hazards in Nevada. Their consequences are likely to be small in scope compared to floods, earthquakes, and wildfires.

Due to our geography, severe windstorms occur regularly and are widespread throughout the State of Nevada. This hazard usually occurs in the winter and spring months, although severe winds are know to occur at any time. Additionally, high winds often accompany severe storms and thunderstorms. This is generally looked upon as a continuing problem. It is noted that as land development continues into those areas noted for severe wind events, property damage will continue to happen. This problem may require modification of building codes as well as public education. In order to prevent accidents, injury and property damage due to wind-caused accidents along U.S 395 in Washoe Valley, NDOT has had a wind warning system in place since the early 1980s to prohibit high-profile vehicles (such as commercial trucks, RVs, campers, buses and truck-trailers) during severe winds. Automated signage alerts motorists to highway status during severe wind events.

The rating for severe wind hazard acquired from approved hazard mitigation plans or the hazard mitigation survey sent to counties and tribes is summarized in the table below.

Table 3-50. Severe Wind
Hazard Rating by County/Community/Tribal Districts

County/Tribal Hazard Mitigation Plans	Low	Moderate	High	Not Rated
Carson City			X	
Churchill County				X
Clark County				X
Douglas County				X
Elko Band	X			
Elko County		X		
Ely Shoshone Tribe				X
Esmeralda County	X			
Eureka County				X
Humboldt County				X
Lander County				X

Lincoln County		X		
Lyon County				X
Mineral County				X
Nye County	X			
Pershing County				X
Shoshone-Paiute Tribes of Duck Valley		X		
South Fork Band Tribe				X
Storey County		X		
Washoe County	X			
Washoe Tribe		X		
White Pine				X

3.4 VULNERABILITY ASSESSMENT

The next step of risk assessment is the vulnerability assessment. This section includes assessing vulnerability by jurisdiction and assessing vulnerability of State facilities.

3.4.1 Overview

The vulnerability assessment completed included only the "very high" and "high"-rated hazards: Earthquake, Terrorism, Flood (including Dam Failure), and Wildlfire. The data compiled were derived from approved local hazard mitigation plans, UNR's HAZUS runs and assessment as well the Community Wildfire Protection Plans (CWPP) for each county.

DMA 2000 REQUIREMENTS: RISK ASSESSMENT

Assessing Vulnerability by Jurisdiction

Requirement §201.4(c)(2)(ii): The State risk assessment **shall** include an overview and analysis of the State's vulnerability to the hazards described in this paragraph (c) (2), based on estimates provided in local risk assessments as well as the State risk assessment. The State **shall** describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events.

Element

Does the **new or updated** plan describe the State's vulnerability based on estimates provided in local risk assessments as well as the State risk assessments?

Does the **new or updated** plan describe the State's vulnerability in terms of the jurisdictions most threatened and most vulnerable to damage and loss associated with hazard event(s)?

Does the updated plan explain the process used to analyze the information from the local risk assessments, as necessary?

Does the updated plan reflect changes in development for jurisdictions in hazard-prone areas?

Source: FEMA, Standard State Hazard Mitigation Plan Review Crosswalk 2008

3.4.2 Analysis of State and Local Risk Assessment

The risk analysis was completed exclusively for the "very high" and "high" rated natural hazards earthquake, flood and wildfire.

Earthquakes (very high)

Earthquake-related information was derived from the United States Geological Survey, the Nevada Seismological Laboratory, the Nevada Bureau of Mines and Geology, and FEMA's HAZUS loss-estimation model.

The Nevada Bureau of Mines and Geology used the most current version available of the Federal Emergency Management Agency's loss-estimation computer model, HAZUS-MH, to estimate such factors as total economic loss, numbers of buildings receiving extensive to complete damage, number of people needing public shelter and hospital care, and number of fatalities from earthquakes of magnitude 5.0, 5.5, 6.0, 6.5, and 7.0. NBMG chose 38 communities that include all the major population centers in each of Nevada's 17 counties. The epicenters of the earthquakes were chosen at the fault position that is closest to the community. A depth of 10 kilometers (6 miles) was used for each scenario. Magnitudes from 5.0 to 7.0 were chosen to illustrate the variation that magnitude has on losses.

The data were compiled into tables summarizing losses for each community and the state, including 400 separate HAZUS summary reports. The individual HAZUS summary reports include the following data for each community and the state.

- General description of the region
- Building and lifeline inventory
- Building inventory
- Critical facility inventory
- Transportation and utility lifeline inventory
- Earthquake scenario parameters
- Direct earthquake damage
- Buildings damage
- Critical facilities damage
- Transportation and utility lifeline damage
- Induced earthquake damage
- Fire following earthquake
- Debris generation

The complete report is available as Nevada Bureau of Mines and Geology Open-File Report 09-8, Estimated Losses from Earthquakes near Nevada Communities, in Appendix M and online at: http://www.nbmg.unr.edu/dox/of098/Scenarios/OpenFileReport09-8.pdf

Floods (high)

To assess risks and vulnerability due to flooding, the Nevada Bureau of Mines and Geology used the most current version available of FEMA's loss-estimation model, HAZUS-MH for reaches of the Carson, Humboldt, Muddy, Truckee, Virgin, and Walker Rivers. In all cases, the HAZUS runs used floods with average 100-year return periods.

The HAZUS modeling program integrates many factors contributing to the frequency and severity of flooding that include:

- Rainfall intensity and duration
- Antecedent moisture conditions
- Watershed conditions, including steepness of terrain, soil types, amount and type of vegetation, and density of development
- Changes in landscape resulting from wild fires (loss of moisture-trapping vegetation and increased sediment available for runoff)
- The existence of attenuating features in the watershed, including natural features such as swamps and lakes, and human-built features such as dams
- The existence of flood control features, such as levees and flood control channels
- Velocity of flow
- Availability of sediment for transport, and the erodibility of the bed and banks of the watercourse

These factors were evaluated using:

- (1) a hydrologic analysis to determine the probability that a discharge of a certain size will occur, and
- (2) a hydraulic analysis to determine the characteristics and depth of the flood that results from that discharge.

The complete report with all data generated by these HAZUS runs is contained in Nevada Bureau of Mines and Geology Open-File Report 10-3 entitled “Updated Assessment of Risks and Vulnerability to Flood Hazards in Nevada”

This report is available as an online document at www.nbmg.unr.edu and in Appendix M Tables 3-24 and 3-25 found in Section 3.3.7.5 summarize the HAZUS assessment.

The NHMPC recognizes the need to assess risks of flood due to failure of irrigation canal walls and dams; and flash flooding on developed alluvial fans in populated communities statewide and will be looking at opportunities to enhance and develop our hazard mitigation strategies in these areas in future iterations of this plan.

Wildfire (high)

To assess risks and due to wildland fire, the Subcommittee used the most current version available of the Community Wildland Fire Protection Plans. Detailed information about the process and factors used to assess the wildland fire risk are found in Section 3.3.19.3 Location, Severity, and Probability of Future Events found on page 3-140.

In this iteration of the state plan, the vulnerability assessment for jurisdictions was compiled for the approved local hazard mitigation plans. The state will be working on developing data for those jurisdictions without an approved plan during the three-year update of this plan. The NBMG and the NDF representatives have discussed a joint project for the compilation of the data for building inventory, critical facilities, infrastructure and their respective replacement values in a GIS-based database. Also, NDF is working with other federal agencies such as the Bureau of Land Management and the U.S. Forest Servide to compile a statewide risk assessment for areas not previously assessed. Additionally, work is currently underway in the evaluation of the wildland fire risk for several western states, including Nevada which will provide added information to both risk and vulnerability assessments found in this plan.

3.4.3 State's Vulnerability Based on Local, County, and Tribal Assessments as well as State Assessments

The Nevada Hazard Mitigation Planning Committee reviewed local, county, and tribal hazard mitigation plans and incorporated their hazard ratings into the state plan at the end of each hazard profile. The updated plan includes a description of vulnerability to each hazard based on estimates provided in local risk assessments as well as the State risk assessments (see each Hazard description section above). The State will continue to work with the local, county, and tribal entities to convey the most up-to-date information from risk or vulnerability assessments, such as the HAZUS results presented in Sections 3.3.3.4 for earthquakes, Section 3.3.7.5 for floods, and Section 3.3.19.4 for Wildfire.

3.4.4 State's Vulnerability in Terms of Jurisdictions Most Threatened and Vulnerable.

Local jurisdiction vulnerability to the three highest-ranked hazards is found in the sections listed below:

- Earthquake — Section 3.3.3.4; Tables 3-10, 3-11 and 3-12
- Flood — Section 3.3.7.5 & 3.3.8.4; Tables 3 -22 and 3-23
- Wildfire — Section 3.3.19.4

Table 3-51 below, Threat Ranking by County, contains the most threatened jurisdictions by hazard as analyzed:

The following Threat Ranking by County table was developed using approved local hazard mitigation plans and a 2007 survey for counties without an approved plan. The highlighted figures show those counties that rank themselves as highest threatened by earthquake, flood and wildfire along with the stated vulnerability rating for each of the three hazards.

Carson City, Douglas, Storey and Washoe counties ranked the most threatened communities. Clark County has the largest infrastructure however it rates itself as at low risk to flood and earthquake. This is due to the large number of flood projects constructed and the large number of buildings built with more recent buiding codes.

This ranking is considered during the NHMPC grant application prioritization process.

Table 3-51. Threat Ranking by County

Local Jurisdiction	Earthquake Risk/Vulnerability						Flood Risk/Vulnerability						Wildfire Risk/Vulnerability						Most Threatened Ranking
	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	
Carson City			5			5			5			5			5			5	30
Churchill												5							5
Clark	1					5	1				3		1			1			12
Douglas			5			5			5			5	1					5	26
Elko		3			3			3			3				5		3		20
Esmeralda		3		1				3		1			1				3		12
Eureka					3						3								6
Humboldt					3						3								6
Lander				1							3								4
Lincoln			5	1					5		3				5		3		22
Lyon					3							5							8
Mineral				1						1									2
Nye			5	1				3		1				3			3		16
Pershing				1							3								4
Storey			5			5			5	1					5			5	26
Washoe			5			5			5			5			5			5	30
White Pine				1						1									2

Risk Values: No Plan or not rated = 0, L=1, M=3, H=5
Source: Local HMP approved by state thru 2010 and 2004 Survey
High Threat Ranking

3.4.5 Changes in Development

Table 3-52. Population Change in Nevada by County

Rank		July 1, 2007	July 1, 2008	July 1, 2009	Pop Difference 2007 to 2009	% gained
	NEVADA	**2,567,752**	**2,615,772**	**2,643,085**	**75,333**	**3%**
1	Clark County	1,838,635	1,879,093	1,902,834	64,199	3%
2	Washoe County	406,335	412,219	414,820	8,485	2%
3	Carson City	55,007	55,274	55,176	169	0%
4	Lyon County	52,305	52,813	52,641	336	1%
5	Elko County	46,993	47,184	47,896	903	2%
6	Douglas County	45,775	45,741	45,464	-311	-1%
7	Nye County	44,234	44,175	44,067	167	0%
8	Churchill County	24,733	24,808	24,897	164	1%
9	Humboldt County	17,617	17,918	18,260	643	4%
10	White Pine County	9,110	9,136	9,188	78	1%
11	Pershing County	6,376	6,292	6,286	-90	-1%
12	Lander County	5,085	5,127	5,159	74	1%
13	Lincoln County	4,455	4,643	4,794	339	8%
14	Mineral County	4,753	4,648	4,662	-91	-2%
15	Storey County	4,281	4,438	4,411	160	4%
16	Eureka County	1,536	1,599	1,707	171	11%
17	Esmeralda County	689	664	626	-63	-9%

Source: U.S. Census Bureau's website http://www.census.gov/popest/counties/tables/CO-EST2009-01-32.xls

Table 3-52 shows the annual change in population in Nevada counties from 2007 to 2009. The greatest total increase by population is found in Clark and Washoe Counties, however, Eureka and Lincoln counties have the greatest growth by percentage. The growth trend that Nevada has seen over the last 6 years is likely to slow over the next three years as unemployment remains high. This growth trend is likely to continue as employment is found in the two most populated and industrialized counties. This slowdown in rapid growth provides an opportunity for the planning of land use and has eliminated the competition for available qualified employees/staff. This will be a challenge as communities suffer from smaller budgets and therefore smaller staffs to enforce existing codes and regulations. Enforcement of codes and regulations become cumbersome with rapid growth or small staffs and the communities are ultimately responsible for this enforcement following the

Home Rule found in Nevada.

A challenge, especially for wildfire and flood hazards, is the stewardship of federally owned lands, which impacts private land.

The population growth slowdown provides opportunity to avoid the risks caused by rapid increases in population that place more people at risk for the high-risk hazards of earthquake, wildfire, dam failure and flood. These risks come into play when:

- Building along faults and locations prone to extreme shaking during an earthquake.
- Development of residential locations within areas prone to wildfire without the required defensible space, water storage, or building materials.
- Flood and dam failure concerns are linked as dams are built along the creeks, rivers and waterways.
- Nevada is an arid state; de-watering issues such as land subsidence and fissures are becoming a concern for local and state government.

This creates challenges to land use planning:

- Enforcement – lack of staffing in rural counties due to the county's economic, administrative and technical capabilities.
- Home rule – State laws are not effective until counties and cities adopt and enforce them.
- Federal ownership of land - over 85% of the land in Nevada is federal property. New development is often flanked on several sides by federally owned land making the mitigation of hazards cumbersome.

Possible solutions to avoid risks posed by hazards are:

1) Provide incentives to communities for providing the added enforcement of existing codes.
2) Create stricter requirements.
3) Enhance land use planning capabilities.
4) Initiate water reclamation projects.
5) Restrict water saving features to new homes;
6) Provide incentives for new and existing homeowners to mitigate the risk to their homes from possible hazards.
7) Increase public awareness for all hazards.

3.5 Assessing Vulnerability of State Facilities

The requirements for assessing vulnerability of State facilities, as stipulated in the DMA 2000 and ithe regulations implementing the act, described below.

DMA 2000 REQUIREMENTS: ASSESSING VULNERABILITY
Assessing Vulnerability of State Facilities
Requirement §201.4(c)(2)(ii): State owned critical or operated facilities located in the identified hazard areas shall also be addressed … .
Element
Does the **new or updated** plan describe the types of State owned or operated critical facilities located in the identified hazard areas?
Source: FEMA, Standard State Hazard Mitigation Plan Review Crosswalk 2008

3.5.1 Types of State-Owned or Operated Critical Facilities in Hazard Areas

Definition of a critical facility

Critical facilities in the state are defined as those that will impact the delivery of vital services to Nevadans; or whose damage would put special populations at risk; or which could cause greater damage to other sectors of the community.

The State recognizes that some privately owned critical facilities are essential to Nevada's economy and livelihood such as casinos. A major disaster would have a strong negative impact on these private assets as well as on state facilities.

At the completion of this update, a total of 2,885 facilities are owned by the state. Table 3-53 below summarizes the state's critical facilities and infrastructure, and replacement value. These data were gathered from the State Public Works Board (SPWB), the Department of Transportation and the Department of Information Technology.

Table 3-53. State Critical Facilities and Infrastructure

Category	Number	Replacement Value ($ Millions)
Government (legislative, judicial, executive)	5	131
DMV	17	76.7
Public Safety (prisons, EOC, highway patrol, fire)	31	1,253.7
University/colleges	7	480
National Guard	3	140.1
Hospitals/ Clinics	8	257.6
Communication	110	55
Bridges	3	750
Water Well	15	0.5

3.5.2 Estimating Potential Losses by Jurisdiction

The requirements for estimating potential losses by jurisdiction, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 REQUIREMENTS: ESTIMATING POTENTIAL LOSSES

Estimating Potential Losses by Jurisdiction

Requirement §201.4(c)(2)(iii): The State risk assessment **shall** include an overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment.

Requirement §201.4(d): **Plan must be reviewed and revised to reflect changes in development . . .**

Element

Does the **new or updated** plan present an overview and analysis of the potential losses to the identified vulnerable structures?

Are the potential losses based on estimates provided in local risk assessments as well as the State risk assessment?

Does the updated plan reflect the effects of changes in development on loss estimates?

Source: FEMA, Standard State Hazard Mitigation Plan review Crosswalk 2008

The SHMO has tasked the NBMG and the NDF representatives of the NHMP subcommittee with developing a joint project for geocoding all state facilities and incorporating this data into a comprehensive GIS database available to all of the State agencies and partners involved in mitigation planning activities. These data will be available for vulnerability analyses to be included in the next iteration of this plan.

As part of the current update to this plan, the most recent version of HAZUS was run for a series of earthquake and flood scenarios. An earthquake that has happened in the geological past was chosen on a fault near each county seat. Results for these earthquakes are discussed and tabulated in Section 3.3.3.4.

For floods, HAZUS was run for 100-year floods on the major rivers within the state (Carson, Humboldt, Muddy, Truckee, Virgin, and Walker. Results are discussed and tabulated in Section 3.3.7.4. For potential failures of major dams on the Truckee (and its tributaries in California), Carson, and Humboldt Rivers, the 100-year flood values serve as a proxy for potential losses. HAZUS scenarios for failures of the two dams on the Colorado River in Nevada (Hoover and Davis) have not been analyzed; Hoover Dam is discussed in Section 3.3.8.3.

For wildfires, considering that all counties in Nevada are subject to severe droughts and wildfires, the HAZUS building-exposure information in Section 3.3.19.4 provides a proxy for maximum potential fire loss.

3.5.3 Estimating Potential Losses of State Facilities

The requirements for estimating potential losses of State facilities, as stipulated in the DMA 2000 and its implementing regulations, are described below. The Division of Water Resources estimates that the dam failure losses will be similar to flood losses. Therefore, we do not present separate data for dam failure but include it as a type of flooding. Potential losses to State building facilities were estimated for the three highest ranking natural hazards: earthquake, wildfire, and flood. These loss estimations are presented in the following subsections.

DMA 2000 REQUIREMENTS: ESTIMATING POTENTIAL LOSSES

Estimating Potential Losses of State Facilities

Requirement §201.4(c)(2)(iii): The State **shall** estimate the potential dollar losses to State-owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.4(d): **Plan must be reviewed and revised to reflect changes in development . . .**

Element

Does the **new or updated** plan present an estimate of the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities in the identified hazard areas?

Source: FEMA, Standard State Hazard Mitigation Plan Review Crosswalk 2008

3.5.3.1 Earthquake Loss Estimation for State Facilities

The earthquake vulnerability analysis for state buildings was not updated for this iteration. SPWB and NBMG will coordinate the geocoding of the facilities and infrastructure to include in the HAZUS runs, and will develop GIS layers enhancing this analysis. The 2010 values were updated by multiplying the previous value from the 2007 analysis by an inflation factor of 5.1 percent provided by the Federal Reserve website http://www.usinflationcalculator.com/

NBMG calculated the losses listed below using the identified ***"Nevada State Owned Building List"*** data found in the 2007 SHMP and using the same replacement value of $210.29 per square foot.

1. The sum of the square footage for all state buildings equaled 18,160,364 sq. ft.
2. The sum of the square footage for Critical State Buildings equal 17,144,729 sq. ft.
3. The replacement value all buildings totaled $3,818,964,914.01.
4. The sum of the replacement value for Critical buildings was $ 3,605,385,801.

UNR's NBMG ran a probabilistic HAZUS run for Nevada annualized over a 100-yr period. A HAZUS run using the out-of-the box default data, which does not include many State or local government structures, produced an annualized loss rate of 0.00044213 or 0.044213 percent. This came to $54,867,897.55 per year when calculated against the total dollar value of the existing building stock for Nevada as identified in HAZUS.

Using this loss rate and a calculation against the values obtained from the HAZUS mitigation report table results in an annualized rate of loss of $1,688,462.82 for all state buildings listed and $1,594,033.66 for critical state buildings.

A similar run, with a ratio approach to obtain potential structural and nonstructural loss for critical State buildings in the Reno area in the event of a single 7.1 earthquake yields a loss of - $14,203,503.61 and in the event of a 6.9 earthquake for the Las Vegas area yields a result of - $4,596,672.49.

In the words of the State Seismologist, "Although the average annualized loss to critical state facilities predicted from this HAZUS analysis is only $1,577,184.07 per year, a single likely earthquake in the Reno-Carson City area (magnitude 7.1 on the Carson Range frontal fault zone) is predicted to cause $14,194,656.65 in damage to critical state facilities. A single likely earthquake in the Las Vegas area (magnitude 6.9 on the Frenchman fault) is predicted to cause $4,783,001.01 in damage to state critical facilities."

3.5.3.2 Loss Estimation for Flood for State Facilities

The State Division of Risk Management provided a listing of state facilities found in a Special Flood Hazard Area along with the insured value for the building.

The State Flood Insurance Program Manager, based on historical data, concluded that there would be a building loss of approximately 30% for buildings located within the 100-year flood zone. The losses calculated include contents of each facility as provided by the Division of Risk Management. Using this loss percentage, the estimated losses for State-owned critical and non-critical facilities during a 100-year flood are summarized in Table 3-54 below.

Table 3-54. Flood Vulnerability of State-Owned Buildings

	Hazard Rating	Building Inventory Affected				Total Losses in ($) Millions
		Critical		Non Critical		
		Number	Value in ($ Mill)	Number	Value in ($ Mill)	
Statewide	Extreme					
	High	23	15.9	73	27.4	
	Medium					43.3
Source: NV Risk Management						

3.5.3.3 Loss Estimation for Wildland/Urban Interface Fires for State Facilities

For buildings in the listing provided by the State Public Works Board (SPWB) without a replacement value, the members of the Planning Subcommittee agreed to use the previous cost of $200 sq ft for replacement cost of a structure. For all facilities, the state Fire Program Manager confirmed the loss of the entire structure when faced with wildland fire whether in extreme, high or medium risk location, the value of contents was calculated by adding 50 percent to its total cost. This is considered an average cost to include cleaning of smoke damage, loss of function, equipment, and supplies. The formula is Loss = (Area X $200) + ((Area X $200) X .50) for facilities with no current replacement value. Otherwise, the value provided by the SPWB was used with a 50 percent value for contents added. The Nevada Division of Forestry (NDF) used GIS data to overlay the density of fuels around state facilities with current location to determine the risk of the structures to wildland fire. No facilities were found to be at extreme or high wildland fire risk. The loss estimation due to wildfire for state facilities is shown in Table 3-55. The maps created for this vulnerability assessment are found in Appendix J.

Table 3-55. Wildfire (WUI) Vulnerability of State-Owned Buildings

	Hazard Rating	Building Inventory Affected				Total Losses in ($) Millions
		Critical		Non Critical		
		Number	Value in ($ Million)	Number	Value in ($ Million)	
Statewide	Extreme					
	High					
	Medium	30	932.6	12	65.4	998.0
Source: NDF & SPWB						

3.5.3.4 Vulnerability of State Communication Facilities due to Earthquake, Flood, and Wildfire

In Nevada, communication facilities are managed by the Department of Transportation and the Department of Information Technology (DoIT). Because the management lies outside of the State Public Works Board and was received at a later time, this information was not included in the HAZUS or wildfire vulnerability assessments. Table 3-56 below shows the vulnerability for state-owned communications facilities based on the information provided by DoIT Director of Communications. The location of these facilities will be integrated into the HAZUS data base and the wildfire GIS module for inclusion in the overall analysis next iteration of this plan. The analysis consists of applying the number of facilities at risk of each hazard by the replacement value, estimated at $500,000 each, with an increase of 50 percent of the value for contents. For example, all 110 facilities are at risk of earthquake, presuming complete damage, 110 X $500,000 = $5,500,000. With a 50 percent increase for contents: $5,500,000+2,750,000 =$8.250 million. DoIT estimates that 20 percent and 60 percent of the communication facilities are at risk of flood and wildland fire respectively.

Table 3-56. Vulnerability for State-owned Communication Facilities

		Communications Facilities Inventory Affected						**Total Losses in ($) Millions**
		Earthquake		Flood		Wildfire		
	Hazard Rating	Number	$ Mill	Number	$ Mill	Number	$ Mill	
Statewide	Extreme	110	82.5					148.5
	High					66	49.5	
	Medium			22	16.5			
Source: NV Department of Information Technology								