This section identifies and profiles the hazards that could affect Yamhill County.

5.1 OVERVIEW OF A HAZARD ANALYSIS

A hazard analysis includes the identification and screening of each hazard and subsequently the profiling of each hazard. Hazard identification is the process of recognizing the natural and human-caused events that threaten an area. Natural hazards result from unexpected or uncontrollable natural events of sufficient magnitude. Human-caused hazards result from human activity and include technological hazards and terrorism. Technological hazards are generally accidental or result from events with unintended consequences (for example, an accidental hazardous materials release). Terrorism is defined as the calculated use of violence (or threat of violence) to attain goals that are political, religious, or ideological in nature. 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 considered; the hazards that are unlikely to occur or for which the risk of damage is accepted as being very low, are eliminated from consideration.

Hazard profiling is accomplished by describing hazards in terms of their nature, history, magnitude, frequency, location, and probability. Hazards are identified through the collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area. Hazard maps are used to determine the geographic extent of the hazards and define the approximate boundaries of the areas at risk.

5.2 HAZARD IDENTIFICATION AND SCREENING

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

DMA 2000 and FMA Requirements: Risk Assessment: Identifying Hazards

Identifying Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type of all natural hazards that can affect the jurisdiction.

FMA Requirement §78.5(b): Description of the existing flood hazard and identification of the flood risk, including estimates of the number and type of structures at risk, repetitive loss properties, and the extent of flood depth and damage potential.

Element

- Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?

Source: FEMA, July 2008.

For the first step of the hazard analysis, the Steering Committees identified 19 possible hazards that could affect Yamhill County and the participating communities. The Steering Committees evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard (see Table 5-1). The Steering Committee determined that 13 hazards pose the greatest threat to the county: flood, winter storm, landslide, wildland/urban fire, earthquake, volcano,

wind, El Niño and La Niña, drought, dam failure, disruption of utility and transportation systems, hazardous materials, and terrorism. The remaining hazards excluded through the screening process were considered to pose a lower threat to life and property in the county due to the low likelihood of occurrence or the low probability that life and property would be significantly affected.

Table 5-1. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Natural Hazards		
Avalanche	No	Yamhill County is not located in an area prone to frequent or significant snowfall.
Erosion (Coastal or Riverine)	No	Yamhill County is located inland and is not subject to coastal erosion. Impacts associated with riverine erosion were not identified as a hazard by the Steering Committees.
Drought	Yes	Similar to the entire State of Oregon, Yamhill County is subject to impacts associated with drought.
Dust Storm	No	No historic events have occurred in Yamhill County or other jurisdictions.
Earthquake	Yes	Yamhill County is located within the geographical area bordering the Cascadia Subduction Zone and is subject to impacts associated with earthquakes.
El Niño / La Niña	Yes	Historic El Niño / La Niña patterns have been observed throughout the state.
Expansive Soils	No	Impacts associated with expansive soils were not identified as a hazard by the Steering Committees.
Flood	Yes	Historic flooding has been identified as occurring throughout Yamhill County.
Landslide/Debris Flow	Yes	Yamhill County is vulnerable to slope instability, especially after prolonged rainfalls.
Tsunami	No	Yamhill County is located inland and is not subject to tsunami impacts.
Volcano	Yes	Yamhill County is located in the vicinity of active volcanoes.
Wind	Yes	Yamhill County is vulnerable to high winds.
Winter Storm	Yes	Winter storms in Yamhill County result in several natural hazards – including floods, ice formations, snow, and wind.
Fire: Wildland/Urban Conflagration	Yes	The terrain, vegetation, and weather conditions in the region are favorable for the ignition and rapid spread of wildland fires in Yamhill County.
Man-Made/Technological Hazards		
Dam Failure	Yes	Several dams are located within Yamhill County.
Disruption of Utility and Transportation Systems	Yes	Yamhill County is subject to the impacts of disruption of utility and transportation systems.
Other: Hazardous Materials	Yes	Hazardous materials facilities and major transportation routes are located throughout Yamhill County and all jurisdictions.
Terrorism	Yes	Terrorism impacts have been identified in several jurisdictions within Yamhill County.

Table 5-2 shows the natural and technological hazards newly identified (*) through the County's update process: erosion, El Niño / La Niña, dam failure, disruption of utility and transportation systems, hazardous materials, and terrorism. Again, where hazards were excluded through the screening process by each jurisdiction, they were considered to pose a lower threat to life and property due to the low likelihood of occurrence or the low probability that life and property would be significantly affected. Should the risk from these hazards increase in the future, the MHMP can be updated to incorporate vulnerability analyses for these and other identified hazards.

Table 5-2. Hazards by Jurisdiction

Hazard	Yamhill County	City of Amity	City of Carlton	City of Dayton	City of Dundee	City of Lafayette	City of Newberg	City of Sheridan	City of Willamina	Yamhill City
Flood	X	X	X	X	X	X	X	X	X	X
Winter Storm	X	X	X	X	X	X	X	X	X	X
Landslide	X		X	X	X		X	X	X	X
Fire (Wildland/Urban)	X	X	X	X	X	X	X	X	X	X
Earthquake	X	X	X	X	X	X	X	X	X	X
Volcano*	X		X	X	X		X	X	X	
Wind*	X	X		X	X	X	X	X	X	X
El Niño / La Niña*	X	X	X	X			X			
Drought	X	X	X	X	X	X	X	X	X	X
Dam Failure*	X		X					X	X	
Disruption of Utility and Transportation Systems*	X	X	X	X	X	X				
Hazardous Materials*	X	X	X	X	X		X	X	X	X
Terrorism*	X	X					X	X	X	X

5.3 HAZARD PROFILE

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

DMA 2000 and FMA Requirements: Risk Assessment – Profiling Hazards

Profiling Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

FMA Requirement §78.5(b): Description of the existing flood hazard and identification of the flood risk, including estimates of the number and type of structures at risk, repetitive loss properties, and the extent of flood depth and damage potential.

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 risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

Source: FEMA, July 2008.

The specific hazards selected by the Steering Committees for profiling have been examined in a methodical manner based on the following factors:

- Nature
- History
- Location
- Extent
- Probability of future events

The hazards profiled for Yamhill County (including the participating jurisdictions) are presented in the rest of Section 5.3. The order of presentation does not signify the level of importance or risk.

5.3.1 Flood

5.3.1.1 Nature

A flood is the temporary inundation of water or mud on normally dry land. Heavy or prolonged rain, snowmelt, or dam collapse can cause inundation, as can riverine and flash floods. (NOAA 2008) Urban and riverine flooding primarily affect Yamhill County.

Urban flooding occurs in developed areas where the amount of water generated from rainfall and runoff exceeds the stormwater systems capacity. As land is converted from agricultural and forest to urban uses, it often loses its ability to adsorb rainfall. Rain flows over impervious surfaces such as concrete and asphalt and into nearby storm sewers and stream which can result in the rapid rise of floodwaters. During urban floods, streets can become inundated, and basements can fill with water. Storm drains often back up because of the volume of water and become blocked by vegetative debris like yard waste, which can cause additional flooding. Development in the floodplain can raise the base flood elevation and cause floodwaters to expand past their historic floodplains. (Yamhill County Emergency Management 2006)

Riverine or overbank flooding of rivers and streams is the most common type of flood hazard. Riverine flooding most frequently occurs in winter and late spring. Air rises and cools over the Coast Range and its foothills and heavy rainfall develops over high-elevation streams, as storms move from the Pacific across the Oregon Coast. In this region, as much as four to six inches of rain can fall over a 24-hour period. Severe and prolonged storms can raise rivers and streams to their flood stages for three to four days or longer. (State of Oregon 2008)

Floods usually are the result of prolonged rainfall over a large area from major weather systems that cause flooding of smaller streams that flow into major rivers. This type of flood and inundation of the natural floodplains of the river system is a part of the natural process. Development in or near the floodplain puts lives and property at risk.

Flood damage can include:

- Inundation of structures
- Erosion of stream banks, road embankments, foundations, footings for bridge piers and other features
- Impact damage from high-velocity flow and from debris
- Additional debris damage from accumulation on or blockage of infrastructure
- Destruction of croplands
- Release of sewage and hazardous or toxic materials from damaged pipelines, tanks and facilities
- Economic loss (local facilities, utilities, communications, agriculture)

5.3.1.2 History

The Willamette, North Yamhill, and South Yamhill rivers and smaller tributaries are susceptible to annual floods. (Yamhill County Emergency Management 2006)

The Willamette River has flooded on many occasions with the largest flood in 1861. In 1880 another large flood damaged the Yamhill River Bridge and the washed out portions of the Willamette Valley Railroad's track. Flood control dams constructed in the 1940s and 1950s have changed the pattern of flooding. There have been four major floods and several smaller floods in the last 40 years in Yamhill County: December 1955 and 1964, January 1965, 1972, 1974, and 1996, and November 1973. The largest and most damaging was the flood of 1964

which FEMA called a 100-year flood event. The most recent flood event occurred in December 2007.

- December 1964 – January 1965. Two storm systems brought record rainfall to the region where that already experienced record, early season low-elevation snow. In Yamhill County, the flooding caused 10 deaths, caused hundreds of landslides, washed out roads and bridges, and damaged or destroyed houses. Thousands evacuated and the entire state was declared a disaster area.
- January 1974. Snowmelt caused by a series of storms combined with heavy snow and freezing rain to produce rapid runoff. Several roads were closed because of landslides and high water including some roads in Sheridan and Willamina. In several communities along the Willamette River, wastewater plants exceeding capacity discharged raw sewage into the river.
- February 1986. The flood was caused by heavy rains and snow melt. The Willamette River crested 29 feet and was within inches of flooding. Homes were flooded and highways closed.
- February 1996. A series of floods were caused by deep snow pack, warm temperatures, and record breaking rain. The City of Carlton's wastewater treatment plant overflowed into the North Yamhill River. Total damages in the county exceeded $4 million.
- November 1996. A warm weather system deposited heavy rain on the area causing flooding.
- January 1997. Heavy rains caused flooding throughout the county. Willamette River crested at 29 feet, one foot above flood level. The South Yamhill River at McMinnville crested at 55 feet, five feet above flood level. Five thousand residents lost power when high winds damaged power lines.
- December 2007. Severe storms, winds, mudslides, landslides, and flooding occurred between December 1 and 17, 2007 shutting down roads and highways including Interstate 5. Public infrastructure, homes, and personal property were damaged. In Oregon, 73,000 residents were without power, and wastewater treatment plants were overwhelmed. A major disaster was declared for the State of Oregon on December 8, 2007 with Yamhill County included in the declaration. (FEMA 2008) Yamhill County suffered the loss of the south approach fill at Ayers Creek Bridge on North Valley Road.

  March 2008 FEMA disaster aid was estimated at approximately $20 million as follows:

  - ❖ $6,051,729 in individual assistance approved
  - ❖ $10,957,500 in low-interest disaster loan assistance approved to homeowners, renters and businesses of all sizes
  - ❖ $3,157,918 in public assistance obligated
  - ❖ 3,569 individuals registered for assistance
  - ❖ 3,864 individuals visited Disaster Recovery Centers
  - ❖ 2,014 home inspections completed

5.3.1.3 Location

Yamhill County is in the Willamette River basin in northwestern Willamette Valley, and lies east of the Coast Range and west of the Cascade Mountain Range. Weather patterns generally move west to east where air masses from the Pacific Ocean rise over the Coast Range where they cool and become saturated. The Coast and Cascade ranges buffer the Willamette Valley from continental air moving westward. (Yamhill County Emergency Management 2006)

Yamhill County is subject to flooding from overflowing rivers (Willamette, North Yamhill, and South Yamhill) and smaller tributaries (Ayers, Panther, Turner, Haskins, Fairchild, Mill, Willamina, Rock, and Agency creeks), and flooding from local storm water drainage. Between October and April the county is susceptible to winter rain flooding, while between May and July, snowmelt and runoff can create floods. Typically, the most severe floods are winter rainfall floods in December, January, and February.

Figure D-3 shows the location of the 100 and 500-year floodplain in the county.

5.3.1.4 Extent

Floods can result in loss of life and property, with the extent of the damage dependant on the depth and velocity of the floodwaters. Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence.

FEMA has mapped most of the flood-prone streams in Oregon for 100- and 500-year flood events. A 100-year flood (1 percent probability) is used as the standard for floodplain management in the U.S. and is also referred to as a base flood. Flood Insurance Rate Maps (FIRMs) prepared by FEMA provide the most readily available source of information for 100-year floods. These maps are used to support the NFIP. FIRMs delineate 100- and 500-year floodplain boundaries for identified flood hazards; these areas are Special Flood Hazard Areas (SFHAs) and provide the basis for flood insurance and floodplain management requirements.

For Yamhill County, there are 61 FIRMs for cities as well as for communities in the unincorporated portions of the county. Major SFHAs identified within Yamhill County include:

Table 5-3. Yamhill County FIRMs

Flood Source	FIRM[1]
Willamette River	410249 0195 C, 410249 0189 C, 410249 0187 C, 410249 0186 C, 410249 0188 C, 410249 0169 C, 410249 0335 C, 410249 0345 C, 410249 0510 C, 410249 0505 C
North Yamhill River	410249 0125 C, 410249 0130 C, 410249 0137 C, 410249 0141 C 410249 0145 C, 410249 0140 C, 410249 0306 C, 410249 0307 C
South Yamhill River	410249 0380 C, 410249 0385 C, 410249 0405 C, 410249 0428 C 410249 0429 C, 410249 0433 C, 410249 0431 C, 410249 0432 C 410249 0455 C, 410249 0460 C, 410249 0295 C, 410249 0315 C 410249 0320 C, 410249 0309 C, 410249 0308 C, 410249 0307 C 410249 0326 C, 410249 0327 C, 410249 0335 C
Ayers Creek	410249 0050 C, 410249 0065 C, 410249 0175 C

Panther Creek	410249 0125 C, 410249 0140 C, 410249 0145 C, 410249 0306 C
Turner Creek	410249 0025 C, 410249 0125 C
Haskins Creek	410249 0125 C
Fairchild Creek	410249 0025 C, 410249 0125 C
Mill Creek	410249 0433 C, 410249 0429 C
Willamina Creek	410249 0275 C, 410249 0250 C, 410249 0426 C, 410249 0428 C
Rock Creek	410249 0275 C, 410249 0427 C, 410249 0431 C
Agency Creek	410249 0225 C, 410249 0385 C, 410249 0405 C

[1]FIRM = Flood Insurance Rate Map. The last effective date for these maps was 1983.

An area totaling 65.3 square miles within the county is within the 100-year floodplain and 69 square miles are within the 500-year floodplain.

Historic data indicates flood depths exceeding flood levels by one foot on the Willamette River (crested at 29 feet) and levels by five feet on the South Yamhill River (crested at 55 feet).

The FEMA-mapped floodplains in Yamhill County include, for the most part, only areas along the larger rivers and streams which also have significant population and/or development. Other areas in the county have flood risk, but are not included in the FIRM because of small stream size or low population. Flood hazard evaluation for Yamhill County must also take into account these localized areas of high flood risk or repetitive flooding which lie outside mapped floodplains.

5.3.1.5 Probability of Future Events

Flood studies often use historical records, such as streamflow gauges, to determine the probability of occurrence for floods of different magnitudes. The probability of flood occurrence is expressed as a percentage indicating the probability of a specific flood event occurring in any given year.

Factors contributing to the frequency and severity of riverine flooding 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
- 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
- Tide heights and storm surge
- Availability of sediment for transport, and the erodability of the bed and banks of the watercourse

These factors are evaluated using a hydrologic analysis to determine the probability that discharge of a certain size will occur, and to determine the characteristics and depth of the flood resulting from that discharge.

Yamhill County is rated as having an above average flood risk. (State of Oregon 2008) Communities in Yamhill County participating in the NFIP are required to regulate floodplain development. Any structure built in the floodplain after 1974 has to meet NFIP requirements for elevation and flood proofing. FEMA has developed floodplain maps that are used as the basis for implementing floodplain regulations. FIRMs delineate flood hazard areas where NFIP regulations apply. FIRMS and flood insurance studies assess the probability of flooding at given locations. These maps represent a snapshot in time, and do not account for later changes which occurred in the floodplains. Development and other natural and artificial changes in floodplain have caused changes to the rivers and streams in Yamhill County. For areas not mapped by FIRMS, flood susceptible areas can be delineated and flood levels estimated by using historic stream flow records to determine flood frequency and recurrence. (ONHW 2006)

Yamhill County has a wide range of climate and elevations with average monthly precipitation ranging from approximately fourteen inches in the highest elevations to five inches in lower elevations. (ONHW 2006) Floods are most common in Yamhill County from October through April when storms from the Pacific Ocean brings intense rainfall. (Yamhill County Emergency Management 2006) Based on previous occurrences, flood events are likely around the county every 1 to 10 years.

5.3.2 Winter Storm

Winter storms in Yamhill County result in several natural hazards— including ice formations, snow, extreme cold temperatures, floods, and wind. Each on its own, or in combination, can completely immobilize emergency response activities, close down transportation corridors, and disrupt transportation and utilities.

Winter storms in Yamhill County can bring rain as well as snow, or can be followed by rising temperatures that melt newly fallen snow. Either scenario often causes flooding; most floods in western Oregon occur as a result of winter storms. This hazard is described in detail in Flood section of this plan.

As is the case with flood, wind as a hazard in Yamhill County most frequently occurs as part of a winter storm. The *nature, history, location, extent,* and *probability of future events* for wind, including winter storm wind, are explored in detail in the Wind section of this plan.

5.3.2.1 Nature

Ice storms, which include freezing rain, sleet, and hail, can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages and personal injury. Ice storms result in the accumulation of ice from freezing rain, which coats every surface it falls on with a glaze of ice. Freezing rain is most commonly found in a narrow band on the cold side of a warm front, where surface temperatures are at or just below freezing. Typically, ice crystals high in the atmosphere grow by collecting water vapor molecules, which are sometimes supplied by evaporating cloud droplets. As the ice crystals fall, the air warms and the particles melt and collapse into raindrops. As the raindrops approach the ground, they

encounter a layer of cold air and cool to temperatures below freezing. However, since the cold layer is shallow, the drops themselves do not freeze, but rather are supercooled, that is cooled in a liquid state to below-freezing temperatures. These supercooled raindrops freeze on contact when they strike the ground or other cold surfaces.

Snowstorms happen when a mass of very cold air collides with a mass of warm air. The warm air rises quickly and the cold air cuts underneath it, cooling and condensing as it rises, forming a cloud bank in the process. As the moisture droplets in the cloud cool to a point below freezing, they become ice crystals, which then collide within the cloud and snow is formed. The resulting precipitation falls as snow only when the temperature of the air between the bottom of the cloud and the ground is below 40 degrees Fahrenheit. (ONHW 2006) A higher temperature will cause the snowflakes to melt as they fall through the air, turning them into rain or sleet. Similar to those of ice storms, the effects of a snowstorm can disturb a community for weeks or even months. The combination of heavy snowfall, high winds and cold temperatures poses danger from prolonged power outages, automobile accidents and transportation delays, dangerous walkways, and through direct damage to buildings, pipes, crops, other vegetation, and livestock. Buildings and trees can also collapse under the weight of heavy snow.

5.3.2.2 History

As shown in Table 5-4, 12 significant ice and snow storms have occurred in western Oregon, including the county, since 1892.

Table 5-4. Ice and Snow Events, 1950 - 2007

Date	Storm Type	Details
December 1892	Snow	Large amounts of snow fell across all of northern Oregon, with accumulation ranging from 15 to 30 inches.
December 1919	Snow	Third largest snowstorm in Oregon history, freezing the Columbia River.
January – February 1937	Snow	More than 26 inches of snow fell over a five-day period.
January 1950	Snow	A total 39 inches of snow fell in the Salem area during the month of January.
March 1960	Snow	Heaviest snowfall accumulation since 1950.
January 1963	Snow and Ice	Four inches of snow and large amounts of ice recorded.
January 1978	Snow and Ice	Heavy snowfall.
February 1989	Snow	Storm resulted in 5-feet of snow drifts and single digit temperatures.
February 1993	Snow	Storm dropped 12 inches of snow in 24 hours.
February 1996	Ice	Freezing rain fell for 2 days.
December 2003 – January 2004	Ice	Both Polk and Yamhill counties federally declared disaster areas as a result of freezing rain.
December 2006	Ice	Both Polk and Yamhill counties federally declared disaster areas as a result of freezing rain.

Source: (ONHW 2006)

5.3.2.3 Location

Yamhill County is usually affected by severe winter storms occurring between October and March that originate in the Gulf of Alaska or the central Pacific Ocean. Snow events can occur if a wet Pacific storm reaches the area when a cold air mass is present. Also, a natural break in the Cascade Mountains sometimes allows cold air from the east to funnel through the Columbia Gorge into the Portland area, which can eventually settle south to the Willamette Valley, and thus create snow and ice events. (ONHW 2006) Ice events include freezing rain, sleet, and hail.

Cold air rarely travels west of the Cascade Range, as the mountains provide a natural barrier separating the Willamette Valley from the cold air to the east. However, the Columbia River Gorge can provide a low-level passage funneling cold air westward. Rain, sleet, and/or snow will fall if moisture-saturated warm air from the Pacific moves into the area colliding with the colder air mass.

5.3.2.4 Extent

Yamhill County is located in Climate Zone 2, generally consisting of wet winters and dry summers. Winter storm characteristics are determined by the amount and extent of ice and snow, air temperature, wind speed and wind direction. Winter storms can cause power outages, transportation and economic disruptions, injuries, and loss of life. Winter storms can also cause traffic related accidents and death, hypothermia, and heart attacks from snow shoveling. Emergency response times can be slowed because of icy road conditions. The weight of the snow or ice can cause utility disruption and falling trees and limbs. Snowmelt can cause flooding and landslides.

5.3.2.5 Probability of Future Events

The mix of cold air and moisture over western Oregon can produce snow and ice hazards and extreme cold. Yamhill County has an average risk of experiencing a severe winter storm. (ONHW 2006)

5.3.3 Landslide

5.3.3.1 Nature

Landslide is a general term for the dislodgment and fall of a mass of soil or rocks along a sloped surface, or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rockfalls, rockslides, debris avalanches, debris slides and slump-earth flows. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation and weather.

Landslides can be triggered by natural events such as seismic tremors and earthquakes, volcanic eruptions, wave or stream erosion, snowmelt, and prolonged or heavy rainfall. Development and other human activities can also provoke landslides. Increased runoff, excavation in hillsides, shocks and vibrations from construction, placement of non-engineered fill, and changes in vegetation from fire, timber harvesting and land clearing have all led to landslide

events. Weathering and decomposition of geologic material, and alterations in flow of surface or ground water can further increase the potential for landslides.

The United States Geological Survey (USGS) identifies six types of landslides, distinguished by the type of material and movement mechanism:

- **Slides:** The more accurate and restrictive use of the term landslide refers to a mass movement of material, originating from a discrete area of weakness that slides from stable underlying material. A *rotational slide* occurs when there is movement along a concave surface; and a *translational slide* originates from movement along a flat surface.
- **Debris flows:** Flows arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslides on steep slopes, then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than 35 miles per hour for several miles. Other types of flows include debris avalanches, mudflows, creeps, earthflows, debris flows, and lahars.
- **Lateral Spreads:** This type of landslide generally occurs on gentle slope or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.
- **Falls:** Falls are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.
- **Topples:** Topples are rocks and boulders that rotate forward and may become falls.
- **Complex:** Any combination of landslide types.

In general, the probability of slope failure increases with an increase in slope inclination. However, this is not always the case. Depending on various factors such as soil or rock type, water content, vegetative cover, slope aspect, permeability and rate of infiltration, proximity to seismic sources, magnitude of seismic events, and potential vertical and horizontal accelerations, a slope having a relatively low inclination could be at greater risk of failure than a slope having a relatively high inclination.

The likelihood of a landslide in any given slide-prone location is largely dependent on the water content of the soil or rockfill. Landslides may happen at any time of the year, especially during rainy months when soils become saturated with water. Earthquakes can add to slope stress and disrupt ground stability, thereby triggering landslides, usually in already slide-prone locations. In addition, unconsolidated deposits of alluvial and glacial outwash materials are subject to accelerated streambank erosion and landslides.

Indicators of a possible landslide include:

- springs, seeps, or wet ground that is not typically wet;
- new cracks or bulges in the ground or pavement;
- soil subsiding from a foundation;
- secondary structures (decks, patios) tilting or moving away from main structures;
- broken water line or other underground utility;

- leaning structures that were previously straight;
- offset fence lines;
- sunken or dropped-down road beds;
- rapid increase in stream levels, sometimes with increased turbidity;
- rapid decrease in stream levels even though it is raining or has recently stopped; and
- sticking doors and windows, visible spaces indicating frames out of plumb.

Rapidly moving landslides have the greatest potential to endanger human life or inflict serious injury, especially to those living in or traveling through rapidly moving slide prone areas. Slow moving slides are less likely to inflict serious human injuries, but can cause property damage. (ONHW 2006)

Landslides often occur in conjunction with other natural hazards, thereby exacerbating conditions, as described below:

- Shaking due to earthquakes can trigger events ranging from rockfalls and topples to massive slides.
- Intense or prolonged precipitation that causes flooding can also saturate slopes and cause failures leading to landslides.
- Landslides into a reservoir can indirectly compromise dam safety, and a landslide can even affect the dam itself.
- Wildfires can remove vegetation from hillsides, significantly increasing runoff and landslide potential.

5.3.3.2 History

Oregon Department of Geology and Mineral Industries (DOGAMI) reports few landslides in Willamette Valley, however, southern Yamhill County and the edges of the valley are susceptible because of the occurrence of marine sedimentary rock and clay-rich residual soils overlying basalts. (ONHW 2006) Yamhill County does not have a comprehensive list of landslide events, but they likely occur during major storms in western Oregon. Major landslides were reported in 1964, 1966, 1982, and 1996 during storms. Two winter storms in November 1996 triggered over 9,500 landslides and debris flows on logged and un-logged land mostly in the Cascade and Oregon Coast mountain ranges. (ONHW 2006)

5.3.3.3 Location

In Yamhill County, DOGAMI reports the slopes nearest to the Willamette River, in the western portion of the Salem Hills, are at greatest risk of landslides. Weak, low-permeability marine sediments overlain by basalts, and clay rich residual soils overlying basalts are susceptible to water-induce landslides on steep slopes and within existing slide masses. Features such as "hummocky topography, disrupted drainage patterns, sag ponds, springs, back-tilted bedrock blocks, and subdued head scarps" are indicative of landslide terrain. (ONHW 2006)

Excavation and grading on sloping terrain and the addition of fill on slopes can increase the risk of landslides by affecting slop stability and angle. Alteration of drainage patterns causing water to flow over landslide prone slopes can trigger landslides. Likewise, broken pipes, leaking water or sewer lines, water retention facilities, irrigation, alterations to stream channels, stormwater management, increases in impervious surfaces and runoff can also increase landslide potential. Vegetation removal from steep slopes increases landslide potential. The Oregon Department of Forestry analyzed the storm impacts and landslides of 1996 and determined landslides increased during the ten years following timber harvesting. Developments adjacent to the base of steep slopes, in confined stream channels (canyons), or on fans (rises) at stream channel mouths can be impacted by landslides. Excavating steep slopes, developing on gentle slopes, and on or adjacent to existing landslide prone areas can also put development sites at risk. Natural conditions such as rainfall, volcanic eruptions, or earthquakes can trigger landslides. (ONHW 2006) Figure K-4 shows the landslide hazard areas in Yamhill County.

5.3.3.4 Extent

The geographic extent of a landslide event is usually confined to the immediate slide location, while the effects can vary widely, depending on the amount and type of infrastructure impacted by the slide. Ideally, vulnerability of critical infrastructure would be assessed by each jurisdiction on a case-by-case basis. The extent of effects could be as limited as one building or property, or region-wide, in the case of a major transportation disruption, slide-induced dam failure, or utility outage. Landslides associated with rainfall and saturated soils tend to be smaller than earthquake or volcanic eruption induced slides.

5.3.3.5 Probability of Future Events

Some landslide activity can be expected annually during the rainy months, October through April. Previously saturated soils are prone to debris flows during periods of intense rainfall Even though major property damage and other significant impacts from past landslide events have not been recorded for Yamhill County, it is important to map potential landslide and debris flow areas to prevent future losses. (ONHW 2006)

Landslides in western Oregon are generally a result of intense or prolonged rainfall, particularly during a rain on snow event. As such, based on previous occurrences, future widespread activity can be expected every 20 years and possibly more often depending on rain and storm events.

5.3.4 Wildfires

5.3.4.1 Nature

A wildland fire is a type of wildfire that spreads through the consumption of vegetation. It often begins unnoticed, spreads quickly, and is usually signaled by dense smoke that may be visible for miles around. Wildland fires can be caused by human activities such as arson or campfires, or by natural events like lightning. Wildland fires often occur in forests or other areas with ample vegetation. In addition to wildland fires, wildfires can be classified as urban fires,

interface or intermix fires, and prescribed fires. Fires that involve a mixture of vegetation and structures are considered wildland/urban interface fires.

The following three factors contribute appreciably to wildland fire behavior and can be used to identify hazards.

- **Topography:** As slope increases, the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildland fire behavior. Canyons, gulches and other local topographic effect can act as chimneys, intensifying fires in certain areas. (ONHW 2006) However, ridgetops can mark the end of a wildland fire's spread, since fire spreads more slowly or may even be unable to spread downhill.
- **Fuel:** The type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will 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 moisture content of both living and dead plant matter decreases during periods of prolonged drought and greatly increases the risk of fire. Vertical continuity of fuels, the linkage between fuels at ground level and tree crowns, also affects the fire potential. Forests with strong ladder fuels (understory growth between ground fuels and tree crowns) are more likely to have major fires involving tree crowns. Forests with limited ground fuels and little or no ladder fuels are much more likely to experience minor ground fires than a fire involving tree crowns. (ONHW 2006)
- **Weather:** The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures coupled with low humidity, can lead to devastating wildland fires. Conversely, cool temperatures and higher humidity often signal reduced wildland fire occurrence and easier containment of existing fires.

In the planning area, wildland fires burn primarily vegetative fuels, outside highly urbanized areas. Wildland fires can be categorized as occurring in the following locations:

- **Agricultural:** Agricultural fires burn in areas where the primary fuels are flammable cultivated crops, such as wheat. This type of fire tends to spread very rapidly, but is relatively easy to suppress if adequate resources are available. Structures threatened, if any, are generally those belonging to ranch owners. There can also be significant losses in agricultural products.
- **Forest:** Forest fires are the classic wildland fire. These fires burn fuels composed primarily of timber and associated fuels, such as brush, grass, logging residue and thick stands of reproduction. Due to variations in fuel and topography, this type of fire may be extremely difficult and costly to suppress.
- **Wildland-Urban Interface:** Fires involving the wildland-urban interface occur in areas where urbanization and the presence of natural vegetation fuels allow a fire to spread rapidly from natural fuels to structures and vice versa. Especially in the early stage of such fires, structural fire suppression resources can be quickly overwhelmed, increasing the number of structures destroyed. Such fires are known for the large number of

structures simultaneously exposed to fire. Nationally, wildland interface fires commonly produce widespread losses.

Although thought of as a summer occurrence, wildland fires can, and do, occur during any month of the year. The vast majority of wildland fires burn between July and October. Dry spells during the winter months, especially when combined with the factors of winds or dead fuels, result in fires that burn with alarming intensity and rate of spread. Common causes of wildland fire include: lightning; equipment use; railroad activity; debris burning; arson; and improperly extinguished cigarettes.

Wildland fires are part of the natural ecology and natural life cycles of wildlands. Fires create open spaces with different habitats for both plants and animals than existed previously. Fires also maintain small fuel loads in areas, which in turn decreases the potential for large catastrophic fires. (ONHW 2006) However, a wildland fire may grow into an emergency or disaster if not promptly controlled. Even a small fire can threaten lives and resources and destroy property. Additionally, large fires can strip the land of vegetation and destroy forest resources, 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, thus increasing flood potential, harming aquatic life and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards, as discussed in the landslides hazard profile.

5.3.4.2 History

Wildland fires have burned the Oregon landscape for thousands of years. Generally, wildfires have resulted from natural lightning strikes and intentional human activities. In Yamhill County, the indigenous Che-ahm-ill people, a subgroup of the Kalapuyan culture, purposely ignited large portions of the basin valley annually for agriculture, hunting, communication, warfare, visibility, safety, and sanitation. The Kalapuyans occupied the Yamhill basin valley at the time of Euro-American contact, but such systemic burning may have been used for as long as ten thousand years prior to Euro-American settlement. Euro-American settlement in the mid-19th century continued to shape the landscape with fire. Euro-Americans burned land to protect timber and property in the region. Euro-Americans directed more attention to forested areas and coastland. As a result, valley prairies and savannas burned less and areas that were not used for fields or pastures began growing into forests. (ONHW 2006)

While fire control in the area has often been viewed as necessary, the region also has a history of uncontrolled fires.

- 1933. The Tillamook valley fire ravaged nearly a quarter of a million acres and is thought to have caused several localized burns in the Willamina watershed.
- 1949. The largest, well-documented forest fire occurred when a fire started in Peavine Canyon and spread to the East Creek area, burning 18,000 acres.

As shown in Figure K-5, between 1962 and 2004, only two state-reported fires larger than 1,000 acres burned in the region.

Yamhill County also has a growing history of wildland/urban interface fires. With suburban growth in the early 1970s, increasingly wildland fires in the area have affected or involved

homes. In the 1990s, more than 100 structures burned in wildland fires and thousands more were threatened. (ONHW 2006) Throughout the country, decades of strict fire suppression have resulted in thick overgrown forests that are highly vulnerable to even small fires in dry windy conditions.

5.3.4.3 Location

The Oregon Department of Forestry has developed a list of high-risk wildland fire communities. High-risk communities are defined as those that have at least 28 persons per square mile within 5 miles of a high-risk watershed. No communities within Yamhill County are included on this list.

However, as shown on Figure K-6, there are a few areas within the county that are at moderate and high risk for wildland fires. In general, steep, south-facing sloped forested areas are considered to be most at risk for wildland fires while flat, north-facing developed or wetland areas are considered to be at least risk for wildland fires. As such, the urbanized areas of Willamina, McMinnville, Dundee, and Newberg are at low risk for wildland fires. The evergreen and deciduous forests that border all sides of the county are at moderate risk for a wildland fire.

Furthermore, the 2001 Federal Register lists some Yamhill County communities at risk from wildfire damage. In Yamhill County, fire hazards are likely due to a lack of firebreaks around buildings, limited water during summer months, and fire suppression practices over the last 100 years. (ONHW 2006)

5.3.4.4 Extent

The magnitude of wildfires is primarily dependent on severe drought coupled with lightning strikes and windy, stormy conditions, and the effects of wildfire suppression. For example, wildfire suppression has changed the vegetation of the Willamette Valley, which in turn has made some areas more susceptible to wild fires. The Willamette Valley was originally covered by lowland evergreen and deciduous forests and native prairie grasslands. Now there is more brush, small diameter trees, Douglas fir, and more crops, such as wheat, which can increase potential for wildfire damage.

Impacts of a wildland fire that interfaces with the population of Yamhill County could grow into an emergency or disaster if not properly controlled. A small fire can threaten lives and resources and destroy property. In addition to impacting human lives, wildland fires may severely impact livestock and pets. Such events may require emergency watering and feeding, evacuation and alternative shelter. (ONHW 2006)

5.3.4.5 Probability of Future Events

In Oregon, wildland fire season normally begins in late June, peaks in August, and ends in October. However, a combination of above normal-temperatures and drought can increase the length of the traditional fire season. Wildland fires are not common in the Willamette Valley and based on historic events, large fires (1,000-acres) are only likely to occur every 20 years.

5.3.5 Earthquake

5.3.5.1 Nature

An earthquake is a sudden motion or trembling of the earth produced by the rupture of rocks due to stresses beyond the rocks' elastic limits. The point inside the Earth where the rupture takes place is termed the hypocenter. The point on the planet's surface directly above the hypocenter is the epicenter. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning and, after just a few seconds, can cause massive damage and extensive casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake.

The severity of ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. Ground motion causes waves in the earth's interior, also known as seismic waves, and along the earth's surface, known as surface waves. There are two kinds of seismic 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 (vertical motion). S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side to side (horizontal motion). When P and S waves hit the surface of the Earth, they generate surface waves, which are further categorized into Raleigh waves and Love waves. Slower than seismic waves, and therefore later to hit, surface waves are responsible for most of the damage during an earthquake.

Earthquakes are usually measured in terms of magnitude and intensity. Magnitude is related to the amount of energy released during an event, while intensity refers to the effects on people and structures at a particular place. Small to moderate earthquake magnitude is usually reported according to the standard Richter scale. Larger earthquakes are reported according to the moment-magnitude scale because the standard Richter scale does not adequately represent the energy released by these large events.

Intensity is usually reported using the Modified Mercalli Intensity Scale. This scale has 12 categories ranging from "not felt" to "total destruction." Different values can be recorded at different locations for the same event depending on local circumstances such as distance from the epicenter or building construction practices. Peak ground acceleration (PGA) is also used to measure earthquake intensity. It measures the earthquake's intensity by quantifying how hard the earth shakes in a given location. PGA can be measured in *g*, which is acceleration due to gravity. Table 5-5 identifies corresponding intensity and magnitude ratings as well as effects associated with each rating.

Table 5-5. Effects of Intensity and Magnitude Ratings

Magnitude	MM Intensity	PGA (% *g*)	Perceived Shaking
0 – 4.3	I	<0.17	Not Felt
	II-III	0.17 – 1.4	Weak
4.3 – 4.8	IV	1.4- – 3.9	Light
	V	3.9 – 9.2	Moderate
4.8 – 6.2	VI	9.2 – 18	Strong
	VII	18 – 34	Very Strong
6.2 – 7.3	VIII	34 – 65	Severe
	IX	65 – 124	Violent
	X	124 +	Extreme

In addition to ground motion, several secondary hazards can occur from earthquakes, such as surface faulting. Surface faulting is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (up to 20 feet), as can the length of the surface rupture (up to 200 miles). Surface faulting can cause severe damage to linear structures, such as railways, highways, pipelines and tunnels.

Earthquake-related ground failure due to liquefaction is another secondary hazard. Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its structure, and causing some of the empty spaces between granules to collapse. Pore-water pressure may also increase sufficiently to cause the soil to briefly become fluid. 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, but up to 12 miles) and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.

The most common earthquakes that occur in Oregon are crustal, intraplate or great subduction earthquakes. Yamhill County is most susceptible to deep intraplate and subduction zone earthquakes. (ONHW 2006) These are described as follows:

Crustal earthquakes: generally occur along shallow faults near the earth's surface. Crustal earthquakes make up the majority of earthquakes in the Cascadia area (western Washington, Oregon and northwestern California) and are a result of fault movement in the Earth's surface. These shallow earthquakes are usually less than 7.5 magnitude and strong shaking generally lasts 20 to 60 seconds. Aftershocks, as well as tsunamis and landslides, are anticipated after a crustal event. The Mount Angel Fault is located than 15 miles from Yamhill County, and is responsible for the 5.7 magnitude Spring Break Quake in 1993. (ONHW 2006)

Intraplate earthquakes: occur deeper, at 20 to 40 miles beneath the ground surface. These deep earthquakes are usually less than 7.5 magnitude, and damaging events occur every 10 to 30 years in this region. There are few aftershocks, and tsunamis are generally not anticipated, although landslides can trigger localized tsunamis. Due to the deep earth movement, an intraplate earthquake is felt over a larger area with less intensity. Damage from this type of event is generally less than with an equally sized crustal earthquake.

Great subduction earthquakes: occur offshore of the Oregon and Washington Coasts along the Cascadia Subduction Zone. This zone is the result of the Juan de Fuca plate being pushed under the North American plate. Earthquakes centered along this zone can be as great as 9.0 magnitude. Geologic evidence demonstrates approximately 500 years between events with the last significant event on January 26, 1700. Aftershocks up to 7.0 magnitude are anticipated to cause additional damage. Liquefaction, tsunamis and landslides are expected as a result of a great subduction earthquake.

5.3.5.2 History

Approximately 7,000 earthquakes in the Pacific Northwest have been documented over the past 200 years. This documentation has occurred sporadically, with only the most significant events being recorded until recent history. More than 6,000 earthquakes have been recorded in Oregon since 1841. Many earthquakes were documented as below a magnitude three. The University of Washington expanded its seismograph coverage of Yamhill County and northwestern Oregon in 1980. (ONHW 2006)

Currently, the University of Washington seismology laboratory records approximately 1,000 earthquakes of magnitude 1.0 or greater annually in Washington and Oregon. While most of these events are barely felt, anywhere from 12 to 24 earthquakes cause enough ground shaking to be recognized as an actual earthquake by area residents. Table 5-6 shows magnitude 4.0 or greater earthquakes affecting the planning area since 1949. Figure K-7 shows historic earthquakes affecting the region from 1840-2006.

The February 28, 2001 Nisqually earthquake caused evacuations in Yamhill County and Willamette Valley, and damage was reported to the Dundee Fire Hall. The Scott Mills earthquake cause bricks to fall from an un-reinforced masonry building in Dayton and approximately 90 buildings were damaged in Newberg. The Dayton Bridge on Highway 18 was closed for structural damage. The Highway 18 at Highway 99 West was closed and Portland General Electric reported power outages to customers in Dundee. (ONHW 2006)

Table 5-6. Magnitude 4.0 or Greater Earthquakes, 1949 - 2006

Date	Magnitude	Location	Approximate Distance to Planning Area
1941	7.1		
April 13, 1949	7.1	Olympia, WA	150 miles
April 18, 1961	4.5	Albany, OR	40 miles
1962	5.2		
November 5, 1962	5.5	Vancouver, WA	65 miles
March 7, 1963	4.6	Salem, OR	25 miles
March 25, 1993	5.6	Scotts Mills, OR	45 miles
February 28, 2001	6.8	Anderson Island, WA	150 miles

5.3.5.3 Location

The planning area is located within the geographical area bordering the Cascadia Subduction Zone. This zone is comprised of an 800-mile sloping fault and several smaller offshore faults located west of the Pacific Coast, from British Columbia to the north and Northern California to

the south. The fault system separates the Juan de Fuca and North American plates. A series of inferred faults, faults extending underground from a visible fault, and concealed faults are present near Dayton, south of McMinnville. (ONHW 2006)

Inland, there are nine faults located within the USGS Quaternary Fault and Fold Database for the Salem 1° x 2° Sheet (44°- 45° by 124° -122°), including the Portland Hills Fault, East Bank Fault, and Mount Angel Fault. Major offshore and onshore faults are shown in Figure K-8.

Shaking hazard maps produced by the United States Geological Survey (USGS) consider two alternative scenarios for damaging earthquakes (M 8.3 or M 9.0) along the subduction zone. The shaking hazard maps show the level of ground motion that has 1 chance in 475 of being exceeded each year, which is equal to a 10 percent probability of being exceeded in 50 years. As such, as shown in Figures K-9 and K-10, the planning area falls within the strong to very strong shaking range (9-25 percent of acceleration of gravity). All of Yamhill County may be subject to an earthquake. However, the western portion of Yamhill County is more likely to be more affected by a major quake, because of closer proximity to the Cascadia Subduction Zone.

5.3.5.4 Extent

The extent of earthquake effects depends on the nature, magnitude, and location of the quake. An earthquake can be anything from a tiny tremor affecting only a very localized area, to a major shake that affects an entire region. For hazard mitigation purposes, it should be considered that the extent of a major event would be greater than county-wide.

5.3.5.5 Probability of Future Events

Oregon ranks third for future earthquake damages, with losses of exceeding $12 billion in an 8.5 magnitude Cascadia Subduction Zone earthquake. Recent research shows the Cascasdia Subduction Zone is capable of producing a 9 magnitude earthquake. The risk of damage to structures and human life is greater today because of the increase in population. Many of the older structures and utility infrastructures were not designed to withstand an earthquake. (ONHW 2006)

Geological evidence indicates that damaging earthquakes (M 8.0 to M 9.0) may have occurred at least seven times in the last 3,500 years, suggesting a return time of 300 to 600 years. While it is impossible to predict when an earthquake may occur, it is highly probable (1 event in 35 years) that a moderate earthquake (M 4.0 and greater) will occur along the Cascadia Subduction Zone, thereby affecting Yamhill County.

5.3.6 Volcano

5.3.6.1 Nature

A volcano is a vent or opening in the earth's crust from which molten lava (magma), pyroclastic materials, and volcanic gases are expelled onto the surface. Volcanoes and other volcanic phenomena can unleash cataclysmic destructive power greater than nuclear bombs,

and can pose serious hazards if they occur in populated or cultivated regions. Ashfall, or tephra, an eruptive hazard, is of the greatest concern in Yamhill County.

There are four general types of volcanoes found in Oregon:

- **Lava domes** are domes that are formed when lava erupts and accumulates near the vent.
- **Cinder cones** are cone-shaped and formed by accumulation of cinders, ash, and other fragmented materials originating from an eruption.
- **Shield volcanoes** are broad, gently sloping volcanic cones of flat domical shape, usually several tens or hundreds of square miles in extent, built chiefly of overlapping and interfingering basaltic lava flows.
- **Composite or stratovolcanoes** are typically steep-sided, symmetrical cones of large dimensions built of alternating layers of lava flows, volcanic ash, cinders, and blocks. Most composite volcanoes have a crater at the summit containing a central vent or clustered group of vents.

Along with the different kinds of volcanoes, there are different types of eruptions. Eruption type is a major determinant of the physical results it creates and the hazards it poses. Six main types of volcano hazards exist:

- **Volcanic gases** are made up of water vapor (steam), carbon dioxide, ammonia, as well as sulfur, chlorine, fluorine, boron, and several other compounds. Wind is the primary source of dispersion for volcanic gases. Life, health, and property can be endangered from volcanic gases within about six miles of a volcano. Acids, ammonia, and other compounds present in volcanic gases can damage eyes and respiratory systems, and heavier-than-air gases, such as carbon dioxide, can accumulate in closed depressions and suffocate humans and animals.
- **Lahars** are formed when loose masses of unconsolidated, wet debris become mobilized, and are usually created by shield volcanoes and stratovolcanoes. Eruptions may trigger one or more lahar directly by quickly melting snow and ice on a volcano or ejecting water from a crater lake. More often, lahars are formed by intense rainfall during or after an eruption. Rainwater can easily erode loose volcanic rock and soil on hillsides and in river valleys. As a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.
- **Landslides** are common on stratovolcanoes because their massive cones typically rise thousands of feet above the surrounding terrain, and are often weakened by the very process that created the mountain – the rise and eruption of molten rock (magma). If the moving rock debris is large enough and contains a large content of water and soil material, the landslide may transform into a lahar and flow down valley sometimes more than 50 miles from the volcano.
- **Lava flows** are streams of molten rock that erupt from a vent and move down slope. Lava flows destroy everything in their path. However, deaths caused directly by lava flows are uncommon because most move slowly, and flows usually do not travel far from the source vent. Lava flows can bury homes and agricultural land under hardened rock, obscuring landmarks and property lines in a vast, new, hummocky landscape.

- **Pyroclastic flows** are dense mixtures of hot, dry rock fragments and gases that can reach 50 mph. Most pyroclastic flows include a ground flow composed of coarse fragments and an ash cloud that can travel by wind. Escape from a pyroclastic flow is unlikely because of the speed at which they move.
- **Tephra** is a term describing any size of volcanic rock or lava that is expelled from a volcano during an eruption. Large fragments generally fall back close to the erupting vent, while particles of ash can be carried hundreds to thousands of miles away from the source by wind. Ash clouds are common adaptations of tephra.

5.3.6.2 History

Cascade volcanoes that have erupted during the past 4,000 years include Mount Baker, Mount Rainier, Mount St. Helens, Mount Adams, Mount Hood, Three Sisters, Newberry Volcano, Mount Mazama (Crater Lake), Medicine Lake Volcano, Mount Shasta, and Lassen Peak (Figure K-11).

The closest volcanoes to Yamhill County are Mount St. Helens, Mount Jefferson and Mount Hood, all to the east.

Mount St. Helens has been the most active volcano in the Cascade Range during the past 10,000 years. In Oregon, awareness of the potential for volcanic eruptions was greatly increased by the May 18, 1980 eruption of nearby Mount St. Helens in Washington which killed 57 people. The upper portion of the summit collapsed in a massive landslide triggered by volcanic tremors. That portion of the mountain is now a horseshoe-shaped crater partially filled by a lava dome. Early 19th Century non-Native settlers in the region witnessed eruptions occurring along the north flank area of the mountain.

As a result of the 1980 eruption and the far-reaching extent of the lateral blast, damage and reconstruction exceeded $1 billion. The coverage area was 230 square miles and reached 17 miles northwest of the crater. Impacts from pyroclastic flows covered six square miles and reached 5 miles north of the crater, and landslides covered 23 square miles. Lahars (mudflows) affected the North and South Forks of the Toutle River, the Green River, and ultimately the Columbia River as far as 70 miles from the volcano.

Mount St Helens' most recent eruption began in October of 2004, with initial steam and ash eruptions giving away to slow-moving lava flows which ceased in January of 2008.

Mount Hood erupted in approximately 1805. Two other minor eruption periods occurred during the last 500 years with some lava flow near the summit. The eruptions created pyroclastic flows and lahars with little ash fall. (State Interagency Hazard Mitigation Team 2006) The other volcanoes in the Planning Area have undergone similar formation and eruption cycles.

Mount Jefferson last erupted about 15,000 years ago. Research of other stratovolcanoes suggest that Mount Jefferson should be considered dormant, not extinct. A major eruption could generate pyroclastic flows and lahars, and an explosive eruption could spew ash for hundreds of miles downwind. The volcano has steep slopes and debris flows would likely be contained in within 10 miles of the surrounding valley. (ONHW 2006)

5.3.6.3 Location

The extensive north-south oriented chain of volcanoes known as the Cascadia volcanic arc, or Cascade Range, has been formed by the Cascadia subduction zone. As the seafloor plate sinks beneath the North American Plate, it heats up and melts, providing a vast reservoir of the heat and molten rock that create the magma chambers that become volcanoes.

Three closest three volcanoes to Yamhill County, Mount St. Helens, Mount Hood, and Mount Jefferson, all lie to the east.

- **Mount St. Helens,** a stratovolcano, is located approximately 50 miles northeast of Portland in Skamania County and has an elevation of 9,677 feet. Access is provided from the west in Cowlitz County by State Route 504 about 34 miles west of Interstate Highway 34. (USGS 2008)
- **Mount Hood** is located approximately 47 miles east-southeast of Portland and is the most accessible of Oregon's volcanos. Access to the volcano is provided by US Highway 26 from the south and Oregon Highway 35 from the east side. Other paved roads provide further access to this most often climbed peak in the Pacific Northwest. A hiking trail circles the volcano. In the winter, the mountain hosts downhill and cross county skiing. At 11,239 feet, Mount Hood is the highest peak in the state and is part of the Mount Hood National Forest. (USGS 2008)
- **Mount Jefferson** is located in the Mount Jefferson Wilderness area and the Warm Springs Indian Reservation approximately 70 miles from Portland, and 50 miles from Bend, Oregon. Access is provided by Highway 22 east of Salem and US Forest Service roads and trails lead into the wilderness area. (USGS 2008)

5.3.6.4 Extent

Mount St. Helens, a stratovolcano, is believed to be the volcano with the greatest potential to have a near-term impact on the region because of its ongoing activity since the cataclysmic event in May 1980. A large eruption of Mount St. Helens can eject tephra to altitudes of 12 to 20 miles and to deposit tephra over an area of 40,000 square miles or more. Wind direction and velocity, along with the vigor and duration of the eruption, will control the location, size, and shape of the area affected by tephra fall. Another eruption from Mount St. Helens is likely in the near future.

Mount St. Helens most recently erupted in October of 2004, pushing ash more 10,000 ft into the air, and lava flows continued until January, 2008, after which activity ceased. The volcano has been recently downgraded to inactive, although another eruption in the near future is highly likely.

Due to proximity, the major hazard for Yamhill County would be impacts from ash (i.e., minor ash falls from eruptions from Mount St. Helens (or lesser ash falls from more distant volcanoes). Prevailing wind is a factor in how much ash is disrupted among communities within Yamhill County. Volcanic eruptions may impact water bodies. River valleys are susceptible to debris flows, landslides, and lahars; this may require dredging to maintain channel depths for navigation.

Buildings streets and roads throughout the entire county would require minor cleanup with negligible impacts. Temporary utility interruptions are likely, and minor cleanup may be required for electrical and other utility services. Water treatment facilities may require additional attention to address high turbidity water. Injuries associated with respiratory problems may result. (Goettel 2005)

5.3.6.5 Probability of Future Events

Yamhill County has a low risk of experiencing damage from a volcano. Ashfall is of greatest concern in the county. The US Geologic Survey estimates there is annual probability of 0.01 percent that 10 centimeters or more of tephra (ash) accumulation will occur in the far west portions of Yamhill County. Most of the county has less than 0.01 percent probability of ash fall impact. Ashfall deposition is controlled by prevailing wind direction, which in the Cascades is predominately from the west. During previous eruptions, ashfall has drifted to the east of the volcanoes. (ONHW 2006)

By careful analysis of past activity, geologists can make general forecasts of long-term activity associated with individual volcanoes, but these are on the order of trends and likelihood, rather than specific events or timeline. Short-range forecasts are often possible with greater accuracy. Several signs of increasing activity can indicate that an eruption will follow within weeks or months. Magma moving upward into a volcano often causes a significant increase in small, localized earthquakes, and increased emissions of carbon dioxide and compounds of sulfur and chlorine that can be measured. Shifts in magma depth and location can cause changes in ground level elevation that can be detected through ground instrumentation or remote sensing.

The USGS has identified several other potentially active volcanoes in Washington, Oregon, and California. The effects of volcanic activity from these volcanoes could include landslide avalanches, lahars, tephra, lava, and pyroclastic flows or surges. Activity from one of these volcanoes is highly likely in the near future.

5.3.7 Wind

5.3.7.1 Nature

Wind is air flow that travels horizontally with respect to the Earth's surface and topography. High winds are defined as those that last longer than one hour at greater than 39 miles per hour (mph) or for any length of time at greater than 57 mph. Wind speeds vary with individual storms. Windstorms often accompany snow, ice, and extreme cold temperature events during winter storms.

In general, the damaging effects of windstorms may extend for distances of 100 to 300 miles from the center of storm activity. Tornadoes are the most violent and destructive type of windstorm, usually caused by thunderstorms. (Taylor et al. 1996) A tornado is a rotating column of air in contact with both a cloud base and the ground. (AMS 2000) Wind speeds can exceed 300 to 400 mph leaving widespread destruction in their paths. While tornadoes are most common in the Midwest, they have occurred in Oregon. (ONHW 2006) Oregon ranks 46th for frequency of tornados. Historically, Yamhill County has experienced five tornadoes.

5.3.7.2 History

Windstorms have historically threatened Yamhill County. Numerous damaging windstorms have occurred within the county. The following table, Table 5-7, includes some of the most noteworthy that brought extensive damage to the region.

Table 5-7. Windstorm Events, 1926 - 2008

Date	Sustained Wind Speed	Details
February 19, 1926		Tornado. Tree damage was reported.
April 1931	40 mph (75 mph gusts)	The wind caused multiple wildfires in the Willamette Valley, and dust clouds reduced visibility (Oregon Statesman. April 22, 1931).
November 10–11, 1951	40-50 mph (75-80 mph gusts)	Damage experienced statewide.
December 1951	60 mph (75 mph gusts)	Winds damaged buildings and utility lines statewide, four fatalities (Oregon Statesman. December 5, 1951).
December 21, 1955	55-65 mph	In addition to extensive damage to buildings, power and telephone lines throughout the state, heavy destruction occurred in the Willamette Valley orchards.
November 1958	51 mph (71 mph gusts)	Fallen trees blocked highway access.
October 12, 1962	62 mph (90 mph wind gusts)	The Columbus Day storm was the equivalent of a Category IV hurricane in terms of central pressures and wind speeds. The storm, which started east of the Philippines as Typhoon Freda, measured 1,000 miles long as it hit the West Coast. The damage to Yamhill County was estimated to be over $15 million. Extensive damage occurred to farm buildings and tree farms. Thirty-eight fatalities were recorded in Willamette Valley (News Register 1962).
March 1971	50 mph	Falling trees damaged homes and utilities. Most of the state was affected by the windstorm, but the worst damage occurred in Willamette Valley.
May 25, 1971	40-72 mph	Tornado. Limited damage ($500-$5000).
August 20, 1978		Tornado. Limited damage ($5000-$50,000).
November 13 –14, 1981	52 mph (71 mph gusts)	Strongest windstorm since the Columbus Day storm. Widespread power outages and roof damage occurred. Eleven fatalities resulted from storm.
April 18, 1984		Tornado. Limited damage ($500-$5000).
January 1990	75 mph	Damage experienced statewide, one fatality.
December 8, 1993	113-157 mph	Tornado. Considerable damage resulted ($500,000-$5 million).
December 12, 1995	62 mph	Very wet soil from an unusually rainy fall resulted in the toppling of many trees in the Willamette Valley. Three fatalities occurred, as well as over $1 million in damages to the mid-Willamette Valley (Statesman Journal 1995).
November 1997	52 mph	Trees uprooted.

Table 5-7. Windstorm Events, 1926 - 2008

Date	Sustained Wind Speed	Details
February 7–8, 2002	70 mph	Resulted in a Presidential declaration for coastal counties south of Polk and Yamhill counties.

Source: Taylor, George H., and Ray Hatton, The Oregon Weather Book (1999), pp.151-157
Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon, February 7, 2002 (FEMA-1405-DR-OR)
ONHW 2006

5.3.7.3 Location

Yamhill County in the Willamette Valley is somewhat sheltered from strong westerly winds, as the north-south orientation of the Coast Range and Cascades obstructs and slows down these surface winds. The north-south orientation of the Willamette Valley often channels the winds in a north south direction. (ONHW 2006) Winds blowing along a north to south axis, parallel to the major mountain ranges, can prove to be extremely destructive. Regardless of wind direction, prolonged windstorms are likely to last an average of three to six hours before moving on.

Most frequently surface winds are from the southeast and are associated with storms moving in from the Pacific Ocean. Winds out of the south are generally more destructive. Chinook winds are strong easterly, warm, dry winds that come out of the Columbia River Gorge and can gust up to 100 mph. Chinook winds are caused by rapid atmospheric pressure changes. Prevailing winds vary with the seasons. Local topography plays a part in wind direction. (ONHW 2006)

5.3.7.4 Extent

High winds are likely to occur during the months of October through April. Destructive windstorms are less frequent, but recent research has revealed a connection between the neutral years of the El Niño Southern Oscillation conditions and major Pacific Northwest windstorms. Generally, windstorms have a short duration and winds move in a straight line with gust exceeding 50 mph. (ONHW 2006) Damaging winds can extend for 100 to 300 miles from the center of a storm. (State Interagency Hazard Mitigation Team 2006)

Tornados are characterized by wind speed and duration. Typically, they can last between several minutes to several hours, and can travel miles. The width of their paths varied between 10 feet and over one mile. (ONHW 2006)

5.3.7.5 Probability of Future Events

The risk of experiencing a windstorm in Yamhill County is low. There is four percent probability of experiencing a 25-year event with winds of 60 mph. There is a two percent annual probability of experiencing a 50-year event with winds of 67 mph, and a one percent annual probability of experiencing a 100-year event with winds of 75 mph. (State Interagency Hazard Mitigation Team 2006)

Each winter, several Pacific low pressure centers make landfall in the northwest, bringing sustained winds strong enough (40-60 mph) to topple power lines and trees. Less frequently (one to two times every ten years), storms of considerably greater magnitude can produce winds

gusting up to 70 mph or greater. The typical windstorm pattern in this area is a southwesterly flow as air heads directly into the Pacific Northwest.

The preliminary research shows that El Niño events tend to shear weather systems apart as they approach the Northwest and La Niña events tend to have periods with enhanced high pressure, thereby producing enhanced cool, northerly flows. The wind-producing intervening neutral years tend to occur every 3-7 years.

5.3.8 El Niño and La Niña

El Niño and La Niña are part of a weather phenomenon known as El Niño/Southern Oscillation (ENSO). While ENSO is not a hazard itself, it can lead to severe weather events and large-scale damage in Yamhill County. Direct correlations have been found linking ENSO to severe weather across the Pacific Northwest, particularly drought, flooding, and severe winter storms. (State of Oregon 2004) Therefore, increased awareness and understanding of the impacts of El Niño and La Niña on regional weather are important in hazard mitigation planning.

For more detailed discussions on drought, flood, and winter storms, please refer to their respective sections in this chapter.

5.3.8.1 Nature

Commonly referred to simply as El Niño, ENSO is the periodic warming and cooling of the central Pacific Ocean. This warming and cooling cycle has global implications as normal weather patterns are altered over vast areas of the world, causing changes in temperature and precipitation from Chile to Indonesia to the Pacific Northwest.

During El Niño periods, alterations in atmospheric pressure in equatorial regions yield an increase in the surface temperature off the west coast of South America. This gradual warming sets off a chain reaction affecting major air and water currents throughout the Pacific Ocean. In the North Pacific, the Jet Stream is pushed north, carrying moisture laden air up and away from its normal landfall along the Pacific Northwest coast. In Oregon, this shift results in reduced precipitation and warmer temperatures, normally experienced several months after the initial onset of the El Niño. (Taylor 2008) These periods tend to last nine to twelve months, after which surface temperatures begin to trend back towards the long-term average.

When surface temperatures increase past the long-term average, a La Niña period ensues. Typical weather patterns throughout the Pacific Ocean are strengthened, yielding stormier than normal weather throughout the Pacific Northwest. Above average precipitation and colder temperatures are experienced across Oregon during these periods, with the potential for severe snow storms increasing. (Taylor 2008) These periods generally last longer than El Niños, taking anywhere from one to three years to dissipate.

Both El Niño and La Niña periods tend to develop between March and June, and peak from December to April. (NOAA 2005)

5.3.8.2 History

An examination of past ENSO patterns shows both El Niño and La Niña have been regularly observed in Oregon. Direct correlations have been found linking precipitation, temperature, and

snowfall with ENSO across Oregon, including Yamhill County (Taylor 2008). In general, El Niño periods result in warmer temperatures and lower precipitation, while La Niña periods are colder and wetter. (Lubomudrov 2008)

Strong El Niños of 1982 and 1997 were observed throughout the state, and the El Niño in 1994 resulted in widespread drought conditions. Alternatively, severe flooding caused by the heavy snow and intense rain in the winters of 1995-1996 and 1998-1999 were due to La Niñas. (State of Oregon 2004)

5.3.8.3 Location

ENSO affects weather patterns on a global scale. Any local climate changes experienced in Yamhill County will be reflective of a much broader trend impacting the entire Pacific Northwest. Hazards resulting from one of these periods will most likely be spread across large regions of the state, with adjoining counties experiencing similar conditions.

5.3.8.4 Extent

Yamhill County has a climate generally consisting of wet winters and dry summers. (ONHW 2006) During El Niño years, decreased precipitation and increased temperatures throughout the winter can lead to drought. Alternatively, increased precipitation and decreased temperatures associated with La Niña periods can result in widespread flooding and severe winter storms.

5.3.8.5 Probability of Future Events

As climate scientists continue to unravel the oceanic and atmospheric relationships governing ENSO, predictive powers are growing. 1997 marked the first time an El Niño was accurately forecasted, and as more studies detail how ENSO impacts the Pacific Northwest, and Oregon in particular, hazard mitigation agencies will benefit from increased warning time. ENSO generally follows a two to seven year cycle, with El Niño or La Niña periods occurring every three to five years. However, the cycle is highly irregular, and no set pattern exists (Taylor 2008). Furthermore, variations are likely to continue, and not all droughts and floods are related to El Niño or La Niña events. (State of Oregon 2004)

5.3.9 Drought

5.3.9.1 Nature

Drought is variously defined as a period of abnormally dry weather creating hydrologic imbalance, shortage of precipitation adversely affecting crops, or a period of below average water in streams and lakes, reservoirs, aquifers, and soils. (USGS 2008) There is no universal measure of precipitation or dryness that signifies drought. Historically, droughts have been seen as unpredictable and unavoidable events. Climate fluctuations occur everywhere, and periods of low precipitation are a normal, recurrent feature of climate.

Drought is commonly referenced in terms of its effects on agriculture, with crop damage or failure used to measure its effects. Other direct environmental effects of drought include livestock death or decreased production, wildland fire, impaired productivity of forest land,

damage to fish habitat, loss of wetlands, and air quality effects. Indirect effects to society are measured by the economic and physical hardships brought on by drought and by the increased stress on residents of a drought-stricken area. (ONHW 2004) The economic impact of drought is estimated between $6 and $8 billion annually in the United States. These costs primarily affect agricultural, forestry, fisheries, recreation and tourism, transportation and energy sectors. Drought is also associated with insect infestation, disease, and wind erosion. (ONHW 2006)

Drought is usually thought of as a meteorological phenomenon, resulting from abnormally low precipitation. It can also be an institutional phenomenon, resulting from poor management of water supply and reserves – an imbalance in supply and demand – and is often due to a combination of these factors. Understanding drought as a recurring climate cycle is a first step toward creating management practices that effectively mitigate its effects.

Drought is difficult to measure, due to its diverse geographical and temporal nature, and to its operation on many scales. Despite that difficulty, various indices for measuring and characterizing drought can be useful. The Palmer Drought Indices and the Standardized Precipitation Index are most commonly used. Palmer's indices describe water balance—looking at water supply (precipitation), demand (evapotranspiration), and loss (runoff)—on three scales; weekly during growing season, long-term cumulative measured by month, and another long-term scale that takes into account hydrological factors such as reservoir and groundwater levels. These are the Crop Moisture Index, the Palmer Drought Severity Index, and the Palmer Hydrological Drought Index, respectively. The Standardized Precipitation Index considers precipitation alone, comparing the probability of a region's receiving a given amount of precipitation (based on historical levels) in a given time period with precipitation actually recorded. (NOAA 2008)

There are four types of drought: meteorological, agricultural, hydrological and socioeconomic. Meterological drought is based on the degree of dryness. Agricultural drought focuses the amount soil moisture versus the needs of the crops. Hydrological drought is associated with shortfalls of surface and subsurface water supply. Socioeconomic drought refers to physical water shortages and its human effect, and occurs when the need for water exceeds the supply resulting in a shortfall. (ONHW 2006)

5.3.9.2 History

Drought occurs in all parts of Oregon, and has had profound effects in the past on the state's economy, particularly the agricultural and hydro-power sectors. Environmental consequences have included insect infestations in forests, insufficient stream flows to support endangered fish species, and increased susceptibility to fire.

Drought appears to be a cyclic part of the climate of Oregon, occurring in both summer and winter, with an average recurrence interval between 8 and 12 years. Short-term, seasonal events are more frequent, while the less frequent, long-term events have ranged from 3 to 12 years in length.

The following past drought events were recorded for Yamhill County:

- 1928-1941 – Statewide prolonged drought caused major agricultural problems

- 1976-1981 – Stream flows were low for western Oregon; 1976 and 1977 were the driest years of the century.
- 1985- 1994 – Ten consecutive years of drought cause problems statewide; fires were common and insects attacked trees; a drought emergency was declared in 1992.
- 2000-2001 – Severe drought conditions; October 2000 to February 2001 was the second driest period of record in Washington and Oregon.
- 2003 – Yamhill County was one of nine counties designated a disaster area brought on by an ongoing drought and became eligible for disaster relief.
- 2005 – February 2005 was the driest since 1977. (ONHW 2006)

5.3.9.3 Location

Droughts occur in every climate zone, and can vary from region to region. Drought occurs in all parts of Oregon, and has had profound effects in the past on the state's economy, particularly the agricultural and hydro-power sectors. All parts of the county are susceptible to drought.

5.3.9.4 Extent

Drought is often associated with El Niño events affecting the polar and subtropical jet streams. The polar jet stream dips southward causing the northwest to be drier than average. The severity of drought depends on the degree of moisture deficiency, duration, and size of the affected area. The agricultural sector is the usually the first to feel the impacts of drought because of its dependence on soil moisture. Those reliant on surface and groundwater sources are usually the last to feel the effects of drought. (ONHW 2006)

5.3.9.5 Probability of Future Events

As part of a statewide HMP process, county emergency management program managers conducted risk analyses to determine probability of, and vulnerability to, severe drought occurrence in each county. Oregon's Partnership for Disaster Resilience assesses Yamhill County as having an average risk for drought; a future drought affecting the planning area is likely. (*Partnership* 2008)

Estimating drought probability and frequency is difficult, but understanding cyclic climate variations and other variables that contribute to weather behavior is advancing. (State Interagency Hazard Mitigation Team 2006) Understanding the El Niño and La Niña weather systems are helping scientists to better predict weather changes in the Pacific Northwest.

5.3.10 Dam Failure

5.3.10.1 Nature

Dams are impervious artificial barriers typically constructed of earth, rock, concrete, or mine tailings. The purpose of a dam is to divert water or impound (store) water, wastewater, or liquid-borne materials for any one or a combination of several reasons including:

- flood control
- human water supply
- irrigation
- livestock water supply
- energy generation
- mine tailings containment
- recreation
- pollution control

Dams can be embankment dams constructed with excavated natural materials or masonry dams constructed with stone, brick, or concrete blocks painted with mortar. Most dams are built at the narrowest part of a river on a stable foundation made of concrete, rock, or compacted soil. The abutments of a dam can be the natural valley walls or constructed of artificial materials when a natural abutment is not suitable. There are several types of dams named for the primary construction material used, the dam's primary purpose, and/or the way the dam is engineered to function. Common types of dams include:

- **Diversion Dam:** diverts water from one waterway to another waterway
- **Arch Dam:** a concrete dam that is convex on the upstream side and concave on the downstream side, taking advantage of the water load itself to compress the concrete, and allowing the majority of water load to shift to the abutments
- **Overflow Dam:** designed to be overtopped
- **Regulating Dam:** designed to regulate water flow downstream
- **Gravity Dam:** masonry material construction wherein the weight and internal strength provides stability

Dam inundation is flooding that results from the dam's structural failure, breach, or improper operation. It is an "unscheduled release." Inundation can also refer to the downstream extent or area which is flooded by the released water. Outlet works and spillways allow dam managers to make "scheduled releases" when necessary, e.g., to prevent damaging flooding and to prevent total dam failure. Dam failure can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding
- Seismic activity/Earthquake
- Landslides into reservoir or onto the dam itself
- Inadequate spillway capacity, resulting in excess overtopping flows
- Internal erosion caused by leaks in embankments, foundation, or piping
- Improper design or construction
- Improper maintenance or operation

- Upstream dam failure on the same waterway
- Vegetation growth
- Structural integrity loss from burrowing small animals

Dam failures can create flash floods that are catastrophic to life and property. Seismic activity can directly cause dam failure, and can also generate a wave capable of overtopping a dam, which may inundate the surrounding area but not cause dam failure. Two factors that influence the potential severity of a full or partial dam failure include: (1) the amount of water impounded, and (2) the density, type, and value of development and infrastructure located downstream.

The hazard potential rating for dams describes only the extent of expected losses from failure. Its hazard potential is determined by the downstream damage that could result from improper operation or dam failure. Neither the dam's integrity nor the failure probabilities are considerations when determining its hazard potential. Hazard potential categories are organized into three tiers:

- **High hazard:** would probably cause loss of life in the event of failure or improper operation. Economic, environmental, and lifeline losses are also likely but not necessary for this rating, which is based solely on probable loss of life.
- **Significant hazard:** would cause property damage or temporary road or utility losses with a remote chance of loss of life.
- **Low hazard:** would have little or no effect to life and property downstream from a dam's failure.

5.3.10.2 History

During the 1840s and 1850s, Yamhill County experienced substantial development. Shortly thereafter, dams were constructed to encourage the growth of cities and to help with local commodities such as farming and logging. Dams were used for irrigating fields and forming lakes for log storage. River transportation was also successful for moving these commodities. With the success of river transportation, locks and dams were built to improve the waterways. (Yamhill County Parks, Lafayette Locks) (Carlton Citizen Involvement and Land Use Planning, 1999) There have been no known dam failures in Yamhill County.

5.3.10.3 Location

The National Inventory of Dams (NID), maintained by the US Army Corps of Engineers, is a database of all dams in the United States posing a significant or high hazard, or that meet inclusion criteria for dam height and storage (exceed 25 feet in height and 15 acre-feet of storage, or exceed 6 feet in height and 50 acre-feet of storage). There are many dams too small to be listed in the NID, but these small dams are not expected to have significant impacts if they fail, and they are not generally considered in hazard mitigation planning.

NID lists 30 dams in Yamhill County. Of these dams, 23 are privately owned, six are owned by local government, and one is a public utility. However, only three dams are considered a

concern by the participating jurisdictions, two of which do not meet NID's criteria. These dams are summarized in Table 5-8.

Table 5-8. Jurisdiction Identified Dams

Dam Name	River	Owner	Year	Storage (acre-feet)	Hazard	EAP
Stony Mountain Impound Facility	East Creek	City of Sheridan	2007	184	L	N
Panther Creek Reservoir	Panther Creek	City of Carlton	1971	75	L	N
Willamina Reservoir	Willamina Creek	City of Willamina				

EAP refers to whether or not the dam has an emergency action plan, which is not required for dams in the size range of those listed here.

NID listed dams in Yamhill County are summarized in Table 5-9 and shown on Figure K-12.

Table 5-9. NID Listed Dams in Yamhill County

Dam Name	River	Owner Name	Owner Type	Year Completed	NID Storage (acre-feet)	Hazard	EAP
Haskins Creek Dam	Haskins Creek; Trib/Yamhill R.	McMinnville Water and Light	L	1930	704	S	N
Pacific Plywood Log Pond	Willamina River	City of Willamina	L	1944	132	L	N
Hawn Creek Reservoir	Hawn Creek	Hawn Cr. District Improvement Corp.	L	1961	250	L	N
Panther Creek Reservoir	Panther Creek	City of Carlton	L	1971	100	L	N
McGuire Reservoir	Nestucca River	McMinnville Water & Light	U	1969	5000	H	N
Turner Creek Reservoir	Turner Creek	City of Yamhill	L	1978	60	L	N
Dundee Sewer Project	Municipal Waste	City of Dundee	L	1979	65	L	N

OWNER TYPE: F=Federal, S=State, L=Local Government, U=Public Utility, P=Private.
NID STORAGE: A calculated field based on maximum storage and normal storage.
EAP refers to whether or not the dam has an emergency action plan, which is not

Table 5-9. NID Listed Dams in Yamhill County

Dam Name	River	Owner Name	Owner Type	Year Completed	NID Storage (acre-feet)	Hazard	EAP

required for dams in the size range of those listed here.

5.3.10.4 Extent

The extent of dam failure effects in Yamhill County can be assessed region-wide or by each body of impounded water. Effects depend a great deal on the nature of the failure—for instance, whether a dam fails when retaining a normal level of water, or whether water influx is involved in the dam failure, which then involves a greater-than-usual volume of impounded water. Likewise, whether a dam is overtopped, damaged, or fails will make a great difference in volume of water released, and therefore in effects. An isolated dam failure, even a significant release, may have less significant impact than a series of dam failures caused by region-wide flooding.

The City of Sheridan's Stony Mountain Impoundment Facility is a spring-fed reservoir, retained by an earthen dam approximately 10 miles outside of town. The emergency spillway empties into La Toutena Mary Creek. The dam embankment, if breached, will spill into a La Toutena Mary Creek tributary, and the flood hydrograph will travel 3.37 miles to the La Toutena Mary Creek and East Creek confluence, with an additional 3.15 miles to East Creek's confluence with Willamina Creek. Based on a clear day piping failure stimulated by the City of Sheridan, if the dam embankment was breached, it would take approximately 35 minutes for the dammed water to travel the 3.37 miles to the East Creek confluence and an additional 100 minutes to travel to the Willamina Creek confluence.

Under normal conditions, the flood wave would start with approximately 10,670 cubic feet per second (cfs) at the dam and end with approximately 1,090 cfs at Willamina Creek. Due to the limited size of the watershed, the limited inflow to the reservoir, and the height of the dam compared to the emergency spillway (1657 feet vs. 1653 feet), an overtopping failure is unlikely. Thus, a catastrophic failure of the dam would not present a threat to human life downstream. Neither the road nor any residential structures would likely be inundated by the flood wave generated by a piping failure.

Even when the clear-day scenario was tested using more extreme assumptions, such as increased water levels, a dam failure still did not pose a threat to residential structures. Possible developments that could cause piping failure include rapid drawdown, seismic activity, or slope failure. As water flows through the dam, the passage could continue to grow as material is eroded away. Eventually the size of the passage could compromise the structural integrity of the dam and cause it to collapse. (City of Sheridan Dam Failure Analysis, 2007)

The City of Carlton's Panther Creek Reservoir is approximately 8 miles west of town. The drainage basin above the dam is approximately 3.19 square miles. There has been some erosion

caused by tree removal activities by local landowners during the rainy season. There is a main 4.5 mile long 10-inch diameter transmission line to the city, which includes a 6-inch emergency connection with the McMinnville Water and Light main transmission line. However, no agreement exists as to the when the connection can be used. (City of Carlton Citizen Involvement and Land Use Planning, 1999)

The City of Willamina's Dam is an earthen dam located approximately 12 miles north or town. It is expected that a dam failure would affect the city by causing a mud flow down Willamina Creek. There is also a moderate concern of debris flowing down the Willamina Creek in the case of a dam failure of the City of Sheridan's Stony Mountain Impoundment Facility. (City of Willamina Hazard Profile)

5.3.10.5 Probability of Future Events

There is always the possibility of dam failure. Dam failures can result from a variety of causes, including:

- Prolonged periods of rainfall and flooding
- Seismic activity/Earthquake
- Landslides into reservoir or onto dam itself
- Inadequate spillway capacity, resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping
- Improper design or construction
- Improper maintenance or operation
- Failure of upstream dams on the same waterway
- Vegetation growth
- Burrowing small animals

To try and prevent dam failure from controllable factors, such as improper design or maintenance, the Oregon Water Resources Department manages dam safety and requires dam owners to submit their plans prior to construction, as well as prepare for periodic inspection of existing dams. However, there is no required frequency of inspections by Oregon law. For example, Panther Creek was last inspected Oct. 19, 1989. Owners are expected to maintain their hydraulic structure and make repairs as needed. (Oregon State Water Resources Department Dam Safety Guide).

Many factors are uncontrollable. For example, Oregon ranks third for future earthquake damages, and flooding is a pervasive problem every year. (ONHW 2006)

5.3.11 Disruption of Utility and Transportation Systems

Disruption of utility and transportation systems is treated as a separate hazard because, while such disruption is a potential impact of each of the natural and human-caused hazards reviewed, its ramifications are far-reaching and much broader than direct damage and direct loss of service.

It is important to remember, in considering any of the other hazards profiled in this plan, that disruption of utility and transportation systems should be viewed in addition to other impacts. The probability, duration, extent, and risk associated with disruption of systems is described below, and in some cases quantified. Electric power outages are dealt with in more detail that other disruptions because loss of electric power has the most widespread effects on other utilities.

5.3.11.1 Nature

The major transportation modes of significance to Yamhill County are roads and railways. Both are subject to disruption from the hazards profiled in this plan; flood, dam failure, landslide, earthquake, volcano, wind, fire, winter storm, infectious disease epidemic (quarantine, public transit restrictions), hazardous materials incidents, and terrorism.

The ramifications of transportation system disruption range from effects on life, health, and safety (emergency vehicle mobility, access to hospitals, access to evacuation routes, access to vital supplies if transport is seriously disrupted for a long time) to the economic effects of delays, lost commerce, and lost time.

Similarly, disruption of utility systems can affect the county at the level of commerce and recreation as well as at the level of fundamental health and safety. Analysis of potential utilities disruptions is complicated because utilities like electric power, potable water, wastewater, natural gas, and telecommunications are all networks, consisting of nodes (centers where something happens) and links (connections between nodes). Networks typically have some level of redundancy built in, and the amount and nature of alternate pathways determines the robustness of the system to any particular disturbance. (Goettel 2005)

Quantitative analysis of network disruption, then, often requires specialized expertise to produce meaningful results. (Goettel 2005) However, potential effects of interruption of utility services can be described qualitatively.

Many water treatment plants are located in flood-prone areas. Inundation can cause raw water to circumvent filtration and treatment systems, and systems with source wells are vulnerable to contamination of the well head by floodwater. Earthquakes can damage water storage, treatment, and transport systems. Water systems are also extremely vulnerable to power outages. Storage tanks are usually located 60 to 200 feet above the water customer network, and water is pumped into these tanks using electricity. Storage tanks typically contain one to two days supply of water. Power outages of longer duration can result in a shortage of clean water for drinking and cooking—a basic requirement for public health. (Goettel 2005)

Wastewater management is also crucial for public health, and wastewater systems are similarly vulnerable to flood, seismic damage, and loss of power. Floods may cause collection pipes to overflow, and can cause inflow that exceeds treatment plant capacity, resulting in release of untreated or partially treated water. Treatment plants are often located in low-lying areas, which facilitates gravity flow of collected water to the plant. However, this means that treatment plants are often found in flood zones. Wastewater pipes and plants are subject to earthquake damage, and loss of power can result in plant shutdown and releases of untreated or partially treated water. (Goettel 2005) Public health hazards can be posed by backed up wastewater and sewage, as well as by releases of untreated or incompletely treated water.

Natural gas systems (compression stations and distribution pipes) are vulnerable to seismic events, and compression stations are vulnerable to flood damage and power loss. Landslides, too, can affect natural gas systems. (Goettel 2005) Where it is used for cooking or heating, disruption of natural gas distribution can cause difficulties. In enclosed areas it presents a health hazard, and it is both flammable and explosive, attributes which are addressed in the Hazardous Materials section.

Telecommunications systems (including telephone, broadcast radio and television, as well as cable networks) are generally somewhat less vulnerable to hazards than other services, given that few nodes (stations) are located in flood zones or landslide areas. Buried lines have more ability to stretch than do gas and water lines, and can usually accommodate several feet of ground movement before failing. Above-ground lines are vulnerable to falling trees or the failure of poles, but disruptions are about ten times less common than electrical line failures—partly because electrical lines are the highest on utility poles and therefore the first to be hit by falling trees and branches, and partly because the much lower voltage of communications lines makes them much less vulnerable to arcing or shorting out if lines come very close to one another. (Goettel 2005) Telecommunications failures can have devastating impacts on a community because emergency response systems at the individual level (fire, police, ambulance) as well as at the disaster-response level rely on immediate, accurate communications.

Electrical power plants and transmission lines are vulnerable to most of the hazards covered in this Plan. Flood, fire, earthquake, volcano, intentional sabotage and/or terrorism are all threats to power sources and transmission and distribution lines. Portland General Electric supplies electrical power to Yamhill County. Electric power is pivotal to modern life. Residential, commercial, and public facilities all rely heavily on electricity. Emergency facilities such as hospitals and emergency response centers typically are equipped with backup generators for critical life-support and communications functions. Nonetheless, the consequences of long-term and widespread electrical power outages are significant. Other utility systems, discussed above, are also dependent on electricity for normal operations, so loss of electric power can have serious secondary effects.

5.3.11.2 History

The history of utility and transportation systems disruptions in Yamhill County are addressed in the other hazard sections of this plan.

5.3.11.3 Location

Yamhill County has and relies upon modern infrastructure: transportation and utility systems are the basis of everyday life in both urban and rural areas of the county. The extent of vulnerability to this hazard is county-wide. While each jurisdiction may wish to identify critical system nodes and links, critical components relied upon by the county as a whole are summarized in Table 5-10.

5.3.11.4 Extent

Yamhill County relies upon modern transportation and utility systems as the basis for both urban and rural everyday life. The vulnerability extent of this hazard is county-wide.

Virtually every hazard profiled in this plan can result in transportation or utility service disruption.

5.3.11.5 Probability of Future Events

Because virtually every hazard profiled in this plan can result in disruption of transportation or utility service, future events are highly probable.

Table 5-10. Countywide Infrastructure Affected by Utility and Transportation System Disruptions

	Central Governance And EOC	Electrical Power Distribution	Emergency Medical Response And Care	Emergency Response Access/ Transportation Route	Emergency Response And Equipment Maintenance	Coordinate Emergency Infrastructure Repairs	Emergency Transportation	Fire Equipment/ Management, Emergency Response	Fuel Distribution	Law Enforcement/ Emergency Response	Law Enforcement/ Confinement	Material Transportation	Possible Shelter/ Community Aid Centers	Public Health And Safety	Volunteer Organization/ Dispatch Center
Airport/ Heliport							L,S					L,S			
City Hall	A,CA, D,DU, L,S,Y														
Courthouse/ Jail											A,C A,L,				
Police/Sheriff Station										A,CA, D,S,W ,Y					
Fire/Rescue Dept								A,CA, D,DU, L,S,W ,Y							
Medical			CA, D,S												
Elec Pwr Distr/Comm		A,CA,D ,DU,L,S ,W,													
Potable Water Distr.														A,CA, D,DU, L,S,W, Y	
Waste Water														A,CA,	

Table 5-10. Countywide Infrastructure Affected by Utility and Transportation System Disruptions

	Central Governance And EOC	Electrical Power Distribution	Emergency Medical Response And Care	Emergency Response Access/ Transportation Route	Emergency Response And Equipment Maintenance	Coordinate Emergency Infrastructure Repairs	Emergency Transportation	Fire Equipment/ Management, Emergency Response	Fuel Distribution	Law Enforcement/ Emergency Response	Law Enforcement/ Confinement	Material Transportation	Possible Shelter/ Community Aid Centers	Public Health And Safety	Volunteer Organization/ Dispatch Center
Treatment														D,DU, L,S,W, Y	
Public Works				A,D,D U,S											
Maintenance					A,D, DU, S										
Railroad				A,DU, L,S			A					A			
Bridges				A,CA, D,L,S, Y											
Highway				A,CA, D,DU, L,S,W, Y											
Marina/Port															
Private Fuel Distr.									A,CA,D, DU,L,S, W,Y					A,CA, D,DU, L,W,Y	
Private Nat. Gas Distr.									A,CA,D, DU,L,S, W,Y					A,CA, D,DU, L,S,W, Y	

Table 5-10. Countywide Infrastructure Affected by Utility and Transportation System Disruptions

	Central Governance And EOC	Electrical Power Distribution	Emergency Medical Response And Care	Emergency Response Access/ Transportation Route	Emergency Response And Equipment Maintenance	Coordinate Emergency Infrastructure Repairs	Emergency Transportation	Fire Equipment/ Management, Emergency Response	Fuel Distribution	Law Enforcement/ Emergency Response	Law Enforcement/ Confinement	Material Transportation	Possible Shelter/ Community Aid Centers	Public Health And Safety	Volunteer Organization/ Dispatch Center
Private Trans. Co.									**S**					**A,**	
Churches													**A,CA,D, DU,L,S, W,Y**		**A,CA,D, DU,L,W, Y**
Schools & Distr Offices													**A,CA,D, DU,L,S, W,Y**		**A,CA,D, DU,L,S, W,Y**
Community/ Civic Ctr													**D,L,Y**		**D,Y**
Dam														**CA,Y**	

Key: ***A:*** *Amity,* ***CA:*** *Carlton,* ***C:*** *County,* ***D:*** *Dayton,* ***DU:*** *Dundee,* ***GR:*** *Grand Ronde Tribe* ***L:*** *LaFfayette,* ***M:*** *McMinnville,* ***N:*** *Newberg,* ***S:*** *Sheridan,* ***W:*** *Willamiona,* ***Y:*** *Yamhill*

5.3.12 Hazardous Materials

5.3.12.1 Nature

Hazardous materials can be simply defined as any materials having a negative impact on health: human; animal; aquatic; or environmental. Hazardous materials exposure may cause injury, illness, or death. Exposure impacts may be evident within seconds, minutes, or hours. Or impacts may not surface until days, weeks, or even years after exposure. Also, it is important to note that harmful effects can be short- or long-term.

Some hazardous materials are highly toxic so that even brief exposures to minute amounts may be dangerous or even fatal. Other hazardous materials are much less toxic; negative effects may occur only after a significant exposure to large quantities of a substance, or exposure to smaller quantities for a prolonged period of time. The technical term "toxic," or "toxicity," which is widely used to describe hazardous materials, is simply a synonym for the more common terms "poison" or "poisonous." A toxin is thus defined as any substance that causes injury, illness, or death to living tissue by chemical activity.

The Institute of Hazardous Materials defines hazardous materials according to several regulatory agencies:

> *. . .any item or agent (biological, chemical, physical) which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.* ***Hazardous materials professionals*** *are responsible for and properly qualified to manage such materials. This includes managing and/or advising other managers on such items at any point in their life-cycle, from process planning and development of new products; through manufacture, distribution, and use; to disposal, cleanup, and remediation.*
>
> *Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), and the U.S. Nuclear Regulatory Commission (NRC). Each has its own definition of a "hazardous material."*
>
> *OSHA's definition includes any substance or chemical which is a "health hazard" or "physical hazard," including: chemicals which are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents which act on the hematopoietic system; agents which damage the lungs, skin, eyes, or mucous membranes; chemicals which are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive or water-reactive; and chemicals which in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapors, mists or smoke which may have any of the previously mentioned characteristics. (Full definitions can be found at 29 Code of Federal Regulations (CFR) 1910.1200.)*
>
> *EPA incorporates the OSHA definition, and adds any item or chemical which can cause harm to people, plants, or animals when released by spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment. (40 CFR 355 contains a list of over 350 hazardous and extremely hazardous substances.)*
>
> *DOT defines a hazardous material as any item or chemical which, when being transported or moved, is a risk to public safety or the environment, and is regulated as such under the: Hazardous Materials Regulations (49 CFR 100-180); International Maritime Dangerous Goods Code; Dangerous Goods Regulations of the International Air Transport Association;*

Technical Instructions of the International Civil Aviation Organization; U.S. Air Force Joint Manual, Preparing Hazarous Materials for Military Air Shipments.

The NRC regulates items or chemicals which are "special nuclear source" or by-product materials or radioactive substances. (See 10 CFR 20).

http://www.ihmm.org/dspWhatIsHazMat.cfm

Hazards are nearly everywhere; petroleum products, natural and synthetic gas, acids, and other acutely toxic chemicals found in everyday products such as paints, solvents, adhesives, household cleaners, pesticides and herbicides, batteries, and even medicines.

This plan does not focus on the hazards in everyday products, but rather on the larger quantities of hazardous materials classified as Hazardous Substances (HS) or Extremely Hazardous Substances (EHS) that are transported through the planning area by rail, highway, and air. HS can present problems when spilled, however EHS potentially pose the most catastrophic threat as the category includes substances, such as chlorine and ammonia, which pose an acute threat to humans and animals. (Alaska State HMP, 2007)

The toxicity of a specific substance is one important factor in determining the risk it poses, but there are other factors that can be just as, if not more, significant. Factors affecting the severity of an accidental release include: toxicity; quantity; dispersal characteristics; release location, population density, and environmental sensitivity; and, efficacy of response and recovery actions.

Hazardous materials are generally classified by their primary health effects on humans. Some common types include the following:

- Anesthetics and narcotics: depress the central nervous system.
- Asphyxiants: interfere with normal breathing and can cause suffocation.
- Explosives: pose explosion, fire, and chemical danger.
- Flammable materials: catch fire easily, although they may pose other dangers such as explosion or chemical effects. Gasoline, propane, and diesel fuel are common examples in this category.
- Irritants: cause burns or irritation to body tissues such as eyes, nose, throat, lungs, or skin.

Hazardous substance exposure generally takes place by one, or a combination of, the following mechanisms:

- Direct contact with skin or eyes
- Ingestion via contaminated food or water
- Particulate or gas inhalation via contaminated air

Unless exempted, facilities that use, manufacture, or store hazardous materials in the US fall under the regulatory requirements of the Emergency Planning and Community Right to Know Act, and must report to the US Environmental Protection Agency (EPA). Releases of HS and EHS can occur at facilities or during transport. Transportation-related releases are generally more troublesome because they may occur anywhere, including close to human populations, critical facilities, or environmentally sensitive areas. Transportation-related EHS releases can

also be more difficult to mitigate due to the great area over which any given incident might occur, and the potential distance from response resources.

- Natural phenomena may also cause a hazardous materials release and complicate response activities from not only the primary but also subsequent or combined secondary events. For instance, earthquakes pose a particular risk, because they can damage or destroy facilities, fires can develop, explosions can occur, and high winds can disperse the released chemical. The threat of any hazardous material event may be further amplified by restricted access, reduced fire suppression, and spill containment capability. Response personnel and equipment may have their access cutoff as roads, highways, or railroad traffic will be impeded. EHS releases can trigger evacuation and short- or long-term displacement creating social and business disruptions.

5.3.12.2 History

On behalf of several federal agencies including the EPA and Department of Transportation, the National Response Center serves as the point of contact for reporting oil, chemical, radiological, biological, and etiological incidents within the US. The National Response Center's Internet-based query system of non-Privacy-Act data shows that since 1997, 34 oil and chemical spills have occurred in Yamhill County. Of these spills, one was pipeline, eleven were transport, two were water, and three were toxic substance related incidents (Table 5-11). The majority of the County's incidents occurred in the Cities of McMinnville, Newberg, Sheridan, and Willamina.

The EPA recorded two unverified airborne hazardous material release report in addition to the oil and chemical spills.

Table 5-11. National Response Center "Incidents" 1997 – 2007, Yamhill County Oregon

Entity	Toxic Releases Reported	Air Releases Reported	Transport Accident	Rail	Pipeline	Other
Yamhill County	**3**	**2**	**11**	**--**	**1**	**19**
City of Amity	-	-	2	-	-	2
City of Carlton	-	-	-	-	-	-
City of Dayton	1	-	-	-	-	-
City of Dundee	-	1	5	-	-	1
City of Lafayette	-	-	-	-	-	
City of McMinnville	2	-	4	-	1	3
City of Newberg	1	-	3	-	-	2
City of Sheridan	-	-	-	-	-	6
City of Willamina	-	-	1	-	-	4
Yamhill City	1	1	1	-	-	1
Other	-	-	-	-	-	-

From the State Fire Marhal's Hazardous Substance Information Data Base at ***http://www.sfm.state.or.us/CR2K/cr2k.htm***

5.3.12.3 Location

Hazardous Substances can be found throughout Yamhill County. The Oregon Fire Marshal's Office has documented 515 EHS sites with 2,975 identified substances in Yamhill County as shown in Table 5-12. Figure K-13 shows major transportation routes that are also subject to hazardous materials impacts. The County's ten major cities account for only 42 percent of the entire county's EHS substances. Gas stations, garages, automotive repair facilities, millwork, manufacturing, food processing plants, agricultural supply, petroleum, natural gas, university and school laboratories, public swimming pools, are the major EHS users. The vast majority of these sites would be places where an unintentional release would create an extremely localized event. The greatest exceptions to this would be an accident involving large EHS quantities used at large industrial complexes or being transported by either road or rail. Industrial, manufacturing, and woodworking EHS user sites, with repeated spill and improper storage history, could also create site-specific contamination.

Table 5-12. EHS Listed Sites Yamhill County

Entity	# Facilities Surveyed	# Facilities Reporting Substances	% Facilities Reporting Substances	Total Substances Reported
Yamhill County	**1,221**	**515**	**42**	**2,975**
City of Amity	71	23	32	81
City of Carlton	61	32	52	171
City of Dayton	75	33	44	157
City of Dundee	50	23	46	78
City of Lafayette	24	11	46	28
City of McMinnville	408	175	43	1227
City of Newberg	344	125	36	689
City of Sheridan	84	39	46	295
City of Willamina	54	27	50	182
Yamhill City	56	27	61	66

As listed from the Oregon Hazardous Substance Information Survey Annual Report 2005

The Environmental Protection Agency's online "*Envirofacts TRI"* website and the Oregon State Fire Marshal's Office's website delineated Yamhill County's EPA regulated facilities. The following delineates the fixed facilities and transportation incidents.

Envirofacts TRI also provided EPA permitting information. Table 5-13 shows the indicated number of wastewater and storm water, hazardous waste handler, and super fund permits; and also reported toxic substance and air releases. The indicated communities also have EPA identified sites with "Supplemental Environmental Interests" concerning recurring leaking storage tanks.

> ***Note:*** *The supplemental environmental permits and regulatory programs. . . apply to the facility site or the environmental interest at the facility site. . . include state*

programs, compliance and enforcement programs, and National Pollutant Discharge Elimination Systems (NPDES) general permits.
(EPA, Facility Registry System)

Table 5-13. EPA Notable Loactions

	Water Discharge	Hazardous Waste Handler	Superfund	Toxic Substances	Air Release	Recurring Tank Leaks
Amity	5	6	-	-	-	-
Carlton	2	4	-	-	-	-
Dayton	5	4	-	-	2	-
Dundee	1	-	-	-	-	-
Lafayette	1	1	-	-	-	-
McMinnville	7	58	1	11	5	3
Newberg	6	61	-	2	1	1
Sheridan	2	6	1	2	3	-
Willamina	4	8	1	1	1	-
Yamhill City	4	3	-	-	-	-

http://oaspub.epa.gov/enviro/fii_master.fii_retrieve?fac_search=primary_name&fac_value=&fac_search_type=Beginning+With&postal_code=&location_address=&add_search_type=Beginning+With&city_name=&county_name=yamhill&state_code=OR&epa_region_code=&sic_code=&all_programs=YES&sic_code_desc=&chem_name=&chem_search=Beginning+With&cas_num=&page_no=1&output_sql_switch=FALSE&report=1&database_type=ENVIROFACTS

Other small, fixed facilities (drycleaners, auto body shops, etc.) have varying and relatively small hazardous chemical usage and do not pose a significant risk to Yamhill County. The City of Salem extends across Yamhill and Marion County lines. The number of permitted sites with the Yamhill County portion of Salem is not readily available.

However, large and small facilities can experience hazardous materials events from product delivery systems via road or rail transportation events. Transportation events occur along Yamhill County's highways; namely Highways 99W (Amity, Dundee. & Lafayette), Hwy 240 & 47 (Carlton), Hwy 155, 221 (Dayton), Hwy 18 (Carlton & Sheridan) and along the railroad corridor. The trucks and trains that use these transportation arteries commonly carry a variety of hazardous materials including fuel, crude oil derivatives, and chemicals. Chlorine, ammonia, acids and other chemicals can be very devastating to human and animal life and the environment.

The Oregon Department of Transportation (ODOT) monitored the movement of hazardous materials on Oregon roads in 1987. The study was conducted in three phases over three different three-day periods. Phase I was conducted in March, Phase II in August, and Phase III

surveyed ports of entry at or near the borders of Washington, California, and Idaho in November.

During Phases I and II. Checkpoints were set up at 11 weigh-scale locations on various interstate highways (I) 5 and 84, U.S. highways (U.S.) 30, 26, and 97, and State Road (SR) 99W, 99E, and 6. One checkpoint was set up in Dayton on west S.R. 99E.

A total of 2,511 hazardous materials placarded vehicles, representing 3,637 shipments, and 208 different hazardous commodities were surveyed. The study determined 5.5 percent (%) of total truck traffic at the survey sites carried hazardous materials. Vehicles marked with FLAMMABLE or COMBUSTIBLE placards ranked first with 54%, followed by CORROSIVE placards marking 16% of the 2,511 vehicles. Most DANGEROUS placarded vehicles carried both flammable and corrosive liquids together.

A total of 2,189 deliveries were bound for Oregon destinations, serving 186 cities in 36 counties. At the ports of entry, 35% of all vehicles were bound for out of state destinations. Most hazardous materials moved over the roads between 6 a.m. and 6 p.m. (70%) and 38% of those occurred between 8 a.m. and noon. DANGEROUS –placarded vehicles moved mostly at night between 6 p.m. and 6 a.m. Hazardous materials carrying vehicles moved at a rate of 46.5 per day or nearly 2 vehicles per hour.

Average hazardous material movement in Dayton was recorded at 25 vehicles per day or 1 vehicle per hour. The checkpoint at Dayton recorded 4.9% of hazardous material truck traffic. One hundred seventy-seven shipments were bound for Yamhill County carrying gasoline, fuel oil (diesel), oxygen refrigerated liquid, oxygen, liquefied petroleum gas, and acetylene. One hundred twenty-five stops were made in the county with 52 vehicles passing though to other destinations.

5.3.12.4 Extent

The extent of hazardous materials risk from any given incident depends heavily on materials dispersed, weather conditions, and water presence. Some materials, such as acids, tend to have localized fumes and destruction, while others can displace oxygen and cause suffocation. Many hazardous liquids and gases depend on wind for dispersal. Water can compound the hazard by dispersing materials or through reactions that convert chemicals into a gaseous state.

5.3.12.5 Probability of Future Events

Previous occurrences indicate the likelihood of a small oil or chemical spill occurring within in Yamhill County is twice per year. However, more comprehensive information on the probability and magnitude of hazardous material events from all types of sources is not available. Wide variations among the characteristics of hazardous material sources and among the materials themselves make such an evaluation difficult. While it is beyond the scope of this HMP to make detailed hazardous materials probability and magnitude evaluations for Yamhill County, it is possible to determine building and critical facility exposure to this hazard. Five hundred-fifteen sites were identified as being EHS sites from annual EPA Tier II Material Inventory Reports.

Figure K-12, shows areas at risk for a hazardous material event, including an area within a ¼ mile radius of major highways and railroad routes.

5.3.13 Terrorism

5.3.13.1 Nature

There is no simple definition for terrorism. The Homeland Security Act of 2002, Public Law 107-296, 107th Congress, Nov 25, 2002, 6 USC 101, §2(15) defines terrorism as:

> *"…any activity that involves an act that is dangerous to human life or potential destructive of critical infrastructure or key resources; and is a violation of the criminal laws of the United States or of any State or other subdivisions of the United States; and appears to be intended to intimidate or coerce a civilian population; to influence the policy of government by intimidation or coercion; or to affect the conduct of a government by mass destruction, assassination or kidnapping."*

Terrorists may use a range of possible malevolent actions, including vandalism, arson, explosions and armed attacks, as well as use of chemical, biological, radioactive or nuclear materials.

- Chemical attacks: deliberate release of a toxic agency (gaseous, liquid, or solid) that can poison people or the environment
- Biological attacks: releases of large quantities of living, disease-causing microorganisms that have extraordinary lethal potential
- Radiological attacks: deliberate dispersal of radioactive materials, via dirty bombs (conventional explosives laced with radioactive materials) or other methods.
- Nuclear attacks: explosion of nuclear devices and the radioactive fallout from such explosions.
- Cyber-terrorism: deliberate disruption/damage of computer systems and data.

5.3.13.2 History

Two major underground movements active in Yamhill County, Oregon - the Earth Liberation Front (ELF) and the Animal Liberation Front (ALF) - are among the most destructive domestic terrorist groups in the United States. ALF, ELF, and related movements have claimed responsibility for more than 1,200 criminal acts since 1990 and caused more than $110 million in property damage in the United States since 1976. (J. Lewis 2005, J. Lewis 2004) Since 1996, ALF and ELF have claimed responsibility for acts which have destroyed property in excess of $13 million in Oregon alone.

In January 2006, 11 suspected members of an animal rights and environmental extremist cell in Oregon were indicted on 65 counts of conspiracy and related offenses including arson and attempted arson. The cell was allegedly responsible for a domestic terrorism campaign that spanned five Western states from 1996 to 2001. Specifically in Oregon, ELF is responsible for firebombing a Southern Oregon lumber mill office, toppling a high tension electric line, and torching a Clatskanie tree farm (Mail Tribune 2005). ELF burned part of the headquarters of a cottonwood plantation for a cost of $1 million dollars.

5.3.13.3 Location

Oregon is home to a wide variety of criminal extremist groups including hate groups, anti-government groups, anarchists, and special issue movements like environmental and animal rights extremists, as well as activity by foreign terrorists. Individuals connected to these groups have used criminal activities to achieve their objectives, including arson, harassment, threats, extortion, home invasions, animal releases, sabotage, and destruction of private and government property.

5.3.13.4 Extent

Because of its location among logging industries and endangered species, Yamhill County is susceptible to the following types of terrorism: vandalism, cyber/computer hacking, and ecoterrorism actions.

5.3.13.5 Probability of Future Events

Based on past historic events in Oregon, Yamhill County may be at risk of terrorism incidents based on infrastructure and environmental resources.

This section provides an overview of the vulnerability analysis and describes the five specific steps: asset inventory, methodology, data limitations and exposure analysis for current assets, and areas of future development. County- and city-specific asset inventory and exposure analysis tables are listed in Appendices A through J.

6.1 OVERVIEW OF VULNERABILITY ANALYSIS

A vulnerability analysis predicts the extent of exposure that may result from a hazard event of a given intensity in a given area. The analysis provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing communities to focus attention on areas with the greatest risk of damage. A vulnerability analysis is divided into five steps: including asset inventory, methodology, data limitations and exposure analysis for current assets, and areas of future development.

The requirements for a vulnerability analysis as stipulated in DMA 2000 and its implementing regulations are described below.

- A summary of the community's vulnerability to each hazard that addresses the impact of each hazard on the community.

DMA 2000 and FMA Requirements: Risk Assessment, Assessing Vulnerability, Overview

Assessing Vulnerability: Overview

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

FMA Requirement §78.5(b): Description of the existing flood hazard and identification of the flood risk, including estimates of the number and type of structures at risk, repetitive loss properties, and the extent of flood depth and damage potential.

Element

- Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
- Does the new or updated plan address the impact of each hazard on the jurisdiction?

Source: FEMA, July 2008.

- An identification of the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, if possible, the types and numbers of vulnerable future development.

DMA 2000 and FMA Requirements: Risk Assessment, Assessing Vulnerability, Addressing Repetitive Loss Properties

Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement §201.6(c)(2)(ii): The risk assessment in all plans approved after October 1, 2008 must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.

Element

- Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?

Source: FEMA, July 2008.

DMA 2000 and FMA Requirements: Risk Assessment, Assessing Vulnerability, Addressing Repetitive Loss Properties

DMA 2000 and FMA Recommendations: Risk Assessment, Assessing Vulnerability, Identifying Structures

Assessing Vulnerability: Identifying Structures

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

FMA Requirement §78.5(b): Description of the existing flood hazard and identification of the flood risk, including estimates of the number and type of structures at risk, repetitive loss properties, and the extent of flood depth and damage potential.

Element

- Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
- Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

Source: FEMA, July 2008.

- Estimate of potential dollar losses to vulnerable structures and the methodology used to prepare the estimate.

DMA 2000 and FMA Recommendations: Risk Assessment, Assessing Vulnerability, Estimating Potential Losses

Assessing Vulnerability: Estimating Potential Losses

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Element

- Does the new or updated plan estimate potential dollar losses to vulnerable structures?
- Does the new or updated plan describe the methodology used to prepare the estimate?

Source: FEMA, July 2008.

- Assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

DMA 2000 and FMA Recommendations: Multi-Jurisdictional Risk Assessment

Assessing Vulnerability: Multi-Jurisdictional Risk Assessment

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment **must** assess each jurisdiction's risks where they vary from the risks facing the entire planning area

FMA FEMA 299 Guidance: The Plan should be coordinated with, and ideally developed in cooperation with, all of the local jurisdictions within the geographical area.

Element

- Does the new or updated plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?

Source: FEMA, July 2008.

6.2 VULNERABILITY ANALYSIS: SPECIFIC STEPS

6.2.1 Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets within each community that may be affected by hazard events include population, residential and nonresidential buildings, and critical facilities and infrastructure. The assets and insured values throughout all of Yamhill County are identified and discussed in detail below. As noted above, community-specific asset inventory lists are located in Appendices A through J.

6.2.1.1 Population and Building Stock

Population data for all of Yamhill County were obtained from the 2000 U.S. Census, which was collected at the census block level. Yamhill County's total population for 2000 was 84,992 and was estimated to be 90,310 for 2005 (Table 6-1).

Table 6-1. Yamhill County Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	**Estimated 2005 Census**	**Total Building Count**	**Total Value of Buildings ($)[1]**
84,992	90,310	30,270	4,425,474,000

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $146,500 per structure).

Estimated numbers of residential buildings and replacement values for those structures, as shown in Table 6-1, were obtained from the 2000 U.S. Census. A total of 30,270 residential buildings were considered in this analysis, including single-family dwellings, mobile homes, multifamily dwellings, temporary lodgings, and institutional dormitory facilities.

6.2.1.2 Repetitive Loss Properties

RL properties are properties that suffer from repeated flooding. FEMA defines a RL property as a property with at least two $1,000 claims within any 10-year period since 1978. SRL properties have been identified by FEMA as most at risk for repeat flooding. These properties include every property that since 1978 has experienced: four or more separate building and content claims each exceeding $5,000 with cumulative claims exceeding $20,000, or at least two separate building claims with cumulative losses exceeding the value of the property (that is, the value of the structure). Table 6-2 show general RL property data located within the county. Locations and addresses for both RL and SRL properties are not available for publication, however are kept on file with the floodplain manager in Yamhill County.

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Table 6-2. Countywide Repetitive Loss Properties

Type	Community	Occupancy	Total Claims Since 1978	Flood Insurance	Value ($)[1]	Total Claims ($)[2]
RL	City of McMinnville	unknown	2	Yes	4,973,200	223
RL	City of Newberg	unknown	1	Yes	1,160,000	0
RL	City of Sheridan	unknown	52	Yes	75,368,400	761,088
RL	City of Willamina	unknown	5	Yes	3,610,700	18,320
RL	Yamhill County	unknown	23	Yes	29,335,600	222,035

Source: FEMA SQANet.
[1] Insured structural value as of 6/23/08.
[2] Content and building claims.

6.2.1.3 Critical Facilities and Infrastructure

A critical facility is defined as a local (non-State or Federal) facility in either the public or private sector that provides essential products and services to the general public, such as preserving the quality of life in Yamhill County and fulfilling important public safety, emergency response, and disaster recovery functions. The critical facilities profiled in this plan include the following:

- Government facilities, such as departments, agencies, and administrative offices
- Emergency response facilities, including police, fire, and Emergency Operations Centers
- Educational facilities, including K-12
- Care facilities, such as congregate living health, residential care, and continuing care retirement facilities
- Community gathering places, such as parks, museums, libraries, and senior centers

The total number of critical facilities within the county is listed in Appendix A and shown on Figure K-14. Community-specific critical facilities are listed in Appendices B through J.

Similar to critical facilities, critical infrastructure includes infrastructure that is essential to preserving the quality of life and safety in the county. Critical infrastructure profiled in this plan includes the following:

- State and Federal Highways
- Railroad Tracks
- Local, State, and Federal bridges

- Utilities, including communication (cell, radio, and television), water and wastewater, and electrical facilities.

6.2.2 Methodology

A conservative exposure-level analysis was conducted to assess the risks of the identified hazards. This analysis is a simplified assessment of the potential effects of the hazards on values at risk without consideration of probability or level of damage.

Using GIS, point locations with conservative buffers of 300 feet, to account for the building footprints of critical facilities, were compared to locations where hazards are likely to occur. If any portion of the critical facility fell within a hazard area, it was counted as impacted.

Replacement values or insurance coverage were developed for physical assets. These values were provided by the local jurisdiction. For facilities that didn't have specific values per building in a multibuilding scenario (e.g., schools), the buildings were grouped together and assigned one value where available. Value information is not available for all critical facilities at this time and will be collected as it becomes available. For each physical asset located within a hazard area, exposure was calculated by assuming the worst-case scenario (that is, the asset would be completely destroyed and would have to be replaced). Finally, the aggregate exposure, in terms of replacement value or insurance coverage, for each category of structure or facility was calculated.

6.2.3 Data Limitations

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in an approximation of risk. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment as well as the use of approximations and simplifications that are necessary for a comprehensive analysis.

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, and critical facilities and infrastructure to the identified hazards. It was beyond the scope of this MHMP to develop a more detailed or comprehensive assessment of risk (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses). Such impacts may be addressed with future updates of the MHMP.

6.2.4 Exposure Analysis

The results of the exposure analysis for loss estimations in Yamhill County and each participating jurisdiction are located in Appendices A-J. Each appendix represents a jurisdiction and lists the critical facilities and the specific hazard areas in which each facility is located.

Appendix A
Yamhill County

Table J-1A Yamhill County Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
84,992	90,310	30,270	4,425,474,000

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $146,500 per structure).

Table A-1B City of Yamhill County NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Yamhill County	91,917	86	147	29,335,600	625.29	23	222,035	1

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table A-2 City of Yamhill County Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	McMinnville Community Center	600 NE Evans St., McMinnville	
	Amity Public Works	401 E. Third St., Amity	$812,888
	Carlton Public Works	191 E. Main St., Carlton	
	Dayton Public Works	416 Ferry St., Dayton	$146,091
	Dundee Public Works	620 SW Fifth St., Dundee	
	Lafayette Public Works	486 Third St., Lafayette	

Table A-2 City of Yamhill County Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	McMinnville Public Works	1900 NE Riverside Dr.	
	Newberg Public Works	500 W Third St.	
	Sheridan Public Works	139 NW Yamhill St.	
	Willamina Public Works	411 NE C St.	
	Yamhill Public Works	450 S. Maple St.	$272,969
	Yamhill County Public Works	2060 Lafayette Ave.	
	Yamhill County Fairgrounds	2070 Lafayette Ave., McMinnville	
	McMinnville City Hall	*230 NE Second Street*	
	Amity City Hall	*401 South Trade Street*	
	Carlton City Hall	*21511 NW Panther Creek Road*	
	Dayton City Hall	*416 Ferry Street*	$688,568
	Dundee City Hall	*620 SW Fifth Street*	
	Lafayette City Hall	*486 Third Street*	$1,800,000
	Newberg City Hall	*414 East First Street*	
	Sheridan City Hall	*120 SW Mill Street*	$135,139
	Willamina City Hall	*411 NE "C" Street*	
	Yamhill City Hall	205 South Maple Street	$219,390
	Yamhill County Dog Control	*2070 Lafayette Avenue, McMinnville*	
	City of Newberg Dog Control	*401 East Third Street*	
	Evergreen-Doe Humane Society	*NE 15th Street, McMinnville*	
	Yamhill County Courthouse	535 NE Fifth Street	
	Yamhill County Jail	535 NE Fifth Street	

Table A-2 City of Yamhill County Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Emergency Response	Amity FD	401 South Trade Street	
	Carlton FD	209 North Kutch Street	
	Dundee FD	759 SW Hwy 99W	
	McMinnville FD	175 NE First Street	
	Newberg FD	414 East Second Street	
	Sheridan FD	230 SW Mill Street	
	Amity PD	401 SouthTrade Street	
	Carlton PD	191 East Main Street	
	McMinnville PD	121 SW Adams Street	
	Newberg PD	401 East Third Street	
	Yamhill PD	205 North Maple Street	
	Yamhill County SO	*535 NE Fifth Street, McMinnville*	
	Yamhill County EM	414 NE Evans Street, McMinnville	
	City of Newberg EM	*414 East First Street, Newberg*	
Educational			
	Amity Grade School	*300 Rice Lane*	
	Carlton Elementary School	*420 South Third Street*	
	Dayton Grade School	*526 South Ferry Street*	$6,687,547
	Dundee Elementary School	*140 SW Fifth Street*	
	Wascher Elementary School	*986 East Seventh Street*	
	Buel Elementary	*1985 SE Davis Street*	
	Columbus Elementary	*1600 SW Fellows Street*	
	Cook Elementary	*800 NE Lafayette Avenue*	
	Grandhaven Elementary	*3200 NE McDonald Lane*	
	Memorial Elementary	*501 West 14th Street*	

Table A-2 City of Yamhill County Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Educational	Newby Elementary	*1125 West Second Street*	
	Antonia Crater Elementary School	*203 West Foothills*	
	Edwards Elementary School	*715 East Eighth Street*	
	Ewing Young Elementary School	17600 NE North Valley Road	
	Joan Austin Elementary	*2200 North Center Street*	
	Mable Rush Elementary	*1441 Deborah Road*	
	Perrydale School	*7445 Perrydale Road*	
	Faulconer Chapman School	*332 SW Cornwall Street*	
	Willamina Elementary	*1100 NE Oaken Hills Drive*	$353,602
	Yamhill Grade School	*310 East Main Street*	$3,367,727
	Amity Middle School	*115 Church Street*	
	Dayton Jr. High School	*801 Ferry Street*	$731,931
	Duniway Middle School	*575 Michelbook Lane*	
	Patton Middle School	*1175 East 19th*	
	Chehalem Valley Middle School	*403 West Foothills*	
	Mountain View Middle School	*2015 North Emery Drive*	
	Willamina Middle School	*1100 NEOaken Hills Drive*	
	Amity High School	*503 Oak Street*	
	Dayton High School	*801 Ferry Street*	$4,486,769
	McMinnville High School	*615 East 15th Street*	
	Newberg High School	*2400 Douglas Avenue*	
	Sheridan High School	*433 South Bridge Street*	

Table A-2 City of Yamhill County Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Educational	Willamina High School	*1100 NE Oaken Hills Drive*	
	Yamhill-Carlton Union High School	275 North Maple Street	$42,933
	Bethel Christian School	*325 NW Baker Creek Road*	
	McMinnville Adventist Christian School	*1349 NW Elm Street*	
	McMinnville Montessori School	*1101 SE Brooks Street*	
	Saint James Catholic School	*206 NE Kirby Street*	
	St. John Lutheran School	*2142 NE McDonald Lane*	
	CS Lewis Academy	*200 South College Street*	
	Open Bible Christian School	*1605 North College Street*	
	Veritas Classical Christian School	*401 Mission Drive*	
	West Valley Academy	*9015 DeJong Road, Amity*	
	The Delphian School	*20950 SW Rock Creek Road*	
	Pioneer Christian School	*885 SW Hill Drive*	
	Chemeketa Community College	*500 NW Hill Road, McMinnville*	
	George Fox University	*414 North Meridian Street, Newberg*	
	Linfield College	900 NE Baker Street, McMinnville	
Care Facility	Willamette Valley Medical Center	2700 SE Stratus Avenue McMinnville	
	Providence Newberg Medical Center	*1003 Providence Drive Newberg*	
	McMinnville Immediate Health Care	321 N. Hwy 99W Suite B	
	Newberg Urgent Care	*2880 Hayes Street*	

Table A-2 City of Yamhill County Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Community	Northwest Senior & Disability Services	300 SW Hill Road McMinnville	
		2250 NE McDaniel Lane McMinnvile	
		101 West Foothills, Newberg	
		917 South Bridge Street, Sheridan	
	Hillside Retirement Community	*440 NW Hillside Parkway*	
	Osprey Court Memory Care	*320 SW Hill Road*	
	Osprey Point Assisted Living	*345 SW Hill Road*	
	Parkland Village	*3121 NE Cumulus Avenue*	
	Villas of McMinnville	*775 NE 27th Street*	
	Windfield Village	*345 SW Hill Road*	
	Astor House at Springbrook	3801 Hayes Street	
	Chehalem Springs Assisted Living	3802 Hayes Street	
	Friendsview Retirement Community	1301 East Fulton	
	Golden Villa Retirement Center	700 East Fifth Street	
	Huffman House	1307 North College	
	Deer Meadow Assisted Living	1350 West Main Street	
	Evergreen Aviation Museum	*500 NE Captain Michael King Smith Way, McMinnville*	
	YCAP	*800 NE Second Street, McMinnville*	
	CVSCC (Chehalem Valley Senior Citizen Council)	125 South Elliott, Newberg	
State and Federal Highways	Hwy 99W		
	Hwy 18		
	Hwy 47		
	Hwy 240		
Railroads	Willamette & Pacific Railroad	*741 NE Third Street, McMinnville*	
Bridges	3-Mile Lane Bridge	*McMinnville Connects to Hwy 18*	

Table A-2 City of Yamhill County Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Bridges	"Green" Bridge, Sheridan	Connects to Hwy 18	
Ground and Air Facilities	Cirrus Aviation	4000 SE Cirrus Avenue, McMinnville	
	Sportsman Airpark	*504 S. Airpark Way, Newberg*	
	Wheatland Ferry	Crossing Willamette River	
Utilities			
	City of McMinnville Wastewater Services	3500 NE Clearwater Drive	
	Riverbend Landfill Co.	*13469 SE Hwy 18, McMinnville*	
	Boneville Power Administration	14297 Pike Road NW, Yamhill	
	McMinnville Water & Light	855 NE Marsh Lane	
	Portland General Electric	130 SW Monroe, Sheridan	
Dams	Haskins Reservoir/Dam		
	McGuire Reservoir/Dam		
	Stormy Mountain Reservoir		

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table A-3 City of Yamhill County Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	90,310	30,270	4,425,474,000
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	90,310	30,270	4,425,474,000
Wind		descriptive	90,310	30,270	4,425,474,000
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table A-4 Yamhill County Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	1	272,969	1	unknown	0	0	2	unknown	0	0
	High	100-year floodplain	3	408,108	2	unknown	2	unknown	3	unknown	0	0
Winter Storm		descriptive	28	4,075,045	14	unknown	48	15,670,509	22	unknown	1	unknown
Landslide	Moderate	14-32 degrees	9	492,359	3	unknown	12	15,627,576	3	unknown	0	0
	High	>32 degrees	0	0	0	0	0	0	1	unknown	0	unknown
Wildland Fire	Moderate	Moderate fuel rank	28	4,075,045	14	unknown	45	15,670,509	22	unknown	0	0
	High	High fuel rank	17	2,907,628	6	unknown	25	8,940,029	9	unknown	0	0
	Very High	Very high fuel rank	1	unknown	0	0	1	unknown	0	0	0	0
	Extreme	Extreme fuel rank	1	unknown	0	0	0	0	0	0	0	0
Earthquake	Strong	9-20% (g)	28	4,075,045	14	unknown	45	15,670,509	22	unknown	1	unknown
	Very strong	>20-40% (g)	0	0	0	0	0	0	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	0	0	0	0
Volcano		descriptive	28	4,075,045	14	unknown	48	15,670,509	22	unknown	1	unknown
Wind		descriptive	28	4,075,045	14	unknown	48	15,670,509	22	unknown	1	unknown
El Nino and La Nina		descriptive	28	4,075,045	14	unknown	48	15,670,509	22	unknown	1	unknown
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	21	3,262,157	14	unknown	26	10,451,809	15	unknown	0	0
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	28	4,075,045	14	unknown	48	15,670,509	22	unknown	1	unknown

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table A-5 Yamhill County Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--	--	--	--	--	--	1	unknown	0	0
	High	100-year floodplain	--	--	--	--	--	--	--	--	3	unknown	1	unknown
Winter Storm		descriptive	4	unknown	1	unknown	2	unknown	--	--	8	unknown	3	unknown
Landslide	Moderate	>14-32 degrees	--	--	--	--	--	--	--	--	1	unknown	2	unknown
	High	>32 degrees	--	--	--	--	--	--	--	--	1	unknown	2	unknown
Wildland Fire	Moderate	Moderate fuel rank	--	--	1	unknown	--	--	--	--	7	unknown	1	unknown
	High	High fuel rank	--	--	1	unknown	--	--	--	--	1	unknown	2	unknown
	Very High	Very high fuel rank	--	--	--	--	--	--	--	--	2	unknown	2	unknown
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--	0	0	1	unknown
Earthquake	Strong	9-20% (g)	--	--	1	unknown	--	--	--	--	7	unknown	2	unknown
	Very strong	>20-40% (g)	--	--	--	--	--	--	--	--	0	0	0	0
	Severe	>40-60% (g)	--	--	--	--	--	--	--	--	0	0	0	0
Volcano		descriptive	4	unknown	1	unknown	2	unknown	--	--	8	unknown	3	unknown
Wind		descriptive	4	unknown	1	unknown	2	unknown	--	--	8	unknown	3	unknown
El Nino and La Nina		descriptive	4	unknown	1	unknown	2	unknown	--	--	8	unknown	3	unknown
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	4	unknown	1	unknown	2	unknown	--	--	3	unknown	0	0
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	4	unknown	1	unknown	2	unknown	--	--	8	unknown	3	unknown

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for Yamhill County. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In Yamhill County, 3 government facilities (worth $408,108), 2 emergency response facilities (value unknown), 2 educational facilities (value unknown), 3 care facilities (value unknown), 3 utilities (value unknown) and 1 dam (value unknown) are located within the boundaries of the 100-year floodplain and therefore accorded a high risk. The 500-year floodplain contains 1 government facility (worth $272,969), 1 emergency response facility (value unknown), 2 care facilities (value unknown) and 1 utility (value unknown), which are considered to have a moderate risk.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Winter storms are regional events. While there will be differences based on geography and topography, these variations are difficult to predict in advance. Higher amounts of precipitation in the form of snow tend to fall at higher elevations, while freezing rain more often impacts lower areas in the county. However, flooding resulting from increased snow fall would be most severe downstream. Different weather patterns can affect different areas throughout the county in different manners, and at different times impacts from a regional event such as a snow storm can be spread out temporally as well as spatially. Therefore all critical facilities, infrastructure, and residents are considered to be at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within Yamhill County. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, Yamhill County has 9 government facilities (worth $$429,359), 3 emergency response facilities (value unknown), 12 educational facilities (worth $15,627,576), 3 care facilities (value unknown), 1 utility (value unknown) and 2 dams (value unknown) located in areas of moderate risk, in addition to 1 care facility (value unknown), 1 utility (value unknown) and 2 dams (value unknown) located in areas of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

Yamhill County has critical facilities and infrastructure located within areas with moderate, high, and very high fuel ranks. Moderate fuel rank areas contain 28 government facilities (worth $4,075,045), 14 emergency response facilities (value unknown), 45 educational facilities (worth $15,670,509), 22 care facilities (value unknown), 1

railroad (value unknown), 7 utilities (value unknown) and 1 dam (value unknown); high fuel rank areas contain 17 government facilities (worth $2,907,628), 6 emergency response facilities (value unknown), 25 educational facilities (worth $8,940,029), 9 care facilities (value unknown), 1 railroad (value unknown), 1 utility (value unknown) and 2 dams (value unknown); very high fuel rank areas contain 1 government facility (value unknown), 1 educational facility (value unknown), 2 utilities (value unknown) and 2 dams (value unknown); extreme fuel rank areas contain 1 government facility (value unknown) and 1 dam (value unknown).

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The eastern portion of Yamhill County is a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and a strong designation corresponds to 9-20 percent of the acceleration of gravity while a very strong designation corresponds to >20-40 percent of the acceleration of gravity.

Yamhill County has 28 government facilities (worth $4,075,045), 14 emergency response facilities (value unknown), 45 educational facilities (worth $15,670,509), 22 care facilities (value unknown), 1 community facility (value unknown), 1 railroad (value unknown), 7 utilities (value unknown) and 2 dams (value unknown) in the region likely to experience strong shaking. There are no critical facilities listed in this report located in the region expected to experience very strong shaking.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within Yamhill County are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

Within Yamhill County, this corresponds to the eastern portion of the county, in the Willamette Valley. However, strong winds are often associated with higher elevations, such as those found in the eastern portion of the county, therefore all of Yamhill County is considered to be susceptible to a windstorm event. All critical facilities, residential structures, and residents are equally at risk for this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In Yamhill County, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to Yamhill County's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region using that method. Of the 30 dams listed in the National Inventory of Dams, 23 are privately owned, six are owned by local government, and one is a public utility. However, only three dams are considered a concern by the cities participating in this study, two of which do not meet NID's criteria.

The City of Sheridan's Stony Mountain Impoundment Facility is a spring-fed reservoir, retained by an earthen dam approximately 10 miles outside of town. The emergency spillway empties into La Toutena Mary Creek. The dam embankment, if breached, will spill into a La Toutena Mary Creek tributary, and the flood hydrograph will travel 3.37 miles to the La Toutena Mary Creek and East Creek confluence, with an additional 3.15 miles to East Creek's confluence with Willamina Creek. Based on a clear day piping failure stimulated by the City of Sheridan, if the dam embankment was breached, it would take approximately 35 minutes for the dammed water to travel the 3.37 miles to the East Creek confluence and an additional 100 minutes to travel to the Willamina Creek confluence.

Under normal conditions, the flood wave would start with approximately 10,670 cubic feet per second (cfs) at the dam and end with approximately 1,090 cfs at Willamina Creek. Due to the limited size of the watershed, the limited inflow to the reservoir, and the height of the dam compared to the emergency spillway (1,657 feet vs. 1,653 feet), an overtopping failure is unlikely. Thus, a catastrophic failure of the dam would not present a threat to human life downstream. Neither the road nor any residential structures would likely be inundated by the flood wave generated by a piping failure.

Even when the clear-day scenario was tested using more extreme assumptions, such as increased water levels, a dam failure still did not pose a threat to residential structures. Possible developments that could cause piping failure include rapid drawdown, seismic activity, or slope failure. As water flows through the dam, the passage could continue to grow as material is eroded away. Eventually the size of the passage could compromise the structural integrity of the dam and cause it to collapse. (City of Sheridan Dam Failure Analysis, 2007)

The City of Carlton's Panther Creek Reservoir is approximately 8 miles west of town. The drainage basin above the dam is approximately 3.19 square miles. There has been some erosion caused by tree removal activities by local landowners during the rainy season. There is a main 4.5 mile long 10-inch diameter transmission line to the city, which includes a 6-inch emergency connection with the McMinnville Water and Light main transmission line. However, no agreement exists as to the when the connection can be used. (City of Carlton Citizen Involvement and Land Use Planning, 1999)

The City of Willamina's Dam is an earthen dam located approximately 12 miles north or town. It is expected that a dam failure would affect the city by causing a mud flow down Willamina Creek. There is also a moderate concern of debris flowing down the Willamina Creek in the case of a dam failure of the City of Sheridan's Stony Mountain Impoundment Facility. (City of Willamina Hazard Profile)

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time.

Similarly, disruption of utility systems can affect Yamhill County in terms of commerce and recreation as well as at fundamental health and safety level. Countywide disruptions are likely to impact all residents equally. Structural

damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk. In general, this corresponds to main transportation arteries throughout the county.

In Yamhill County, 21 government facilities (worth $3,262,157), 14 emergency response facilities (value unknown), 26 educational facilities (worth $10,451,809), 15 care facilities (value unknown)) are considered at risk. Additionally, 4 highways (value unknown), 1 railroad (value unknown), 2 bridges (value unknown) and 3 utilities (worth $383,232) are located within the ¼ mile risk radius.

Terrorism

It is difficult to determine the scope of any terrorist threat to Yamhill County. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are at equal risk of being impacted by this threat, with increased risk near urban centers.

Appendix B

City of Amity

Table B-1A City of Amity Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2006 Census	Total Building Count	Total Value of Buildings ($)[1]
1,478	1,480	495	$55,786,500

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $112,700 per structure).

Table B-1B City of Amity NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[1]
Amity	759	0	2	197,800	379.5	0	0	0

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[1]Content and building claims.

Table B-2 City of Amity Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	City Hall/ Court/ Amity Police and Fire Station #1	401 S. Trade or 109 Maddox Ave. (same location)	
	City of Amity	20000 Briedwell Rd	$40,385
	Other Amity Assets		$1,173,905
Government	Amity Public Works Department	401 E. 3rd St.	$812,888
	Amity US Post Office	102 Woodson St.	
Emergency Response	Amity Police and Fire Station #1	Inside City Hall Bldg 401 S. Trade and/or 109 Maddox Ave (same location)	1,011,057

Table B-2 City of Amity Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Educational	Amity Preschool and Elementary School (K-5)	300 Rice lane	
	Amity Middle School (6-8)	115 Church St.	
	Amity High School (9-12) 503 Oak Street	503 Oak St.	$508,309
	Perrydale School	7445 Perrydale Rd	
	Other School Assets		$2,044,548
Care Facility	Amity Cemetery	See map	
Community	Amity City Library	307 N. Trade St.	
	Amity City Park	See map	
	Amity Assembly of God	310 Getchell St.	$181,490
	Amity First Baptist Church	205 6th St.	
	Amity & McCabe United Methodist Churches	203 SE Nursery Ave	$61,576
	Brigittine Monastery	23300 SW Walker Lane	
	Church of Christ	1305 Goucher St.	$1,051,599
	Church of Jesus Christ of Latter Day Saints	18565 S Hwy 99 W	
	Assembly of God Church	708 S. Jellison St.	$98,774
Health Care	Mid Valley Rehabilitation Center	16700 S Hwy 99 W	
State and Federal Highways	Hwy 99W N/S 2 lane no sidewalk		
	Bellevue Hwy – 2 lane no sidewalks		
	Amity Hopewell Hwy – 2 lane with sidewalks		
Railroads	Willamette & Pacific (Freight Only) parallel Hwy 99	741 NE Third Street, McMinnville	
Bridges	Bridge on Hwy 99 just outside city limits		
	Bridge on Bellevue Hwy just outside city limits		
Utilities	NW Natural Gas	3123 Broadway NE, Salem	
	Amity Water Treatment (South Yamhill River Source – built in 1969)	20000 SW Briedwell Road	$47,109

Table B-2 City of Amity Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Utilities	Amity Waste Water Treatment (built in 1961)	401 E. 3r	$1,011,957
	Amity Storm Drain System		
	City Sanitary & Recycling	1850 Lafayette Ave., McMinnville	
	Lift Stations (3)		
	Landfill – Riverbend Landfill	13469 SW Highway 18, McMinnville	
	Telephone – Verizon	635 NE Highway 99W, McMinnville	
	Cell Services – provided; no towers		
	PGE ELectric	130 SW Monroe, Sheridan	
	Comcast TV	9605 SW Nimbus Ave., McMinnville	
	AT&T Wireless	675 SW Keck Dr, McMinnville	
	Cricket DMT Wireless	2644 NE Highway 99, McMinnville	
	Go Wireless Inc.	2758 NE Highway 99W, McMinnville	

Sources: City of Amity
FEMA HAZUS-MH, local jurisdictions.
[1] Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table B-3 City of Amity Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	1,480	495	$55,786,500
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	1,480	495	$55,786,500
Wind		descriptive	1,480	495	$55,786,500
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table B-4 City of Amity Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	0	0	3	1,051,599
	High	100-year floodplain	0	0	0	0	0	0	0	0	3	1,051,599
Winter Storm		Descriptive	5	2,027,178	0	0	5	2,044,548	1	unknown	10	1,393,439
Landslide	Moderate	14-32 degrees	0	0	0	0	1	unknown	1	unknown	6	1,150,373
	High	>32 degrees	0	0	0	0	0	0	0	0	2	unknown
Wildland Fire	Moderate	Moderate fuel rank	4	853,273	0	0	3	508,309	1	unknown	10	1,393,439
	High	High fuel rank	1	40,385	0	0	3	508,309	1	unknown	5	1,051,599
	Very High	Very high fuel rank	0	0	0	0	0	0	1	unknown	1	unknown
	Extreme	Extreme fuel rank	0	0	0	0	0	0	0	0	0	0
Earthquake	Strong	9-20% (g)	4	853,273	0	0	4	508,309	1	unknown	10	1,393,439
	Very strong	20-40% (g)	0	0	0	0	0	0	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	0	0	0	0
Volcano		Descriptive	5	2,027,178	0	0	5	2,044,548	1	unknown	10	1,393,439
Wind		Descriptive	5	2,027,178	0	0	5	2,044,548	1	unknown	10	1,393,439
El Nino and La Nina		Descriptive	5	2,027,178	0	0	5	2,044,548	1	unknown	10	1,393,439
Drought		Descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		Descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	2	unknown	0	0	3	508,309	0	0	5	
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	341,840
Terrorism		Descriptive	5	2,027,178	0	0	5	2,044,548	1	unknown	10	1,393,439

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table B-5 City of Amity Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	--	--	0	0	0	0
	High	100-year floodplain	0	0	0	0	0	0	--	--	1	unknown	0	0
Winter Storm		descriptive	3	unknown	1	unknown	2	unknown	--	--	15	1,059,066	0	0
Landslide	Moderate	14-32 degrees	0	0	0	0	0	0	--	--	0	0	0	0
	High	>32 degrees	0	0	0	0	0	0	--	--	0	0	0	0
Wildland Fire	Moderate	Moderate fuel rank	0	0	1	unknown	0	0	--	--	10	1,059,066	0	0
	High	High fuel rank	0	0	0	0	0	0	--	--	3	47,109	0	0
	Very High	Very high fuel rank	0	0	0	0	0	0	--	--	0	0	0	0
	Extreme	Extreme fuel rank	0	0	0	0	0	0	--	--	0	0	0	0
Earthquake	Strong	9-20% (g)	0	0	1	unknown	0	0	--	--	11	1,059,066	0	0
	Very strong	20-40% (g)	0	0	0	0	0	0	--	--	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	--	--	0	0	0	0
Volcano		descriptive	3	unknown	1	unknown	2	unknown	--	--	15	1,059,066	0	0
Wind		descriptive	3	unknown	1	unknown	2	unknown	--	--	15	1,059,066	0	0
El Nino and La Nina		descriptive	3	unknown	1	unknown	2	unknown	--	--	15	1,059,066	0	0
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	3	unknown	1	unknown	2	unknown	--	--	6	unknown		
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	0	0
Terrorism		descriptive	3	unknown	1	unknown	2	unknown	--	--	15	1,059,066	0	0

[1]Estimated value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Amity. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Amity, 3 community facilities (worth $1,051,599) are within the boundaries of the 100-year floodplain, while 1 utility (value unknown) is located within the 500-year floodplain.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Amity can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Amity. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Amity has 1 educational facility (value unknown), 1 care facility (value unknown), and 6 community facilities worth $1,150,373 located in areas of moderate risk, while 2 community facilities of unknown value are located within areas of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Risk

levels of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Amity has critical facilities and infrastructure located within areas of moderate, high and very high risk. Moderate risk areas contain 4 government facilities (worth $853,273), 3 educational facilities (worth $508,309), 1 care facility (value unknown), 10 community facilities (worth $1,393,439), and 10 utilities (worth $1,059,066); high risk areas contain 1 government facility (worth $40,385), 3 educational facilities (worth 508,309), 1 care facility (value unknown), 5 community facilities (worth $1,051,599), and 3 utilities (worth $47,109); and very high risk areas contain 1 care facility (value unknown) and 1 community facility (value unknown).

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Amity is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Amity has 4 government facilities (worth $853,273), 4 educational facilities (worth $508,309), 1 care facility (value unknown), 10 community facilities (worth $1,393,439), and 11 utilities (worth $1,059,066) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Amity in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Amity are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can

include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Amity are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Amity, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to Amity's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region. However, as determined by the Army Corps of Engineers and summarized in the National Inventory of Dams, there are no dams that pose a significant hazard to the City of Amity in the instance of failure.

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Amity at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Amity, 3 highways and 1 railroad (values unknown) are considered at risk, as well as 2 government facilities (value unknown), 3 educational facilities (worth $508,309), 5 community facilities (worth $341,840), 2 bridges (value unknown) and 6 utilities (value unknown).

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Amity. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are equally at risk of being impacted by this threat.

Appendix C
City of Carlton

Table C-1A City of Carlton Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
1,514	1,585	588	75,264,000

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $128,000 per structure).

Table C-1B City of Carlton NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Carlton	825	1	2	303,600	412.50	0	0	0

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table C-2 City of Carlton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	US Post Office	438 W. Main St.	
	American Legion Hall	126 NE Atlantic St., McMinnville	
	City Hall / Police Department / Court House / Emergency Ops	191 E. Main St.	
Emergency Response	Fire Station	318 Kutch St.	

Table C-2 City of Carlton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Emergency Response			
Educational	Carlton Elementary School (K-8)	420 S. 3rd St.	
	Yamhill/Carlton High school (In Yamhill)	275 N. Maple St., Yamhill	
Health Care	Vet Clinic	230 S. Pine St.	
	Meloche Linda (Health)	12125 Penny Lane	
	J Stonebridge MD	304 E. Polk St.	
	Mark Miller DDS	133 W. Main St.	
	Senior Center--Carlton Together Cares (Youth Center)	226 E. Main St.	
	Family Tree Healthcare	348 S. Pine St.	
Community	Park – Hawn Creek Park		
	Park – Upper Park	see coordinates	
	Park – Wennerberg Park	see coordinates	
	Pool – Carlton Pool	191 E. Main St.	
	Senior Center & Carlton Together Cares (Youth Center)		
	Carlton Farm/Meat Packing Plant	10600 NW Westside Rd.	
	Meat Cutting Facility/Freezer	455 W. Main St.	
	Western Farm Service Carlton Branch (Fertilizer Plant)		
	Gas Station	210 N Maple St., Yamhill	
	Carlton Vineyard Estates	11195 NW Foothills Rd	
Community	Cornucopia Vineyards Ltd	12020 NE Stag Hollow Rd	

Table C-2 City of Carlton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
	First Baptist Church	500 W. Main St.	
	Grace Baptist Church	E Monroe St.	
	Assembly of God Church	437 S. 3rd St.	
	Carlton Community Church		
	Victory Fellowship Church	500 E. Main St.	
State and Federal Highways	State – HWY 47		
	County – Hendricks Road		
	County – HWY 240		
	County – Meadow Lake		
	County – Westside Road		
	City – East Main		
	City – West Main		
Bridges	County – Yamhill River (Main Street/Meadow Lake Road) heading west out of town	Heading W out of town	
	County – East Main heading east/Hendricks crosses Hahn Creek	Heading E/Hendricks crosses Hahn Creek	
Utilities	Water Treatment Plant (1985)	(city park at end of river street)	
	Wastewater Treatment Plant (1928)		
Utilities	Lift Station 1	150 N Yamhill	

Table C-2 City of Carlton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
	Lift Station 2	E. Main St.	
	Lift Station 3		
	Radio Station (1260) McMinnville	1975 NE Colvin Ct. McMinnville	
	Water Storage Tank 1		
	Water Storage Tank 2		
	Water Storage Tank 3		
	Bulk Fuel Facility		
	Sewage Lagoons		
	Portland General Electric	130 SW Monroe, Sheridan	
	pump station	hawn creek pump station	
	pump station	at wastewater treatment plant	
Dams	Panther Creek Reservoir	approx 7 miles W of town off Panter Cr. Rd	

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table C-3 City of Carlton Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings	
				Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)**[1]
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	1,585	588	75,264,000
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	1,585	588	75,264,000
Wind		descriptive	1,585	588	75,264,000
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table C-4 City of Carlton Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	0	0	1	unknown
	High	100-year floodplain	0	0	0	0	0	0	0	0	1	unknown
Winter Storm		descriptive	3	unknown	1	unknown	2	unknown	6	unknown	13	unknown
Landslide	Moderate	14-32 degrees	1	unknown	1	unknown	0	0	1	unknown	5	unknown
	High	>32 degrees	0	0	0	0	0	0	1	unknown	2	unknown
Wildland Fire	Moderate	Moderate fuel rank	3	unknown	1	unknown	2	unknown	6	unknown	12	unknown
	High	High fuel rank	2	unknown	0	0	0	0	5	unknown	5	unknown
	Very High	Very high fuel rank	0	0	0	0	0	0	1	unknown	0	0
	Extreme	Extreme fuel rank	0	0	0	0	0	0	1	unknown	0	0
Earthquake	Strong	9-20% (g)	3	unknown	1	unknown	2	unknown	6	unknown	12	unknown
	Very strong	20-40% (g)	0	0	0	0	0	0	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	0	0	0	0
Volcano		Descriptive	3	unknown	1	unknown	2	unknown	6	unknown	13	unknown
Wind		Descriptive	3	unknown	1	unknown	2	unknown	6	unknown	13	unknown
El Nino and La Nina		Descriptive	3	unknown	1	unknown	2	unknown	6	unknown	13	unknown
Drought		Descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)	Low	NID	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		Descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	3	unknown	1	unknown	2	unknown	5	unknown	7	unknown
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		Descriptive	3	unknown	1	unknown	2	unknown	6	unknown	13	unknown

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table C-5 City of Carlton Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	--	--	0	0	--	--	1	unknown	0	0
	High	100-year floodplain	0	0	--	--	0	0	--	--	2	unknown	0	0
Winter Storm		descriptive	7	unknown	--	--	2	unknown	--	--	14	unknown	1	unknown
Landslide	Moderate	14-32 degrees	0	0	--	--	0	0	--	--	1	unknown	1	unknown
	High	>32 degrees	0	0	--	--	0	0	--	--	0	0	1	unknown
Wildland Fire	Moderate	Moderate fuel rank	0	0	--	--	0	0	--	--	4	unknown	0	0
	High	High fuel rank	0	0	--	--	0	0	--	--	1	unknown	1	unknown
	Very High	Very high fuel rank	0	0	--	--	0	0	--	--	0	0	1	unknown
	Extreme	Extreme fuel rank	0	0	--	--	0	0	--	--	0	0	0	0
Earthquake	Strong	9-20% (g)	0	0	--	--	0	0	--	--	4	unknown	1	unknown
	Very strong	20-40% (g)	0	0	--	--	0	0	--	--	0	0	0	0
	Severe	>40-60% (g)	0	0	--	--	0	0	--	--	0	0	0	0
Volcano		descriptive	7	unknown	--	--	2	unknown	--	--	14	unknown	1	unknown
Wind		descriptive	7	unknown	--	--	2	unknown	--	--	14	unknown	1	unknown
El Nino and La Nina		descriptive	7	unknown	--	--	2	unknown	--	--	14	unknown	1	unknown
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)	Low	NID	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	7	unknown	--	--	2	unknown	--	--	2	unknown	0	0
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	7	unknown	--	--	2	unknown	--	--	14	unknown	1	unknown

[1]Estimated value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Carlton. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Carlton, 1 community facilities (value unknown) and 2 utilities (value unknown) are within the boundaries of the 100-year floodplain, while 1 community facility (value unknown) and 1 utility (value unknown) are located within the 500-year floodplain.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Carlton can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Carlton. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Carlton has 1 government facility (value unknown), 1 emergency response facility (value unknown), 2 educational facilities (value unknown), 6 care facilities (value unknown), 13 community facilities (value unknown), 1 utility (value unknown) and 1 dam (value unknown) located in areas of moderate risk, while 1 care facility (value unknown), 2 community facilities (value unknown) and 1 dam (value unknown) are located within areas of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Carlton has critical facilities and infrastructure located within areas with moderate, high, very high, and extreme fuel ranks. Moderate fuel rank areas contain 3 government facilities, 1 emergency response facility, 2 educational facilities, 6 care facilities, 12 community facilities, and 4 utilities (all values unknown); high fuel rank areas contain 2 government facilities, 5 care facilities, 5 community facilities, 1 utility and 1 dam (all values unknown); very high fuel rank areas contain 1 care facility and 1 dam (all values unknown); extreme fuel rank areas contain 1 care facility (value unknown).

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Carlton is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Carlton has 3 government facilities, 1 emergency response facility, 2 educational facilities, 6 care facilities, 12 community facilities, 4 utilities and 1 dam (all values unknown) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Carlton in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Carlton are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Carlton are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Carlton, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to the City of Carlton's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

The City of Carlton's Panther Creek Reservoir is approximately 8 miles west of town. The drainage basin above the dam is approximately 3.19 square miles. There has been some erosion caused by tree removal activities by local landowners during the rainy season. There is a main 4.5 mile long 10-inch diameter transmission line to the city, which includes a 6-inch emergency connection with the McMinnville Water and Light main transmission line. However, no agreement exists as to the when the connection can be used. (City of Carlton Citizen Involvement and Land Use Planning, 1999)

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region. However, as determined by the Army Corps of Engineers and summarized in the National Inventory of Dams, Panther Creek Reservoir is considered a Low Hazard Risk. As such, dam failure would have little or no effect to life and property downstream.

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects

of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Carlton at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Carlton, 7 highways and 2 dams (all values unknown) are considered at risk, as well as 2 utilities, 3 government facilities, 2 educational facilities, 5 care facilities, and 7 community facilities (all values unknown).

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Carlton. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are equally at risk of being impacted by this threat.

Appendix D
City of Dayton

Table D-1A City of Dayton Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
2,119	2,280	664	79,680,000

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $120,000 per structure).

Table D-1B City of Dayton NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Dayton	1996	0	5	819,400	399.20	0	0	0

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table A-2 City of Dayton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	City Hall	416 Ferry St.	$688,568
	Rural Fire District Station	401 S. Trade St., Amity	
	Community Center (City Hall Annex)		$657,281
	Public Works Shops	416 Ferry St., Dayton	$146,091
	US Post Office	530 Ferry Street	
	City Streets		$7,000,000

Table A-2 City of Dayton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Emergency Response	Fire District Office		
	County Sheriff Sub-Station	(Inside Annex Bldg)	
Educational	Dayton Head Start	528 Ferry St.	
	Dayton Elementary School	526 Ferry St.	$6,687,547
	Dayton Middle/Junior High School	801 Ferry St.	$731,931
	Dayton High School	801 Ferry St.	$4,486,769
Health Care	Berry Adult Care Facility for handicap and mentally disabled		
	Palmer Creek Apts - 8 unit facility of elderly and handicap	206 Mill Street	
Community	Farm Worker Housing (Fresa Park)	955 Ferry St.	
	11th St. Park	see Coordinates	
	Alderman Park	see Coordinates	
	Park – Courthouse Square Park (restrooms, playground, covered picnic area, bandstand, historic blockhouse, fountain	see Coordinates	$210,000
	The Dayton Pioneer Church	300 4th St.	The Dayton Pioneer Church
	First Baptist Church	300 Flower Lane	First Baptist Church
	Dayton Christian Church	302 5th St.	Dayton Christian Church
	San Martin Catholic Church	405 Ferry St.	San Martin Catholic Church
	Church of Christ of Latter Day Saints	700 Ash St.	Church of Christ of Latter Day Saints
	Jehovah's Witness	16985 SE Neck Rd	
	Makinster Mae's Mosgrove	304 5th St.	

Table A-2 City of Dayton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Community	Hopewell Community Church	21500 SE Church Rd	$166,970
	Full Gospel Assembly Church	411 Oak St.	$171,827
	Cross Grace	406 Church St.	$35,694
	Mary Gilkey Public Library	(Inside City Hall)	
State and Federal Highways	Hwy 155		
	Hwy 221		
	Hwy 18	Adjacent to City Limits	
Bridges	Foot Bridge (wooden suspension bridge) – carries water & sewer lines		4-6,000,000
	Hwy 221 Bridge		
	Overpass at Hwy 18		
Utilities	Nextel Wireless company	8405 SW Nimbus Ave. Beaverton OR	
	Water		
	Sewer		
	Verizon Telephone	635 NE Highway 99W, McMinnville	
	4 Liftstations		
	5 Sewer Lagoons (east of river) and chlorination & dechlorination buildings		1250000 x 5
	Breyman Watershed – Resevoir (2 open concrete reservoirs <100,000 gal each) 1 steel reservoir 980,000 gal; below ground concrete reservoir (300,000 gal); slow sand filter; chlorination bldg pressure reducing valve		3,000,000
	Enclosed Water Tank 1.5 mil gallons		625,000

Table A-2 City of Dayton Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Utilities	8 Community Potable Water Wells		200,000 ea
	Breyman Springs – 12		1,200,000
	Comcast CableTelevision	9605 SW Nimbus Ave., McMinnville	
	Landfill (Riverbend in county)	13469 SW Highway 18, McMinnville	
	Water Treatment Facility	1209 Ferry St.	$3,000,000
	Portland General Electric McMinnville Water & Light	130 SW Monroe, Sheridan	

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table D-3 City of Dayton Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings	
				Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)**[1]
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	2,280	664	79,680,000
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	2,280	664	79,680,000
Wind		descriptive	2,280	664	79,680,000
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table D-4 City of Dayton Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	1	unknown	0	0
	High	100-year floodplain	0	0	0	0	0	0	0	0	1	unknown
Winter Storm		descriptive	6	8,491,940	1	unknown	4	11,906,247	2	unknown	14	584,491
Landslide	Moderate	14-32 degrees	0	0	0	0	3	11,906,247	1	unknown	4	166,970
	High	>32 degrees	0	0	0	0	0	0	1	unknown	1	166,970
Wildland Fire	Moderate	Moderate fuel rank	4	834,659	1	unknown	4	11,906,247	1	unknown	14	584,491
	High	High fuel rank	2	834,659	1	unknown	3	5,218,700	1	unknown	9	374,491
	Very High	Very high fuel rank	0	0	0	0	0	0	0	0	0	0
	Extreme	Extreme fuel rank	0	0	0	0	0	0	0	0	0	0
Earthquake	Strong	9-20% (g)	4	834,659	1	unknown	4	11,906,247	1	unknown	14	584,491
	Very strong	>20-40% (g)	0	0	0	0	0	0	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	0	0	0	0
Volcano		descriptive	6	8,491,940	1	unknown	4	11,906,247	2	unknown	14	584,491
Wind		descriptive	6	8,491,940	1	unknown	4	11,906,247	2	unknown	14	584,491
El Nino and La Nina		descriptive	6	8,491,940	1	unknown	4	11,906,247	2	unknown	14	584,491
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	4	834,659	1	unknown	2	6,687,547	1	unknown	9	417,521
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	6	8,491,940	1	unknown	4	11,906,247	2	unknown	14	584,491

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table D-5 City of Dayton Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--	--	--	--	--	--	0	0	0	0
	High	100-year floodplain	--	--	--	--	--	--	--	--	1	unknown	0	0
Winter Storm		descriptive	3	unknown	--	--	3	6,000,000	--	--	17	7,825,000	0	0
Landslide	Moderate	14-32 degrees	--	--	--	--	--	--	--	--	2	3,000,000	0	0
	High	>32 degrees	--	--	--	--	--	--	--	--	0	0	0	0
Wildland Fire	Moderate	Moderate fuel rank	--	--	--	--	--	--	--	--	5	3,000,000	0	0
	High	High fuel rank	--	--	--	--	--	--	--	--	2	3,000,000	0	0
	Very High	Very high fuel rank	--	--	--	--	--	--	--	--	1	unknown	0	0
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--	0	0	0	0
Earthquake	Strong	9-20% (g)	--	--	--	--	--	--	--	--	6	3,000,000	0	0
	Very strong	>20-40% (g)	--	--	--	--	--	--	--	--	0	0	0	0
	Severe	>40-60% (g)	--	--	--	--	--	--	--	--	0	0	0	0
Volcano		descriptive	3	unknown	--	--	3	6,000,000	--	--	17	7,825,000	0	0
Wind		descriptive	3	unknown	--	--	3	6,000,000	--	--	17	7,825,000	0	0
El Nino and La Nina		descriptive	3	unknown	--	--	3	6,000,000	--	--	17	7,825,000	0	0
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	3	unknown	--	--	3	6,000,000	--	--	2	unknown	0	0
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	3	unknown	--	--	3	6,000,000	--	--	17	7,825,000	0	0

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Dayton. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Dayton, only 1 care facility (value unknown) is located within the boundaries of the 500-year floodplain, while 1 community facility and 1 utility (all values unknown) are found within the boundaries of the 100-year floodplain.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Dayton can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Dayton. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Dayton has 3 educational facilities (worth $11,906,247), 1 care facility (value unknown), 4 community facilities (worth $166,970) and 2 utilities (value unknown) located in areas of moderate risk, while 1 care facility (value unknown) and 1 community facility (worth $166,970) are located within areas of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Dayton has critical facilities and infrastructure located within areas with moderate, high, and very high fuel ranks. Moderate fuel rank areas contain 4 government facilities (worth $834,659), 1 emergency response facility (value unknown). 4 educational facilities (worth $11,906,247), 1 care facility (value unknown), 14 community facilities (worth $584,491) and 5 utilities (worth $3,000,000); high fuel rank areas contain 2 government facilities (worth $834,659), 1 emergency response facility (value unknown), 3 educational facilities (worth $5,218,700), 1 care facility (value unknown), 9 community facilities (worth $374,491) and 2 utilities (worth $3,000,000); and very high fuel rank areas contain 1 utility (value unknown).

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Dayton is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Dayton has 4 government facilities (worth $834,659), 1 emergency response facility (value unknown), 4 educational facilities (worth $11,906,247), 1 care facility (value unknown), 14 community facilities (worth $584,491), and 6 utilities (worth $3,000,000) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Dayton in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Dayton are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Dayton are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Dayton, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to the City of Dayton's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region. However, as determined by the Army Corps of Engineers and summarized in the National Inventory of Dams, there are no dams that pose a significant hazard to the City of Dayton in the instance of failure.

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Dayton at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to

impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Dayton, 3 highways (value unknown), 3 bridges (worth $6,000,000), and 2 utilities (values unknown) are considered at risk, as well as 4 government facilities (Worth $834,659), 1 emergency response facility (value unknown), 2 educational facilities (worth $6,687,547), 1 care facility (value unknown) and 9 community facilities (worth $417,521).

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Dayton. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are equally at risk of being impacted by this threat.

Appendix E

City of Dundee

Table E-1A City of Dundee Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
2,598	2,965	951	145,503,000

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $153,000 per structure).

Table E-1B City of Dundee NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Dundee	965	0	3	980,000	321.67	3	17,679	0

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table E-2 City of Dundee Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	City Hall and Administrative Offices	620 SW 5th St.	
	Dept of Public Works (shop and Fire Dept on same parcel)	791 N Hwy 99W	
	City of Dundee Assets		$1,360,855.00
Emergency Response	Fire Station	759 N Hwy 99W	
	Police Department (Newburg)	401 E. 3rd St., Newberg	

Table E-2 City of Dundee Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Educational	Children's Music Station (private church school)	1110 N. Highway 99 W	
	Dundee Elementary School (K-5)	140 SW 5th St.	$2,430,197.00
	Bonnie Benedict Preschool	502 E. 2nd St.	
Community	Dundee Women's Center	1026 Highway 99W	
	Dundee Pioneer Cemetery		
	United Methodist Church	11th St. & N Highway 99W	$310,609.00
	Promise Church	1802 Haworth Ave., Newbert	$135,215.00
	Chehalem Park District 18 parks	1802 Haworth A	
	Crabtree Park	see Coordinates	
	Dundee/Billick Park	see Coordinates	
	Dundee Scenic Overlook	see Coordinates	
	Falcon Crest Park	see Coordinates	
State and Federal Highways	State Hwy 99W (2 lanes with center turn lane) – with curbs		
Railroads	Pacific Willamette Railroad – runs through town		
Ground and Air Facilities			
Utilities	Multiple Wireless providers – no cell towers		
	Verizon Switching Facility		
	9 potable water wells and lift stations		

Table E-2 City of Dundee Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Utilities	Reservoir, concrete, 1973		
	Reservoir, steel, 1973		
	Reservoir, steel, 1973		
	Lift station and Wastewater Treatment plant		
	Fiber Optic Route through town that goes to Asia		
	Water Tank – reservoirs above ground tanks		
	Verizon	635 NE Highway 99W, McMinnville	
	Comcast Cable Television	9605 SW Nimbus Ave., Beaverton, OR	
	Regional Landfill - near McMinnville (17 miles from Dundee)	13469 SW Highway 18, McMinnville	
	Portland General Electric – no sub stations or power plant	2079 Progress Way, Woodburn, OR	

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table E-3 City of Dundee Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings	
				Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)**[1]
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	2,965	951	145,503,000
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	2,965	951	145,503,000
Wind		descriptive	2,965	951	145,503,000
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table E-4 City of Dundee Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	--	--	0	0
	High	100-year floodplain	0	0	0	0	0	0	--	--	0	0
Winter Storm		descriptive	3	1,360,855	2	unknown	3	2,430,197	--	--	9	445,824
Landslide	Moderate	14-32 degrees	1	unknown	0	0	0	0	--	--	5	135,215
	High	>32 degrees	0	0	0	0	0	0	--	--	1	unknown
Wildland Fire	Moderate	Moderate fuel rank	1	unknown	2	unknown	2	2,430,197	--	--	8	445,824
	High	High fuel rank	1	unknown	2	unknown	2	2,430,197	--	--	8	310,609
	Very High	Very high fuel rank	0	0	0	0	0	0	--	--	2	unknown
	Extreme	Extreme fuel rank	0	0	0	0	0	0	--	--	0	0
Earthquake	Strong	9-20% (g)	2	unknown	2	unknown	2	2,430,197	--	--	8	445,824
	Very strong	>20-40% (g)	0	0	0	0	0	0	--	--	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	--	--	0	0
Volcano		descriptive	3	1,360,855	2	unknown	3	2,430,197	--	--	9	445,824
Wind		descriptive	3	1,360,855	2	unknown	3	2,430,197	--	--	9	445,824
El Nino and La Nina		descriptive	3	1,360,855	2	unknown	3	2,430,197	--	--	9	445,824
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	1	unknown	2	unknown	2	2,430,197			2	310,609
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	3	1,360,855	2	unknown	3	2,430,197	--	--	9	445,824

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table E-5 City of Dundee Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	--	--	--	--	0	0	--	--
	High	100-year floodplain	0	0	0	0	--	--	--	--	0	0	--	--
Winter Storm		descriptive	1	unknown	1	unknown	--	--	--	--	12	unknown	--	--
Landslide	Moderate	14-32 degrees	0	0	0	0	--	--	--	--	1	unknown	--	--
	High	>32 degrees	0	0	0	0	--	--	--	--	0	0	--	--
Wildland Fire	Moderate	Moderate fuel rank	0	0	0	0	--	--	--	--	1	unknown	--	--
	High	High fuel rank	0	0	0	0	--	--	--	--	1	unknown	--	--
	Very High	Very high fuel rank	0	0	0	0	--	--	--	--	1	unknown	--	--
	Extreme	Extreme fuel rank	0	0	0	0	--	--	--	--	0	0	--	--
Earthquake	Strong	9-20% (g)	0	0	0	0	--	--	--	--	3	unknown	--	--
	Very strong	>20-40% (g)	0	0	0	0	--	--	--	--	--	--	--	--
	Severe	>40-60% (g)	0	0	0	0	--	--	--	--	--	--	--	--
Volcano		descriptive	1	unknown	1	unknown	--	--	--	--	12	unknown	--	--
Wind		descriptive	1	unknown	1	unknown	--	--	--	--	12	unknown	--	--
El Nino and La Nina		descriptive	1	unknown	1	unknown	--	--	--	--	12	unknown	--	--
Drought		descriptive	--											
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--											
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	0	0	0	0	--	--	--	--	0	0	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	1	unknown	1	unknown	--	--	--	--	12	unknown	--	--

[1] Estimated and/or insured structural value.

(3) Dam inundation data not available

(4) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Dundee. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Dundee, no facilities are located within the boundaries of either the 100-year or 500-year floodplains.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Dundee can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Dundee. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Dundee has 1 government facility (value unknown), 5 community facilities (worth $135,215), and 1 utility (value unknown) located in areas of moderate risk, while 1 community facility is located within an area of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel

ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Dundee has critical facilities and infrastructure located within areas with moderate, high, and very high fuel ranks. Moderate fuel rank areas contain 1 government facility (value unknown), 2 emergency response facilities (value unknown), 2 educational facilities (worth $2,430,197), 8 community facilities (worth $445,824) and 1 utility (value unknown); high fuel rank areas contain 1 government facility (value unknown), 2 emergency response facilities (value unknown), 2 educational facilities (worth $2,430,197), 8 community facilities (worth $310,609) and 1 utility (value unknown); and very high fuel rank areas contain 2 community facilities (value unknown) and 1 utility (value unknown).

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Dundee is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Dundee has 2 government facilities (value unknown), 2 emergency response facilities (value unknown), 2 care facilities (worth $2,430,197), 8 community facilities (worth $445,824) and 3 utilities (value unknown) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Dundee in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Dundee are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can

include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Dundee are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Dundee, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to the City of Dundee's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region. The Dundee Sewer Project, with a storage capacity of 65 acre-feet, is identified in the National Inventory of Dams and listed as having a low hazard. A low hazard is defined as having little or no effect on life and property downstream in the instance of failure.

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Dundee at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste

from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Dundee, 1 government facility (value unknown), 2 emergency response facilities (value unknown), 2 educational facilities (worth $2,430,197), and 2 community facilities (worth $310,069) are considered at risk.

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Dundee. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are equally at risk of being impacted by this threat.

Appendix F

City of Lafayette

Table F-1A City of Lafayette Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
2,586	3,105	884	91,317,200

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $103,300 per structure).

Table F-1B City of Lafayette NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Lafayette	294	0	1	210,000	294.00	0	0	0

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table F-2 City of Lafayette Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	Lafayette City Hall/ Fire Hall/ Court	486 3rd St.	$1,800,000
	Other Lafayette Assets		$2,299,920
Emergency Response	Fire Station is part of City Hall Building – see above	486 3rd St.	
Educational	Little Learners Preschool	344 3rd St.	
	Wascher Elementary School	986 7th St Ext.	

Table F-2 City of Lafayette Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Community	Joel Perkins Park	see Coordinates	
	Commons Park	see Coordinates	
	Terry Park	see Coordinates	
	Lafayette City Park	451 E. 8th St.	
	Lafayette Locks Park	see Coordinates	
	Lafayetet Community Church	365 3rd St.	
	Bible Baptist Church of Lafayette	514 Market St.	$101,737
	Lafayette Community Center		
	Lafayette Pioneer Cemetery	Duniway Rd. (behind 1541 N Lincoln St)	
	Yamhill County Historical Museum	11275 SW Durham Lane, McMinnville	
Health Care	Lafayette Youth and Senior Citizens Center		
State and Federal Highways	State Highway 99W		
Railroads	Willamette & Pacific Railroad		
Bridges	None in City Limits- Access to town provided by Yamhill County Bridge on Lafayette Hwy		
Ground and Air Facilities	Lafayette Airstrip	see Coordinates	
Utilities	Riverbend Landfill	13469 SW Highway 18, McMinnville	
	Water Treatment Plant including 4 wells and 3 springs		$2,000,000
	Water/Wastewater Treatment Plant	260 S. Madison St.	$7,000,000
	4 Lift Stations		$2,000,000

Table F-2 City of Lafayette Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Utilities	City Park Well		$500,000
	Public Works Shops	260 S. Madison St.	$300,000
	Water Tank (500,000 gal)		$1,000,000
	Water Distribution System		
	Sewage Collection System		

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table F-3 City of Lafayette Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	3,105	884	91,317,200
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	3,105	884	91,317,200
Wind		descriptive	3,105	884	91,317,200
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table F-4 City of Lafayette Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	0	0	0	0
	High	100-year floodplain	0	0	0	0	0	0	0	0	2	unknown
Winter Storm		descriptive	2	4,099,920	1	unknown	2	unknown	1	unknown	10	unknown
Landslide	Moderate	14-32 degrees	0	0	0	0	0	0	0	0	5	unknown
	High	>32 degrees	0	0	0	0	0	0	0	0	1	unknown
Wildland Fire	Moderate	Moderate fuel rank	1	1,800,000	1	unknown	2	unknown	0	0	8	101,737
	High	High fuel rank	1	1,800,000	1	unknown	1	unknown	0	0	7	101,737
	Very High	Very high fuel rank	0	0	0	0	0	0	0	0	0	0
	Extreme	Extreme fuel rank	0	0	0	0	0	0	0	0	0	0
Earthquake	Strong	9-20% (g)	1	1,800,000	1	unknown	2	unknown	0	0	8	101,737
	Very strong	>20-40% (g)	0	0	0	0	0	0	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	0	0	0	0
Volcano		descriptive	2	4,099,920	1	unknown	2	unknown	1	unknown	10	unknown
Wind		descriptive	2	4,099,920	1	unknown	2	unknown	1	unknown	10	unknown
El Nino and La Nina		descriptive	2	4,099,920	1	unknown	2	unknown	1	unknown	10	unknown
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	1	1,800,000	1	unknown	2	unknown	0	0	7	101,737
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	2	4,099,920	1	unknown	2	unknown	1	unknown	10	unknown

[1]Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table F-5 City of Lafayette Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--	--	--	--	--	--	2	7,300,000	--	--
	High	100-year floodplain	--	--	--	--	--	--	--	--	3	7,300,000	--	--
Winter Storm		descriptive	1	unknown	1	unknown	--	--	--	--	10	12,800,000	--	--
Landslide	Moderate	14-32 degrees	--	--	--	--	--	--	--	--	3	7,300,000	--	--
	High	>32 degrees	--	--	--	--	--	--	--	--	1	unknown	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--	--	--	--	--	--	4	7,300,000	--	--
	High	High fuel rank	--	--	--	--	--	--	--	--	3	7,300,000	--	--
	Very High	Very high fuel rank	--	--	--	--	--	--	--	--	1	unknown	--	--
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--	0	0	--	--
Earthquake	Strong	9-20% (g)	--	--	--	--	--	--	--	--	4	7,300,000	--	--
	Very strong	>20-40% (g)	--	--	--	--	--	--	--	--	0	0	--	--
	Severe	>40-60% (g)	--	--	--	--	--	--	--	--	0	0	--	--
Volcano		descriptive	1	unknown	1	unknown	--	--	--	--	10	12,800,000	--	--
Wind		descriptive	1	unknown	1	unknown	--	--	--	--	10	12,800,000	--	--
El Nino and La Nina		descriptive	1	unknown	1	unknown	--	--	--	--	10	12,800,000	--	--
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	1	unknown	1	unknown	--	--	--	--	2	7,300,000	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	1	unknown	1	unknown	--	--	--	--	10	12,800,000	--	--

[1]Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Lafayette. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Lafayette, 2 utilities worth $7,300,000 are located in the 500-year floodplain and therefore accorded a moderate risk, while 3 utilities worth $7,300,000 and 2 community facilities of unknown value are located within the boundaries of the 100-year floodplain and therefore accorded a high risk.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Lafayette can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Lafayette. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Lafayette has 5 community facilities (value unknown) and 3 utilities (worth $7,300,000) located in areas of moderate risk, while 1 community facility (value unknown) and 1 utility (value unknown) are located within an area of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel

ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Lafayette has critical facilities and infrastructure located within areas with moderate, high, and very high fuel ranks. Moderate fuel rank areas contain 1 government facility (worth $1,800,000), 1 emergency response facility (value unknown), 2 educational facilities (value unknown), 8 community facilities (worth $101,737) and 4 utilities ($7,300,000); high fuel rank areas contain 1 government facility (worth $1,800,000), 1 emergency response facility (value unknown), educational facilities (value unknown), 7 community facilities (worth $101,737) and 3 utilities ($7,300,000); and very high fuel rank areas contains 1 utility (value unknown).

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Lafayette is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Lafayette has 1 government facility (worth $1,800,000), 1 emergency response facility (value unknown), 2 educational facilities (value unknown), 8 community facilities (worth $101,737) and 4 utilities ($7,300,000) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Lafayette in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Lafayette are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can

include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Lafayette are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Lafayette, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to the City of Lafayette's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region. However, as determined by the Army Corps of Engineers and summarized in the National Inventory of Dams, there are no dams that pose a significant hazard to the City of Lafayette in the instance of failure.

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Lafayette at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Lafayette, 1 government facility (worth $1,800,000), 1 emergency response facility (value unknown), 2 educational facilities (value unknown), 7 community facilities (worth $101,737) and 2 utilities ($7,300,000) are considered at risk. Additionally, 1 highway (value unknown), 1 railroad (value unknown) are located within the ¼ mile radius.

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Lafayette. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are at equal risk of being impacted by this threat.

Appendix G
City of Newberg

Table G-1A City of Newberg Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
18,064	20,565	6,427	870,215,800

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $135,400 per structure).

Table G-1B City of Newberg NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Newberg	1,885	0	5	1,160,000	377.0	1	0	1

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table G-2 City of Newberg Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government			
	City Hall	414 E. 1st St.	
	Annex	115 S. Howard St.	
	Public Safety Building	401 E. Third St.	
	US Post Office	401 E. First St.	
Emergency Response	Main Fire Station	414 E. 2nd St.	
	Springbrook Fire Station	3100 Middlebrook Dr.	
Educational	Benedict Preschool	504 E. 2nd St.	

Table G-2 City of Newberg Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
	George Fox University	414 N. Meridian	
	Ewing Young Elementary	17600 N. Valley Rd.	
	School District Shops	703 S. Blaine St.	
	Administration Office	714 E. 6th St.	
	Mabel Rush Elementary	1441 N. Deborah Rd.	
	Edwards Elementary	715 E. 8th St.	
	Crater Elementary	203 W. Foothills Dr.	
	Austin Elementary	2200 N. Center St.	
	Mountainview Middle School	2015 N. Emery Dr.	
	Chehalem Valley Middle School	403 W. Foothills Dr.	
	Future School Property	30150 NE Wilsonville Rd.	
	Future School Property	30420 NE Siefken Lane	
	Newberg High School	2400 Douglas Ave.	
Health Care	Providence Newberg Medical Center	310 Villa Rd.	
	Providence Newberg Medical Center	218 Villa Rd.	
	Providence Newberg Medical Center	1515 E. Portland Rd.	
	Providence Newberg Medical Center	1001 Providence Dr.	
	Chehalem Health & Rehab Center	1900 E. Fulton St.	
	Senior Center	303 W. Foothills Dr.	
	Avamere-Newberg	730 Foothills Dr.	
	Friendsview Village	1301 E. Fulton St.	
	Newberg Care Home	1500 E. First St.	
Health Care	Huffman House	1301 N. College St.	
Community	Assembly of God	502 S. St. Paul Hwy	
	Astor House	3801 Hayes St.	
	Calvary Chalpel Church	120 S. Elliott Rd.	
	Chehalem Airpark	NE Dopp Rd.	
	Chehalem Springs	3802 Hayes St.	
	Christ Community Church	611 N Main St.	

Table G-2 City of Newberg Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
	Church of Christ	2505 Haworth Ave	
	Church of God	715 S. River St.	
	Central Community Center	415 E. Sheridan St.	
	Swimming Pool	1802 Haworth Ave.	
	Nicholas Park	1806 Haworth Ave.	
	Community Center	500 E. 2nd St.	
	Memorial Park	411 S. Blaine St.	
	Vacant Land	17800 NE Chehalem Dr.	
	Vacant Land	3720 Mistletoe Dr.	
	Vacant Land	3575 Oak Grove St.	
	Vacant Land	4500 E. Fernwood Rd.	
	Vacant Land	4555 E. Fernwood Rd.	
	Vacant Land	4351 E. Fernwood Rd.	
	Jaquith Park (East)	1215 N. College St.	
	Vacant Land	1060 E. Edgewood Dr.	
	Ewing Young Park	1207 S. Blaine St.	
	Armory Community Center	620 Morton St.	
	Jaquith Park (West)	1414 N. Main St.	
	Vacant Land	2901 Winchester Dr.	
	CPRD Offices	125 S. Elliott Rd.	
	Skate Park	1201 S. Blaine St.	
	Vacant Land	169 Aaron Way	
Community	Vacant Land	1001 Hilltop Dr.	
	Chehalem Valley Baptist Church	26155 NE Bell Rd.	
	Episcopal Church	110 S. Everest Rd.	
	First Baptist Church	1619 E. 2nd St.	
	First Baptist Church	24950 North Valley Rd.	
	FourSquare Gospel	115 W. 3rd St.	
	Friends Church	200 S. College St.	

Table G-2 City of Newberg Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
	Friends Church cemetery	500 S. Everest Rd.	
	Friends Church	600 E. 3rd St.	
	Friends Church vacant land	605 E. 3rd St.	
	Friends Church vacant land	607 E. 3rd St.	
	Friends Church vacant land	215 S. College St.	
	Godsong Community Church	1025 Industrial Parkway	
	Hazelden NW	1901 Esther St.	
	Jehovah's Witness Church	1709 Hoskins St.	
	Joyful Servant Lutheran	1716 N. Villa Rd.	
	Mormon Church	1212 Deborah Rd.	
	Nazarene Church	23177 NE Old Yamhill Rd.	
	Newberg Christian Church	2315 Villa Rd.	
	Jaquith Park (East)	1215 N College St.	
	Mountainview Park	201 E. Mountainview Dr.	
	Hospital Thrift Store	305 S. Howard St.	
	Scout House	411 S. Howard St.	
	Hoover Park	114 S. River St.	
	Scott Levitt Park	1310 E. 10th St.	
	Vacant Land	1542 E. Portland Rd.	
	Kiwanis Park	503 E. Sheridan St.	
	Vacant Land	404 E. 3rd St.	
	Vacant Land	412 E. 3rd St.	
Community	Vacant Land	408 E. 3rd St.	
	Library Annex	211 N. Howard St.	
	Vacant Land	3613 Ivy Dr.	
	Francis Square	625 E. 1st St.	
	Vacant Land	508 W 3rd St.	
	Vacant Land	1415 E. 1st St.	
	Vacant Land	2900 N. Chehalem Dr.	

Table G-2 City of Newberg Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
	Vacant Land	411 E 1st. St.	
	Newberg Gospel Church	4301 N. College St.	
	Newberg Public Library	503 E. Hancock St.	
	Northside Community Church	1800 Hoskins St.	
	NV Friends Church	4020 N. College St.	
	Open Bible Church	1605 N. College St.	
	Presbyterian Church	501 Mission Dr.	
	Vacant Land	603 S. Meridian St.	
	2nd St. Community Church	504 E. First St.	
	Seventh Day Adventist	530 Edgewood Dr.	
	Sportsman Airpark	504 S. Airpark Way	
	St. Peter Catholic Church	2315 N. Main St.	
	Trinity Orthodox Presbyterian	600 E. Columbia Dr.	
	United Methodist Church	1205 Deborah Rd.	
	Zion Lutheran Church	301 S. River St.	
	Word of Faith Church	108 S. Howard St.	
State and Federal Highways	Highway Maintenance Station	801 N. College St.	
	Hwy 99W		
	Hwy 219		
	Hwy 240		
	Sunnycrest Rd.		
	Dayton Ave.		
Railroads	Willamette-Pacific Railroad		
Bridges	Wynooski/ Willamette River bridge		
	Chehalem 99W Bridge		
	St. Paul Hwy 219 Bridge		
	Chehalem Hwy 240 Bridge		
	Chehalem/ Dayton Ave. Bridge		
	Sunnycrest/ Chehalem Bridge		

Table G-2 City of Newberg Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Utilities	Newberg Water Reservoir	25600 North Valley Rd.	
	Pump Station	W 8th St.	
	Pump Station	614 Andrew St.	
	Water Reservoir	31451 NE Corral Creek Rd.	
	Sewer Treatment Plant	2301 Wynooski Rd.	
	Water Treatment Plant	2200 Wynooski Rd.	
	PW Maintenance Yard	500 W. 3rd St.	
	Newberg Garbage Service	2808 Wynooski Rd.	
	PGE	501 E. 4th St.	
	Sportsman Airpark	504 S. Airpark Way	
	Verizon Telephone	115 S. Edwards	
	Western Helicopter	1055 Commerce Parkway	

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table G-3 City of Newberg Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings	
				Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	20,565	6,427	870,215,800
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	20,565	6,427	870,215,800
Wind		descriptive	20,565	6,427	870,215,800
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table G-4 City of Newberg Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	0	0	0	0
	High	100-year floodplain	0	0	0	0	0	0	1	unknown	6	unknown
Winter Storm		descriptive	4	unknown	2	unknown	14	unknown	10	unknown	80	unknown
Landslide	Moderate	14-32 degrees	0	0	0	0	3	unknown	1	unknown	25	unknown
	High	>32 degrees	0	0	0	0	0	0	1	unknown	2	unknown
Wildland Fire	Moderate	Moderate fuel rank	4	unknown	2	unknown	14	unknown	10	unknown	80	unknown
	High	High fuel rank	4	unknown	2	unknown	9	unknown	7	unknown	63	unknown
	Very High	Very high fuel rank	0	0	0	0	0	0	0	0	3	unknown
	Extreme	Extreme fuel rank	0	0	0	0	0	0	0	0	0	0
Earthquake	Strong	9-20% (g)	4	unknown	2	unknown	14	unknown	10	unknown	80	unknown
	Very strong	>20-40% (g)	0	0	0	0	0	0	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	0	0	0	0
Volcano		descriptive	4	unknown	2	unknown	14	unknown	10	unknown	80	unknown
Wind		descriptive	4	unknown	2	unknown	14	unknown	10	unknown	80	unknown
El Nino and La Nina		descriptive	4	unknown	2	unknown	14	unknown	10	unknown	80	unknown
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	4	unknown	1	unknown	3	unknown	8	unknown	59	unknown
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	4	unknown	2	unknown	14	unknown	10	unknown	80	unknown

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table G-5 City of Newberg Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--	--	--	--	--	--	0	0	--	--
	High	100-year floodplain	--	--	--	--	--	--	--	--	2	unknown	--	--
Winter Storm		descriptive	6	unknown	1	unknown	6	unknown	--	--	12	unknown	--	--
Landslide	Moderate	14-32 degrees	--	--	--	--	--	--	--	--	7	unknown	--	--
	High	>32 degrees	--	--	--	--	--	--	--	--	1	unknown	--	--
Wildland Fire	Moderate	Moderate fuel rank	1	unknown	--	--	--	--	--	--	12	unknown	--	--
	High	High fuel rank	--	--	--	--	--	--	--	--	10	unknown	--	--
	Very High	Very high fuel rank	--	--	--	--	--	--	--	--	1	unknown	--	--
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--	0	0	--	--
Earthquake	Strong	9-20% (g)	--	--	--	--	--	--	--	--	12	unknown	--	--
	Very strong	>20-40% (g)	--	--	--	--	--	--	--	--	0	0	--	--
	Severe	>40-60% (g)	--	--	--	--	--	--	--	--	0	0	--	--
Volcano		descriptive	6	unknown	1	unknown	6	unknown	--	--	12	unknown	--	--
Wind		descriptive	6	unknown	1	unknown	6	unknown	--	--	12	unknown	--	--
El Nino and La Nina		descriptive	6	unknown	1	unknown	6	unknown	--	--	12	unknown	--	--
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	6	unknown	1	unknown	6	unknown	--	--	7	unknown	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	6	unknown	1	unknown	6	unknown	--	--	12	unknown	--	--

[1]Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In all cases for the City of Newberg, values were unavailable, and therefore the summaries below do not include any costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Newberg. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Newberg, 2 utilities, 1 care facility, and 6 community facilities are located within the boundaries of the 100-year floodplain and therefore accorded a high risk.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Newberg can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Newberg. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Newberg has 3 educational facilities, 1 care facility, 25 community facilities and 7 utilities are located in areas of moderate risk, while 1 care facility, 2 community facilities and 1 utility are located within an area of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Newberg has critical facilities and infrastructure located within areas with moderate, high, and very high fuel ranks. Moderate fuel rank areas contain 1 highway, 12 utilities, 4 government facilities, 2 emergency response facilities, 14 educational facilities, 10 care facilities, and 80 community facilities; high fuel rank areas contain 10 utilities, 4 government facilities, 2 emergency response facilities, 9 educational facilities, 7 care facilities, and 63 community; and very high fuel rank areas contains 1 utility and 3 community facilities.

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Newberg is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Newberg has 4 government facilities, 2 emergency response facilities, 14 educational facilities, 10 care facilities, 80 community facilities and 12 utilities which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Newberg in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Newberg are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Newberg are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Newberg, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to the City of Newberg's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region. However, as determined by the Army Corps of Engineers and summarized in the National Inventory of Dams, there are no dams that pose a significant hazard to the City of Newberg in the instance of failure.

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Newberg at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Newberg, 4 government facilities, 1 emergency response facility, 3 educational facilities, 8 care facilities and 59 community facilities are considered at risk. Additionally, 6 highways, 1 railroad, 6 bridges and 7 utilities are located within the ¼ mile radius.

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Newberg. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are at equal risk of being impacted by this threat.

Appendix H
City of Sheridan

Table H-1A City of Sheridan Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
3,570	5,785	1,364	149,221,600

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $109,400 per structure).

Table H-1B City of Sheridan NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Sheridan	338,952	489	525	75,368,400	645.62	52	761,088	1

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table H-2 City of Sheridan Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	Sheridan City Hall	120 SW Mill St.	$135,139.00
	Public Works Department	358 NW Washington St.	
	Sheridan Post Office	148 SE Harney St.	
	Other Sheridan Assets		$1,042,574.00
Emergency Response	City of Sheridan Fire Department	230 SW Mill St.	
	City of Sheridan Police Department		

Table H-2 City of Sheridan Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Emergency Response			
Educational			
	Faulconer-Chapman School (K-8)	332 SW Cornwall St.	
	Sheridan High School (9-12)	433 S. Bridge St.	$202,895.00
	Opportunity House (9-12)	437 S. Bridge St.	
	Sheridan Japanese School (4-12)	430 SW Monroe St.	
	The Delphian School (Private Boarding School [K-12])	*20950 SW Rock Creek Road*	
	West Valley Academy (1-12)	*9015 DeJong Road, Amity*	
Health Care	Sheridan Care Center (Intermediate Care)	411 SE Sheridan Rd.	
Community			
	Sheridan City Park	NE Yamhill St. by Blair St.	
	Edward R Moore Park		
	Municipal Pool ?		
	Sheridan Public Library	142 NW Yamhill St.	
	Greencrest Memorial Park (Cemetery)	108 NW Lincoln St.	
	Masonic Cemetery	At end NW Evans St.	
Community	William Cameron House		

Table H-2 City of Sheridan Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
	William Chapman House		
	William Chapman House		
	William Savage House		
	Walter Sleepy House		
	Traveler's Home (formerly Savage-Mendenhall-Seth House)	147 NE Yamhill St.	
	Seventh-Day Adventist Church	940 W. Main St.	
	Church of the Nazarene	917 S. Bridge St.	$35,309.00
	Open Door Community Church	339 NW Sheridan St.	$136,510.00
	Good Shepherd Church	127 NE Hill St.	
	New Hope Christian Church	919 SW 2nd St.	
	First Christian Church	121 NE Yamhill St.	
	Trinity Lutheran Church	311 SE Schley St.	$98,610.00
	Mennonite Church	240 SW Madison St.	
	Sheridan Methodist Church	234 N. Bridge St.	$91,715.00
	Kingdom Hall of Jehovah's Witnesses	825 W. Main St.	$32,918.00
	Baptist Church	643 E. Main St.	$56,594.00
	Sheridan Sun Newspaper	147 NE Yamhill St.	
State and Federal Highways	State Highway 18		
Railroads	Willamette & Pacific Railroad		
Bridges	Sheridan Bride over the Sough Yamhill River Bridge		
Ground and Air Facilities – Listed as	Sheridan Airport (small airport)	21821 SW Rock Cr Rd	

Table H-2 City of Sheridan Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Utilities under Critical Facilities Folder	Yamhill Community Action Program (handicapped and elderly)	800 NE 2nd St., McMinnville	
	Greyhound Bus Service		
	Taylor Lumber Site RR Spur	22100 SW Rock Creek Rd	
	Industrial Area RR Spur		
Utilities	South Yamhill River Water Supply & Treatment		
	Sheridan Area Waste Treatment Plant		
	United Telephone Co of the Northwest		
	Lift Station		
	Wireless company/tower		
	Power Plant/Substations		

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table H-3 City of Sheridan Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings	
				Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)**[1]
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	5,785	1,364	149,221,600
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	5,785	1,364	149,221,600
Wind		descriptive	5,785	1,364	149,221,600
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table H-4 City of Sheridan Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	0	0	4	35,309
	High	100-year floodplain	3	135,139	2	unknown	1	202,895	1	unknown	14	451,656
Winter Storm		descriptive	4	1,177,713	2	unknown	6	202,895	1	unknown	23	451,656
Landslide	Moderate	14-32 degrees	1	unknown	0	0	1	unknown	0	0	4	270,429
	High	>32 degrees	0	0	0	0	0	0	0	0	0	0
Wildland Fire	Moderate	Moderate fuel rank	3	135,139	2	unknown	5	202,895	1	unknown	15	451,656
	High	High fuel rank	1	unknown	0	0	2	unknown	0	0	10	317,737
	Very High	Very high fuel rank	0	0	0	0	0	0	0	0	1	56,594
	Extreme	Extreme fuel rank	0	0	0	0	0	0	0	0	0	0
Earthquake	Strong	9-20% (g)	3	135,139	2	unknown	6	202,895	1	unknown	15	451,656
	Very strong	>20-40% (g)	0	0	0	0	0	0	0	0	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	0	0	0	0
Volcano		descriptive	4	1,177,713	2	unknown	6	202,895	1	unknown	23	451,656
Wind		descriptive	4	1,177,713	2	unknown	6	202,895	1	unknown	23	451,656
El Nino and La Nina		descriptive	4	1,177,713	2	unknown	6	202,895	1	unknown	23	451,656
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	3	135,139	2	unknown	4	202,895	1	unknown	15	451,656
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	4	1,177,713	2	unknown	6	202,895	1	unknown	23	451,656

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table H-5 City of Sheridan Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	0	0	0	0	--	--	0	0	--	--
	High	100-year floodplain	0	0	0	0	0	0	--	--	0	0	--	--
Winter Storm		descriptive	1	unknown	1	unknown	1	unknown	--	--	7	unknown	--	--
Landslide	Moderate	14-32 degrees	0	0	0	0	0	0	--	--	1	unknown	--	--
	High	>32 degrees	0	0	0	0	0	0	--	--	0	0	--	--
Wildland Fire	Moderate	Moderate fuel rank	0	0	1	unknown	0	0	--	--	3	unknown	--	--
	High	High fuel rank	0	0	1	unknown	0	0	--	--	2	unknown	--	--
	Very High	Very high fuel rank	0	0	0	0	0	0	--	--	0	0	--	--
	Extreme	Extreme fuel rank	0	0	0	0	0	0	--	--	0	0	--	--
Earthquake	Strong	9-20% (g)	0	0	1	unknown	0	0	--	--	3	unknown	--	--
	Very strong	>20-40% (g)	0	0	0	0	0	0	--	--	0	0	--	--
	Severe	>40-60% (g)	0	0	0	0	0	0	--	--	0	0	--	--
Volcano		descriptive	1	unknown	1	unknown	1	unknown	--	--	7	unknown	--	--
Wind		descriptive	1	unknown	1	unknown	1	unknown	--	--	7	unknown	--	--
El Nino and La Nina		descriptive	1	unknown	1	unknown	1	unknown	--	--	7	unknown	--	--
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	1	unknown	1	unknown	1	unknown	--	--	2	unknown	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	1	unknown	1	unknown	1	unknown	--	--	7	unknown	--	--

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Sheridan. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Sheridan, 3 government facilities (worth $135,139), 2 emergency response facilities (value unknown), 1 educational facility (worth $202,895), 1 care facility (value unknown) and 14 community facilities (worth $451,656) are located within the boundaries of the 100-year floodplain and therefore accorded a high risk. The 500-year floodplain contains 4 community facilities worth $35,309, which have a moderate risk.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Sheridan can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Sheridan. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Sheridan has 1 government facility (value unknown), 1 educational facility (value unknown), 4 community facilities (worth $270,429) and 1 utility (value unknown) located in areas of moderate risk, and no facilities located in areas of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Sheridan has critical facilities and infrastructure located within areas with moderate, high, and very high fuel ranks. Moderate fuel rank areas contain 1 railroad (value unknown), 3 utilities (value unknown), 3 government facilities (worth $135,139), 2 emergency response facilities (value unknown), 5 educational facilities (worth $202,895), 1 care facility (value unknown), and 15 community facilities (worth $451,656); high fuel rank areas contain 1 railroad (value unknown), 2 utilities (value unknown), 1 government facility (value unknown), 2 educational facilities (value unknown), and 10 community facilities (worth $317,737); very high fuel rank areas contain 1 community facility worth $56,594.

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Sheridan is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Sheridan has 1 railroad (value unknown), 3 utilities (value unknown), 3 government facilities (worth $135,139), 2 emergency response facilities (value unknown), 6 educational facilities (worth $202,895), 1 care facility (value unknown), and 15 community facilities (worth $451,656) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Sheridan in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Sheridan are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Sheridan are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Sheridan, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to the City of Sheridan's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region using that method. However, the City of Sheridan has done extensive research to determine the impacts of a dam failure at the Stony Mountain Impoundment Facility, located 10 miles outside of town.

The City of Sheridan's Stony Mountain Impoundment Facility is a spring-fed reservoir retained by an earthen dam with an emergency spillway that empties into La Toutena Mary Creek. The dam embankment, if breached, will spill into a La Toutena Mary Creek tributary, and the flood hydrograph will travel 3.37 miles to the La Toutena Mary Creek and East Creek confluence, with an additional 3.15 miles to East Creek's confluence with Willamina Creek. Based on a clear day piping failure stimulated by the City of Sheridan, if the dam embankment was breached, it would take approximately 35 minutes for the dammed water to travel the 3.37 miles to the East Creek confluence and an additional 100 minutes to travel to the Willamina Creek confluence.

Under normal conditions, the flood wave would start with approximately 10,670 cubic feet per second (cfs) at the dam and end with approximately 1,090 cfs at Willamina Creek. Due to the limited size of the watershed, the limited inflow to the reservoir, and the height of the dam compared to the emergency spillway (1,657 feet vs. 1,653 feet), an overtopping failure is unlikely. Thus, a catastrophic failure of the dam would not present a threat to human life downstream. Neither the road nor any residential structures would likely be inundated by the flood wave generated by a piping failure.

Even when the clear-day scenario was tested using more extreme assumptions, such as increased water levels, a dam failure still did not pose a threat to residential structures. Possible developments that could cause piping failure include rapid drawdown, seismic activity, or slope failure. As water flows through the dam, the passage could continue to grow as material is eroded away. Eventually the size of the passage could compromise the structural integrity of the dam and cause it to collapse. (City of Sheridan Dam Failure Analysis, 2007)

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Sheridan at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Sheridan, 3 government facilities (worth $135,139), 2 emergency response facilities (value unknown), 4 educational facilities (worth $202,895), 1 care facility (value unknown) and 15 community facilities (worth $451,656) are considered at risk. Additionally, 1 highway (value unknown), 1 railroad (value unknown), 1 bridge (value unknown) and 2 utilities (value unknown) are located within the ¼ mile risk radius.

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Sheridan. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are at equal risk of being impacted by this threat.

Appendix I
City of Willamina

Table I-1A City of Willamina Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
1,844	1,860	730	74,387,000

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $101,900 per structure).

Table I-1B City of Willamina NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Willamina	13,410	7	13	3,610,700	1,031.54	5	18,320	1

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table I-2 City of Willamina Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	Civic Center		
	Yamhill City Hall		
	Administrative Offices		
	Animal Shelter		
	Courthouse		
	Jail		
	Departments/Agencies		
	Dept of Public Works		

Table I-2 City of Willamina Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Emergency Response	Fire Station		
	Police Station		
	Emergency Operations Center		
Educational	Preschool		
	Elementary School		
	Middle/Junior High School		
	High School		
	Vocational School		
	Learning Center		
	Charter School		
	College/University		
Care Facility	Hospital/Emergency Room		
	Clinic		
	Senior Center		
	Medical Center		
	Retirement Facilities		
Community	Museum		
	Golf Course		
	Park		
	Municipal Pool		
	Library		
	Botanical Gardens		
	Cemetery?		
	Church		
State and Federal Highways	Self-explanatory		
Railroads	Self-explanatory		
Bridges	Self-explanatory		

Table I-2 City of Willamina Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Ground and Air Facilities	Airport		
	Transit Authority		
	Harbor/Dock/Port?		
	Transportation-related facilities		
Utilities	Wireless company/tower		
	Telephone		
	Water/Wastewater Treatment Plant		
	Lift Station		
	Radio station/tower		
	Water Tank		
	Television		
	Landfill?		
	Power Plant/Substations		
Dams	Self-explanatory		

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table I-3 City of Willamina Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings	
				Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)**[1]
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	1,860	730	74,387,000
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	1,860	730	74,387,000
Wind		descriptive	1,860	730	74,387,000
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table I-4 City of Willamina Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	0	0	0	0	--	--	1	12,516
	High	100-year floodplain	--	--	0	0	0	0	--	--	0	0
Winter Storm		descriptive	--	--	2	2,900,000	3	353,602	--	--	4	149,347
Landslide	Moderate	14-32 degrees	--	--	2	2,900,000	2	353,602	--	--	1	82,857
	High	>32 degrees	--	--	0	0	0	0	--	--	0	0
Wildland Fire	Moderate	Moderate fuel rank	--	--	2	2,900,000	2	353,602	--	--	4	149,347
	High	High fuel rank	--	--	2	2,900,000	2	353,602	--	--	1	12,516
	Very High	Very high fuel rank	--	--	1	2,900,000	0	0	--	--	0	0
	Extreme	Extreme fuel rank	--	--	0	0	0	0	--	--	0	0
Earthquake	Strong	9-20% (g)	--	--	2	2,900,000	3	353,602	--	--	4	149,347
	Very strong	>20-40% (g)	--	--	0	0	0	0	--	--	0	0
	Severe	>40-60% (g)	--	--	0	0	0	0	--	--	0	0
Volcano		descriptive	--	--	2	2,900,000	3	353,602	--	--	4	149,347
Wind		descriptive	--	--	2	2,900,000	3	353,602	--	--	4	149,347
El Nino and La Nina		descriptive	--	--	2	2,900,000	3	353,602	--	--	4	149,347
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)	Significant	NID	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	2	2,900,000	2	353,602	--	--	4	149,347
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	--	--	2	2,900,000	3	353,602	--	--	4	149,347

[1]Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table I-5 City of Willamina Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--	--	--	--	--	--	--	--	--	--
	High	100-year floodplain	--	--	--	--	--	--	--	--	--	--	--	--
Winter Storm		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Landslide	Moderate	14-32 degrees	--	--	--	--	--	--	--	--	--	--	--	--
	High	>32 degrees	--	--	--	--	--	--	--	--	--	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--	--	--	--	--	--	--	--	--	--
	High	High fuel rank	--	--	--	--	--	--	--	--	--	--	--	--
	Very High	Very high fuel rank	--	--	--	--	--	--	--	--	--	--	--	--
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--	--	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--	--	--	--	--	--	--	--	--	--
	Very strong	>20-40% (g)	--	--	--	--	--	--	--	--	--	--	--	--
	Severe	>40-60% (g)	--	--	--	--	--	--	--	--	--	--	--	--
Volcano		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Wind		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
El Nino and La Nina		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)	Significant	NID	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--	--	--	--	--	--	--	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	--	--	--	--	--	--	--	--	--	--	--	--

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for the City of Willamina. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In the City of Willamina, 1 community facility worth $12,516 is located within the boundaries of the 500-year floodplain and therefore accorded a moderate risk.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, the entire City of Willamina can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within the City of Willamina. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, the City of Willamina has 2 emergency response facilities (worth $2,900,000), 3 educational facilities (worth $353,602) and 1 community facility (worth $82,857) located in areas of moderate risk, and no facilities located in areas of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

The City of Willamina has critical facilities and infrastructure located within areas with moderate, high, and very high fuel rankings. Areas of moderate fuel rank contain 2 emergency response facilities (worth $2,900,000), 2 educational facilities (worth $353,602), and 4 community facilities (worth $149,347); areas of high fuel rank contain 2 emergency response facility (worth $2,900,000), 2 educational facilities (worth $353,602), and 1 community facilities (worth $12,516); areas of very high fuel rank contain 1 emergency response facility worth $2,900,000.

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

The City of Willamina is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

The City of Willamina has 2 emergency response facilities (worth $2,900,000), 3 educational facilities (worth $353,602), and 4 community facilities (worth $149,347) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and the City of Willamina in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within the City of Willamina are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within the City of Willamina are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In the City of Willamina, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to the City of Willamina's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region using that method. However, as determined by the Army Corps of Engineers and summarized in the National Inventory of Dams, The City of WIllamina Dam poses a significant hazard to the City of Willamina in the instance of failure.

The City of Willamina Dam is an earthen dam located approximately 12 miles north or town. It is expected that a dam failure would affect the city by causing a mud flow down Willamina Creek. There is also a moderate concern

of debris flowing down the Willamina Creek in the case of a dam failure of the City of Sheridan's Stony Mountain Impoundment Facility. (City of Willamina Hazard Profile)

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and the City of Willamina at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In the City of Willamina, 2 emergency response facilities (worth $2,900,000), 2 educational facilities (worth $353,602), and 4 community facilities (worth $149,347) are considered at risk as they are within the ¼ mile risk radius.

Terrorism

It is difficult to determine the scope of any terrorist threat to the City of Willamina. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are at equal risk of being impacted by this threat.

Appendix J

Yamhill City

Table J-1A City of Yamhill Estimated Population and Building Inventory

Population		Residential Buildings	
2000 Census	Estimated 2005 Census	Total Building Count	Total Value of Buildings ($)[1]
794	820	261	31,293,900

Source: FEMA HAZUS-MH, Version 2006 and U.S. Census 2000.
[1]Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $119,900 per structure).

Table J-1B City of Yamhill NFIP Insurance Report

City of	Total Premiums ($)	Policies A-Zone	Total Policies	Total Coverage ($)	Average Premium ($)	Total Claims Since 1978	Total Paid Since 1978 ($)	Rep Loss Properties[2]
Yamhill	1,888	1	4	996,600	472.00	1	7,280	0

Source: FEMA NFIP Insurance Report June 23, 2008
FEMA SQANet.
[2]Content and building claims.

Table J-2 City of Yamhill Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Government	City Hall And Police Department with Community Center	205 S. Maple St.	$219,390
	Public Works Offices and Wastewater Lab		$272,969
	Public Works Shops	450 S. Maple St.	$148,455
	(Other City assets)		$1,545,533

Table J-2 City of Yamhill Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Emergency Response	Fire Station & Emergency Operations Center	275 S. Olive St.	$1,690,000
	Fire Trucks		$860,000
Educational	Elementary School	310 E. Main St.	$3,367,727
	High School	275 N. Maple St.	$42,933
	Mid Columbia School Buses		
	(Other school assets)		$2,137,409
Community	Beulah Park	W. 3rd and Maple St.	$401,700
	Menefee Park	8.7 mi. NW on Turner Cr. Rd.	
	Church of Jesus Christ of the Latter Day Saints	7200 NW Pike Rd.	
	First Baptist Church	500 W. Main St., Carlton	
	Yamhill United Methodist Church	195 S. Laurel St.	
	Yamhill Christian Church	265 W. Main St.	$422,422
	St. John's Catholic Church	445 N. Maple St.	
	Pentecostal Church	3928 NW Lincoln Ave.	
State and Federal Highways	Highway 47	ODOT	
	Highway 240		
Bridges	Bridge 1 (3 State Bridges on 3 sides of town)		
	Bridge 2		
	Bridges 3		
	1 County bridge on the west side of town		
Utilities	Wastewater Treatment Plant	(approx 5 mi upstream of carlton)	

Table J-2 City of Yamhill Critical Facilities and Infrastructure

Facility Type	Name / Number	Address	Value[1]
Utilities	Lift Station		
	Water Tank		
	Verizon Phone Switch Behind City Hall		
	Yamhill Soil and Water Conservation District	15580 NW Orchard St.	
Dams	Intake Structure		$750,000
	Impound		$750,000

Sources:
FEMA HAZUS-MH, local jurisdictions.
[1]Estimated and/or insured structural value for critical facilities and estimated values for critical infrastructure.
NA = Not Available.

Table J-3 City of Yamhill Potential Hazard Exposure Analysis Overview – Population and Buildings

			Population	Buildings	
				Residential	
Hazard Type	**Hazard Area**	**Methodology**	**Number**	**Number**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	--	--	--
	High	100-year floodplain	--	--	--
Winter Storm		descriptive	820	261	31,293,900
Landslide	Moderate	14-32 degrees	--	--	--
	High	>32 degrees	--	--	--
Wildland Fire	Moderate	Moderate fuel rank	--	--	--
	High	High fuel rank	--	--	--
	Very High	Very high fuel rank	--	--	--
	Extreme	Extreme fuel rank	--	--	--
Earthquake	Strong	9-20% (g)	--	--	--
	Very strong	>20-40% (g)	--	--	--
	Severe	>40-60% (g)	--	--	--
Volcano		descriptive	820	261	31,293,900
Wind		descriptive	820	261	31,293,900
El Nino and La Nina		descriptive	--	--	--
Drought		descriptive	--	--	--
Dam Failure (1)	Significant	NID	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	--	--	--
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--
Terrorism		descriptive	--	--	--

[1]Estimated and/or insured structural value. Note – population by parcel was not available at the time this document was prepared. Once this data is available, a useful analysis of population and residential structures by hazard can easily be completed.

Table J-4 Yamhill City Potential Hazard Exposure Analysis Overview – Critical Facilities

			Government		Emergency Response		Educational		Care		Community	
Hazard Type	**Hazard Area**	**Methodology**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	1	148,455	0	0	0	0	--	--	0	0
	High	100-year floodplain	1	148,455	0	0	0	0	--	--	3	824,122
Winter Storm		descriptive	4	2,186,347	2	2,550,000	4	5,548,069	--	--	8	824,122
Landslide	Moderate	>14-32 degrees	2	367,845	1	1,690,000	1	3,367,727	--	--	8	824,122
	High	>32 degrees	0	0	0	0	0	0	--	--	1	unknown
Wildland Fire	Moderate	Moderate fuel rank	2	367,845	1	1,690,000	2	3,410,660	--	--	8	824,122
	High	High fuel rank	1	148,455	0	0	1	3,367,727	--	--	4	422,422
	Very High	Very high fuel rank	0	0	0	0	0	0	--	--	1	unknown
	Extreme	Extreme fuel rank	0	0	0	0	0	0	--	--	0	0
Earthquake	Strong	9-20% (g)	2	367,845	1	1,690,000	2	3,410,660	--	--	8	824,122
	Very strong	>20-40% (g)	0	0	0	0	0	0	--	--	0	0
	Severe	>40-60% (g)	0	0	0	0	0	0	--	--	0	0
Volcano		descriptive	4	2,186,347	2	2,550,000	4	5,548,069	--	--	8	824,122
Wind		descriptive	4	2,186,347	2	2,550,000	4	5,548,069	--	--	8	824,122
El Nino and La Nina		descriptive	4	2,186,347	2	2,550,000	4	5,548,069	--	--	8	824,122
Drought		descriptive	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	2	367,845	1	1,690,000	2	3,410,660	--	--	7	824,122
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	4	2,186,347	2	2,550,000	4	5,548,069	--	--	8	824,122

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

Table J-5 Yamhill City Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		G&A Facilities		Utilities		Dams	
Hazard Type	**Hazard Area**	**Methodology**	**Miles**	**Value ($)[1]**	**Miles**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**	**No.**	**Value ($)[1]**
Flood	Moderate	500-year floodplain	0	0	--	--	0	0	--	--	0	0	0	0
	High	100-year floodplain	0	0	--	--	0	0	--	--	0	0	0	0
Winter Storm		descriptive	2	unknown	--	--	4	unknown	--	--	5	383,232	2	1,500,000
Landslide	Moderate	>14-32 degrees	0	0	--	--	0	0	--	--	0	0	1	750,000
	High	>32 degrees	0	0	--	--	0	0	--	--	0	0	0	0
Wildland Fire	Moderate	Moderate fuel rank	0	0	--	--	0	0	--	--	1	383,232	1	750,000
	High	High fuel rank	0	0	--	--	0	0	--	--	1	383,232	1	750,000
	Very High	Very high fuel rank	0	0	--	--	0	0	--	--	1	383,232	1	750,000
	Extreme	Extreme fuel rank	0	0	--	--	0	0	--	--	0	0	0	0
Earthquake	Strong	9-20% (g)	0	0	--	--	0	0	--	--	1	383,232	1	750,000
	Very strong	>20-40% (g)	0	0	--	--	0	0	--	--	0	0	0	0
	Severe	>40-60% (g)	0	0	--	--	0	0	--	--	0	0	0	0
Volcano		descriptive	2	unknown	--	--	4	unknown	--	--	5	383,232	2	1,500,000
Wind		descriptive	2	unknown	--	--	4	unknown	--	--	5	383,232	2	1,500,000
El Nino and La Nina		descriptive	2	unknown	--	--	4	unknown	--	--	5	383,232	2	1,500,000
Drought		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Dam Failure (1)		Inundation area	--	--	--	--	--	--	--	--	--	--	--	--
Disruption of Utility and Transportation Systems		descriptive	--	--	--	--	--	--	--	--	--	--	--	--
Hazardous Material Event (2)	1/4-mile buffered transportation routes	1/4-mile buffered transportation routes	2	unknown	--	--	4	unknown	--	--	1	383,232	0	0
	1/4-mile buffered EHS sites	1/4-mile buffered EHS sites	--	--	--	--	--	--	--	--	--	--	--	--
Terrorism		descriptive	2	unknown	--	--	4	unknown	--	--	5	383,232	2	1,500,000

[1] Estimated and/or insured structural value.

(1) Dam inundation data not available

(2) EHS site data not available

These assessments were performed using the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards.

Flood

FEMA FIRMs were used to outline the 100-year and 500-year floodplains for Yamhill City. The 100-year floodplain delineates an area of high risk, while the 500-year floodplain delineates an area of moderate risk.

In Yamhill City, 1 government facility (worth $148,455) and 3 community facilities (worth $824,122) are located within the boundaries of the 100-year floodplain and therefore accorded a high risk. The 500-year floodplain contains 1 government facility (worth $148,455), which has a moderate risk.

Winter Storm

Winter storms have widespread impacts that are most often the result of the ice, cold, high winds and flooding they bring. Damage to facilities and infrastructure can be severe, depending on the intensity of the storm event.

Since winter storms are regional events, all of Yamhill City can be equally affected. Therefore all critical facilities, infrastructure, and residents are at risk.

Landslide

The potential impacts from landslides can be widespread. Potential debris flows and landslides can impact transportation and rail routes, utility systems, and water and waste treatment infrastructure along with public, private, and business structures located adjacent to steep slopes, along riverine embankments, or within alluvial fans or natural drainages. Response and recovery efforts will likely vary from minor cleanup to more extensive utility system rebuilding. Utility disruptions are usually local and terrain dependent. Damages may require reestablishing electrical, communication, and gas pipeline connections occurring from specific breakage points. Initial debris clearing from emergency routes and high traffic areas may be required. Water and waste water utilities may need treatment to quickly improve water quality by reducing excessive water turbidity and reestablishing waste disposal capability.

USGS elevation datasets were used to determine the landslide hazard areas within Yamhill City. Risk was assigned based on slope angle. A slope angle less than 14 degrees was assigned a low risk, a slope angle between 14 and 32 degrees was assigned a medium risk, and a slope angle greater than 32 degrees was assigned a high risk.

Using these guidelines, Yamhill City has 2 government facilities (worth $367,845), 1 emergency response facility (worth $1,690,000), 1 educational facility (worth $3,367,727), 8 community facilities (worth $824,122) and 1 dam (worth $1,500,000) located in areas of moderate risk, and 1 community facility (value unknown) located in an area of high risk.

Wildland Fires

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load. South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel values. Fuel ranks of moderate, high, very high, and extreme were assigned to the entire region based on the results of this modeling.

Yamhill City has critical facilities and infrastructure located within areas with moderate, high, and very high fuel ranks. Moderate fuel rank areas contain 2 government facilities (worth $367,845), 1 emergency response facility (worth $1,690,000), 2 educational facilities (worth $3,410,660), 8 community facilities (worth $824,122), 1 utility (worth $383,232) and 1 dam (worth $750,000); high fuel rank areas contain 1 government facility (worth $148,455), 1 educational facility (worth $3,367,727), 4 community facilities (worth $422,422), 1 utility (worth $383,232) and 1 dam (worth $750,000); very high fuel rank areas contain 1 community facility (value unknown), 1 utility (worth $383,232) and 1 dam (worth $750,000).

Earthquake

Based on PGA shake maps produced by the USGS, the western portion of Yamhill County is likely to experience higher levels of shaking than the eastern portion, as a result of its proximity to the Cascadia Subduction Zone. Ground movement in both areas, however, is likely to cause damage to weak, unreinforced masonry buildings, and to induce small landslides along unstable slopes. As well as landslide, earthquakes can trigger other hazards such as dam failure and disruption of transportation and utility systems.

Yamhill City is in the eastern portion of Yamhill County, in a region likely to experience strong shaking should a subduction zone earthquake occur. In contrast, the western portion of the county is likely to experience very strong shaking. This rating represents the peak acceleration of the ground caused by the earthquake, and for a strong designation corresponds to 9-20 percent of the acceleration of gravity.

Yamhill City has 2 government facilities (worth $367,845), 1 emergency response facility (worth $1,690,000), 2 educational facilities (worth $3,410,660), 8 community facilities (worth $824,122), 1 utility (worth $383,232) and 1 dam (worth $750,000) which would be impacted by such an event.

Volcano

As discussed in Chapter 5, volcanic activity is most likely to impact Yamhill County and Yamhill City in the form of ashfall or tephra. Damage is likely to result from volcanic eruption columns and clouds which contain volcanic gases, minerals, and rock. The columns and clouds form rapidly and extend several miles above an eruption. Solid particles within the clouds present a serious aviation threat, and can distribute acid rain as sulfur dioxide gas mixes with water. Additionally, these particles can create a risk of suffocation as carbon dioxide is heavier than air and collects in valleys and depressions threatening human and animals. They further pose a toxic threat from fluorine which clings to ash particles potentially poisoning grazing livestock and contaminating domestic water supplies.

However, due to the nature of the hazard, it is impossible to predict the location or extent of future events with any probability, although it can be assumed that all critical facilities and infrastructure within Yamhill City are at risk.

Wind

Many buildings, utilities and transportation systems in open areas, natural grasslands, or agricultural lands are especially vulnerable to wind damage. Impacts associated with wind can include damage to power lines, trees, and structures, and can also cause temporary disruptions of power. Additionally, high winds can cause significant damage to forestlands.

All areas within Yamhill City are equally at risk of a windstorm event. Therefore, all critical facilities, residential structures, and residents are equally susceptible to this hazard.

El Niño and La Niña

Both El Nino and La Nina cause large scale weather pattern changes throughout Yamhill County, and across the entire State of Oregon. In Yamhill City, El Nino periods are generally drier, with an increased likelihood of drought, while La Nina periods tend to be wetter and colder, with an increased risk of winter storm and the associated hazards it brings, particularly flooding and landslides.

The changes wrought by ENSO are on a very large scale, so it is difficult to quantify their impacts locally. Instead, ENSO is manifested in the hazards it influences, such as winter storms, flooding, landslides and drought. Therefore, the quantitative impacts have been summarized in those categories.

Drought

State-wide droughts have historically occurred in Oregon, and as it is a region-wide phenomenon, all residents are equally at risk. Structural damage from drought is not expected; rather the risks apply to humans and resources. Industries important to Yamhill City's local economy such as agriculture, fishing, and timber have historically been affected, and any future droughts would have tangible economic and potentially human impacts.

Dam Failure

Dam inundation data is unavailable for Yamhill County, therefore it is not possible to assess the impacts due to dam failure in this region using that method. However, as determined by the Army Corps of Engineers and summarized in the National Inventory of Dams, there are no dams that pose a significant hazard to Yamhill City in the instance of failure.

Disruption of Utility and Transportation Systems

Transportation system disruption impacts range from effects on life, health, and safety (in the form of emergency vehicle mobility, access to hospitals, access to evacuation routes, and access to vital supplies if transport is seriously disrupted for an extended period) to the economic effects of delays, lost commerce, and lost time. Similarly, disruption of utility systems can affect Yamhill County and Yamhill City at the level of commerce and recreation as well as at the level of fundamental health and safety. Countywide and citywide disruptions are likely to impact all residents equally. Structural damage from disruption to these systems is not expected; rather the risks apply to residents and those traveling in the area.

Hazardous Material Event

The National Response Center and the EPA's Environmental Facts Multisystem Query were used to locate hazardous waste handling facilities and businesses that generate hazardous waste from their activities. Transportation routes likely to carry hazardous waste were examined, and all facilities within a ¼ mile radius of those are considered at risk.

In Yamhill City, 2 government facilities (worth $367,845), 1 emergency response facility (worth $1,690,000), 2 educational facilities (worth $3,410,660), 7 community facilities (worth $824,122) are considered at risk. Additionally, 2 highways (value unknown), 4 bridges (value unknown) and 1 utility (worth $383,232) are located within the ¼ mile risk radius.

Terrorism

It is difficult to determine the scope of any terrorist threat to Yamhill City. Although there seem to be few high-profile targets present, it is impossible to predict future terrorist events. Depending on the extent of the action, the community may suffer economic loss, disruption of utilities, and cleanup relating to explosions and other facility damages. All facilities and residents are at equal risk of being impacted by this threat.