



CITY OF WOODINVILLE

2007

Hazard Identification and Vulnerability Assessment



EMERGENCY MANAGEMENT

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*Woodinville Comprehensive Emergency Management Plan
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I. Executive Summary

The City of Woodinville Hazard Identification and Vulnerability Assessment (HIVA) assesses natural and technological (man-made) hazards within the city limits and in some cases neighboring jurisdictions when the hazard traverses boundaries. Assessment is the initial step in the emergency management process that leads to mitigation against, preparedness for, response to, and recovery from hazards. Hazards have the potential of becoming emergencies or disasters that can adversely affect the people, property, environment and economy of the city.

This hazard assessment helps the City of Woodinville rate the risk, determine vulnerability, and predict the adverse impact of emergencies and disasters. With a hazard assessment the Office of Emergency Management can effectively organize resources and develop comprehensive emergency management plans to minimize the impact of emergencies and disasters, and analyze sustainable development.

This document represents an elementary review of available published material. It is a summary of the relevant information needed to allow a subjective evaluation of the risk posed by certain hazards. It is not, nor is it intended to be, a rigorous or scientific analysis. It does not contain all incidents that have impacted Woodinville but identifies those that contribute to the decision making process of overall assessment in preparation for mitigation and contingency planning. It provides a basic level of knowledge and limited analysis of the hazards posing a threat to the City of Woodinville.

The Washington Administrative Code (WAC 118-30-060 (1)) requires each political subdivision to base its comprehensive emergency management plan on a hazard analysis. The HIVA contains information from local, state, and federal government as well as from public sources.

II. Introduction

There are various phases to emergency management and this document is used to begin the process through documenting the various hazards that may affect the City of Woodinville. For example, by understanding the hazards, emergency management uses this for the mitigation and preparedness phases. Emergency management takes actions to eliminate or reduce the risk to people, property, economy, and the environment from natural and technological (human-caused) hazards. Most mitigation and preparedness actions are based upon the results of the Hazard Identification and Vulnerability Assessment (HIVA).

A. BACKGROUND

Since 1993 the City of Woodinville has not had significant impacts from natural and technological hazards except for two emergencies: in December 2006 a major power outage from a windstorm and the Nisqually Earthquake in February 2001.

B. SCOPE

The scope of this HIVA is the City of Woodinville. The HIVA takes into account natural and technological hazards that pose a threat to the City itself. In addition, due to the importance of environmental hazards this assessment includes the environmental impacts from facilities containing hazardous materials. It also includes an assessment of hazardous materials from transportation due to the close proximity of I-405 and SR-522.

This document satisfies county, state, and federal requirements and sets the basis for the Hazards Mitigation Plan and the Comprehensive Emergency Management Plan (CEMP).

C. WOODINVILLE PROFILE

1. Geography

Woodinville is located at the head of the Sammamish River Valley at the place where the Sammamish River meets the Little Bear Creek; the rivers merge and flow northwest into Lake Washington. The river valley ranges in width from $\frac{1}{2}$ to $\frac{3}{4}$ of a mile and is covered with agricultural land. The valley is bounded by steep, thickly-wooded slopes upon which most of the city's residential development is occurring. Commercial, industrial, and agricultural activities mostly cluster on the valley floor, although some light industry is located on the slopes and plateaus.



Figure 1 City of Woodinville

2. History

The City of Woodinville was incorporated in March, 1993. With a current population of 10,390 the city is bounded on the west by the City of Bothell, on the north by the King-Snohomish County line, and on the remaining sides by unincorporated King County. The area of Grace, just to the north of the County line, may be the subject of annexation in the near future. State Route 522, a major highway connecting I-405 and north King County to points east, traverses the northwest corner of the City. The Woodinville-Redmond Road (State Route 202) runs north-south through the City. Two Burlington Northern-Santa Fe (BNSF) railroad tracks, one a passenger and freight line and the other a little-used spur, also pass through the City.

Woodinville is primarily a community of single-family dwellings, with about 37% multi-family development. A sizeable fraction of the population (nearly 32%) is under the age of 18. The City is served by two school districts, the Northshore School District and the Lake Washington School District. Altogether, there are nine elementary schools, three junior high schools, and one high school in the Woodinville area.

Law enforcement capability is provided under contract by the King County Sheriff's Office. The Woodinville Fire and Life Safety District provides full-service fire and emergency medical capabilities to the City and surrounding area. The Woodinville Water District provides water supply and sewer services, purchasing water from the City of Seattle and conveying waste water to the King County Metro system.

3. Economy

Woodinville is set in the lush Sammamish Valley northeast of Seattle, Washington. Scenic landscapes, wineries, and plant nurseries make Woodinville a premier tourist destination. Recreational opportunities, open space, and a commitment to public safety contribute to Woodinville's outstanding quality of life.

Business in Woodinville is concentrated in the northwest and western parts of the City and in the North Industrial area. It consists mainly of commercial establishments, wineries, one brewery, light manufacturing, and warehousing. In addition, auto repair and body shops, recycling companies, construction supply, and nursery businesses round out the business sector. The annexation of Grace would bring much more of the same types of businesses into the City.

4. Demographics

City Stats

- City Population: 10,390
- Incorporation date: March 31, 1993
- Form of government: Council-Manager
- 2007 Property tax rate = \$1.23 per thousand dollars of assessed valuation

- Fulltime employees: 57.05 ([2007-08 Biennial Budget](#))
- Latitude: 47 degrees 45 minutes
- Longitude: 122 degrees 09 minutes

Corporate City Limits

The corporate City limits are generally described as the lands bounded on the north by the Snohomish/King County line, on the east by 170th Ave NE north of NE Woodinville-Duvall Road and the Sammamish River, on the south by our Tourist District and NE 145th Street (State Route 202), and on the west by 124th Avenue NE.

Land & Roadways

- City geographical area: 5.65 square miles
- Park acreage: 100.84 acres
- State highways in city limits: State Routes 202 and 522

Voting Demographics for City Residents

- 5,764 registered voters as of 2006 General Election
- 3,733 voted in 2006 General Election
- 5,119 voted in 2004 Presidential Election

Legislative Representation

- Woodinville City Council
- Metropolitan King County District 3
- Washington State Legislature: 45th District
- U.S. House of Representatives: 1st District

Diversity (2000 U.S. Census)

- White: 84%
- Asian: 7.3%
- Black or African American, American Indian and Alaska Native, Native Hawaiian and Other Pacific Island: Less than one percent each.

Housing

- Median household income: \$77,900 (2004)
- 2006 median house sale price: \$382,000 (2006)
- Median rent: \$855 (2006)
- Households in city limits: 3512 (2000 census)
- Median Size: 2.61 people (2000 census)

According to the City's Comprehensive Plan:

- Single-family residential units = 54%
- Multi-family residential units = 34%
- Townhouse/Mobile Home = 12%

- Owner-occupied = 73%

Education

- [Northshore School District](#) : Bothell-Woodinville
- [Lake Washington School District](#): Kirkland- Redmond- Woodinville
- [Bellevue Community College](#) : Bellevue
- [Cascadia Community College](#) : Bothell
- [Lake Washington Technical College](#) : Kirkland
- [University of Washington – Bothell](#)

Annual Events

- Cityhood Celebration as part of Celebrate Woodinville (March/April)
- Chipping Event (April/May)
- Earth Day Volunteer Event (April)
- Family Fitness Event (June)
- Summer Concert Series (July/August)
- Sammamish ReLeaf (September/October)
- Harvest Festival (October)
- Spring & Fall Recycling Events
- Light Festival (December)

Business Statistics

- Total sales tax in Woodinville is 8.9%.
- Woodinville is ranked 6th in Washington State in per capital sales tax venue.
- Free business registration.
- 1,100+ registered businesses within City limits.
- No Business & Occupation tax.

Largest Employers in the City (2007--2008 Budget)

- W.A. Botting Company: 289
- Ste. Michelle Wine Estates Ltd: 252
- Molbak's Nursery & Greenhouse: 249
- Loud Technologies: 238
- Target Store: 200

I. Purpose of the HIVA

The purpose of this Hazard Identification and Vulnerability Assessment (HIVA) is to provide information on various large-scale hazards, both natural and technological, that could affect the City of Woodinville. The HIVA serves as a basis for emergency management planning, as a justification for necessary preparedness-related budgeting and expenditures, and as a foundation for mitigation and recovery policy decisions.

The HIVA allows the emergency manager to establish program goals and priorities commensurate with the need for protection. Decisions for creating new emergency management programs, for modifying existing programs, and for assigning personnel and tasks are based upon the HIVA and reflected in the City's emergency management plan. Finally, the HIVA identifies areas needing further research on hazards or the application of technical solutions to mitigate their effects.

The HIVA builds on three concepts:

1. A hazard is a possible source of danger or harm to people, property, or the environment. Hazard identification is the process of recognizing the various dangers present that could threaten a jurisdiction and its residents;
2. Vulnerability is the degree of susceptibility to injury or harm. Vulnerability analysis assesses the relative degree of risk presented by hazards threatening a community;
3. The HIVA identifies potential dangers within or near a community and estimates the community's susceptibility to harm from those hazards.

The HIVA is subject to some limitations. First, it represents a "snapshot" in time, identifying the hazards that exist now. The HIVA should be reviewed and updated periodically to incorporate population growth, new development, gain or loss of industrial facilities, changes in transportation routes or other infrastructure, and any new factors that would affect the existence or distribution of hazards to the community.

The HIVA provides an overview and summary of the types of hazards confronting a community. It cannot pinpoint which hazard will occur, at what time, and in what place. Nor can it be exhaustive, as it is based on historical experience and informed judgment. Not all hazards have been included in this HIVA; new threats may be identified and analyzed at any time.

Finally, vulnerability is a relative, rather than an absolute judgment. One cannot credibly assign hard numbers to the likelihood of various hazards and then determine that because Hazard A has a low number it can be ignored or that Hazard B is "worse" because it has a high number. The uncertainty limits, on such things as earthquake prediction, for example, are too large to permit such analysis.

II. Planning Based on the HIVA

A primary question to consider is planning due to the results of the HIVA. For example, should planning concentrate on low probability/high consequence hazards such as a major earthquake that happens infrequently but could cause numerous casualties and billions of dollars in property damage; or should planning concentrate on high probability/low consequence hazards, such as floods, that occur frequently but cause (relatively) little damage.

Location and circumstance are important factors in assessing hazards. A gas pipeline that runs past an elementary school might be a cause for concern, even though pipeline accidents are relatively rare. Floods that occur every year may be of less concern if the only threatened areas are pasture. A further consideration is that hazards can occur in combination, often in a cause-and-effect manner. Earthquakes can cause landslides, hazardous materials releases, and transportation accidents; severe storms can bring flooding, slides, and utility outages.

A general and accepted principle in emergency management is preparing against major hazards, such as earthquakes, creates a better level of preparedness for smaller hazards. This HIVA provides a basic framework for identifying likely hazards and evaluating their potential impact on the community. However, making good use of the information developed in this hazard assessment is as much a matter of judgment, policy decision, and budgets as it is a matter of science and numbers.

A. RISK ASSESSMENT

Based on the individual hazard profiles and risk assessments, a relative risk assessment is defined with the intent of recommending priorities for emergency management efforts within a comprehensive strategy. Hazards evaluated included: civil disturbance, drought, earthquake, environmental-salmon, epidemic, flood and washouts, hazardous materials/accident, heat wave, landslide, pipeline failure, severe storm, shortage, terrorism, transportation, urban fire and volcano. The following are the top 6 hazards identified with the highest risk: (See the Natural and Technological Hazards Summary for the complete results).

- | | |
|---------------------------------|---------------------------------|
| 1. Severe Storm | 4. Urban Fire |
| 2. Shortage (Water/Electricity) | 5. Hazardous Materials/Accident |
| 3. Earthquake | 6. Transportation |

Table 1 Risk Assessment of Common Hazards

III. Hazard Identification

A. HAZARDS COMMON TO DISASTERS

Landslides (mudslides, slope failure) usually occur as the result of other causal factors. Earthquakes, floods, heavy rains can all lead to landslides as a secondary hazard. Changes in slope gradients, development on steep slopes, removal of stabilizing vegetation can all contribute to slide vulnerability. Slide effects include: damage or destruction of roads; blockage of roads; damage to sewer and water mains; disruption of travel and shipping; damage to homes and other structures. In addition, slides can

block stream or drainage channels, creating a flood hazard where none existed or worsening an existing flood hazard.

Infrastructure damage is likely to occur during most disasters. Infrastructure includes electric power systems, natural gas transmission and distribution networks, petroleum pipelines, water and sewer systems, communications, transportation networks, and other supporting systems usually taken for granted. All of these systems and networks can be destroyed, damaged, or compromised by a variety of disasters. Infrastructure damage can create or worsen a large set of cascading hazards that may well spread beyond the immediate damage area:

- Pipelines undermined by a flood or stressed by earth movement can rupture, spilling their contents;
- Loss of electric power can make the management of emergency response and recovery exceedingly difficult;
- Damaged or blocked roads can hinder the evacuation of residents from threatened areas and slow down the arrival of response and relief resources.

Fires are a common secondary hazard of earthquakes, but they can also result from other types of disasters. Downed power lines, for example, can cause fires in structures as well as in wooded areas. Hazardous materials releases can result in fires if a flammable substance finds an ignition source.

Congestion on roads and streets can result from road damage or blockage, but it can just as easily be caused by uncontrolled evacuation from an area, sightseers, and people trying to get home or find family members. Congestion not only prevents people from getting into or out of an area, but it also hinders the movement of emergency service responders and resources.

Family separation becomes a hazard consideration when families, who may be scattered between home, workplace(s), schools and other places within and out of the disaster areas, try to find each other. Disaster effects, both direct and secondary will undoubtedly hamper their efforts, with the result that families could be scattered all over the greater Seattle area. This will place a tremendous burden on emergency responders, local governments, and other relief agencies in dealing with displaced persons, in trying to gather and convey information about family members, and supporting non-residents who may be temporarily stranded away from their homes and families.

Loss of vital documents and records can bring a local government, a business, and even a family to a standstill. Most disasters can render documents or records unusable, whether by direct destruction, by damage to retrieval mechanisms (e.g., computers), or through damage to the facilities in which records are stored or used. Lack of electric power will make it impossible to retrieve and use records that are stored in a computer, even if no other damage has occurred.

Disaster debris includes debris from buildings, roads, downed trees, etc. damaged in an earthquake or storm; flood-borne debris, volcanic ash; and slide debris. It can be a hazard to transportation; block culverts and channels, widening the flood hazard or threatening structures; and it can impede emergency response and recovery operations until removed. Disaster debris can easily get mixed with organic materials (food, dead animals) and raw sewage (from sewer damage or overflow), posing a serious public health hazard.

Lead and asbestos become hazards when buildings containing these materials have been damaged and must be demolished, repaired, or cleaned.

C. UNDERSTANDING RISK RATINGS

To make this assessment more useful, adjective descriptors (high, moderate, and low) are established for each hazard's probability-of-occurrence and the area's vulnerability in the event of the hazard. A risk rating is assigned on the probability of a hazard occurring over the next 25 years. This interval was chosen because it is the long-term recurrence interval of a dangerous earthquake, the hazard of greatest risk to the City of Woodinville. A final risk rating is assigned based on a subjective estimate of their combination, and this rating will ultimately help focus the emergency management program on the events with the greatest potential risk.

High Risk Rating: Warrants major program effort to prepare for, respond to, recover from, and mitigate against the hazard. A high risk rating for a hazard means that the hazard has a high probability of occurrence and possibly the population of Woodinville is vulnerable to the hazard.

Moderate Risk Rating: Warrants moderate program effort to prepare for, respond to, recover from, and mitigate against the hazard. A moderate risk rating for a hazard means that the hazard has a moderate probability of occurrence, and only a part of the entire population of Woodinville is vulnerable to the hazard.

Low Risk Rating: Warrants modest program effort to prepare for, respond to, recover from, or mitigate against the hazard beyond general awareness training. A low risk rating for a hazard means that the hazard has a low probability of occurrence, and only a small segment of the population in Woodinville is vulnerable to the hazard.

Probability of Occurrence: An adjective description (high, medium or low) of the probability of a hazard impacting the City of Woodinville within the next 25 years. Probability is based on a limited objective appraisal of a hazard's frequency using information provided by relevant sources observations and trends.

High Probability: There is great likelihood that a hazardous event will occur within the next 25 years.

Moderate Probability: There is moderate likelihood that a hazardous event will occur within the next 25 years.

Low Probability: There is little likelihood that a hazardous event will occur within the next 25 years.

Vulnerability: An adjective description (high, medium, low) of the potential impact a hazard could have on the City of Woodinville. It is the ratio of population, property, commerce, infrastructure and services at risk, relative to the entire city. Vulnerability is an estimate generally based on a hazard’s characteristics.

D. NATURAL AND TECHNOLOGICAL HAZARDS SUMMARY OF RESULTS

Summary of Results. The following table is a summary of the results for all the hazards that are evaluated in this report.

Hazard	Hazard Risk Severity + Location + Frequency/Probability	Vulnerability Risk Natural + Manmade + Systems	Total Risk Hazard Risk + Vulnerability – Capability
Civil Disturbance	Low	Low	Low
Drought	Low	Low	Low
Earthquake	High	High	High
Environmental-Salmon	Low	Moderate	Low
Epidemic	Moderate	High	Moderate/High
Flood & Washouts	Moderate	High	Moderate
Hazardous Materials/Accident	Moderate	High	High
Heat Wave	Low	Low	Low
Landslide	Low	Moderate	Low
Pipeline Failure	Low	High	Moderate
Severe Storm	High	High	High

Shortage	High	High	High
Terrorism	Low	Moderate	Moderate
Transportation	High	High	High
Urban Fire	High	Moderate	High
Volcano	Low	Moderate	Moderate
Water Storage Facilities	Low	Moderate	Low

Table 2 Table of Results

Low Results. The following table is a summary of the low results for all the hazards that are evaluated in this report.

Hazard	Hazard Risk Severity + Location + Frequency/Probability	Vulnerability Risk Natural + Manmade + Systems	Total Risk Hazard Risk + Vulnerability – Capability
Civil Disturbance	Low	Low	Low
Drought	Low	Low	Low
Environmental-Salmon	Low	Moderate	Low
Heat Wave	Low	Low	Low
Landslide	Low	Moderate	Low
Water Storage Facilities	Low	Moderate	Low

Table 3 Table of Results

Moderate Results. The following table is a summary of moderate results of hazards evaluated in this report.

Hazard	Hazard Risk	Vulnerability Risk	Total Risk
	Severity + Location + Frequency/Probability	Natural + Manmade + Systems	Hazard Risk + Vulnerability – Capability
Epidemic	Moderate	High	Moderate/High
Flood & Washouts	Moderate	High	Moderate
Pipeline	Low	High	Moderate
Terrorism	Low	Moderate	Moderate
Volcano	Low	Moderate	Moderate

Table 4 Table of Moderate Results

High Results. The following table is a summary of high results of hazards evaluated in this report.

Hazard	Hazard Risk	Vulnerability Risk	Total Risk
	Severity + Location + Frequency/Probability	Natural + Manmade + Systems	Hazard Risk + Vulnerability – Capability
Earthquake	High	High	High
Hazardous Materials/Accident	Moderate	High	High
Severe Storm	High	High	High
Shortage	High	High	High
Transportation	High	High	High
Urban Fire	High	Moderate	High

Table 5 Table of High Results

B. Resources:

- [King County HIVA](#)
- Washington State Comprehensive Emergency Management Plan

- Washington State Hazard Identification and Vulnerability Assessment - 2001
- Washington State Enhanced Hazard Mitigation Plan – July 2004
- National Response Plan – December 2004
- Guide for All-Hazard Emergency Operations, State and Local Guide (SLG) 101 – September 1996
- State and Local Mitigation Planning, How to Guide, Understanding Your Risk, Identifying Hazards and Estimating Losses, FEMA 386-2 - August 2001
- Washington State Emergency Management Division website at www.emd.wa.gov
- Federal Emergency Management Agency website at www.fema.gov
- Local businesses, local media archives, area residents, neighboring jurisdictions

V. Vulnerability Assessment

A. DROUGHT

1. Definition

Drought is a condition of climatic dryness that is severe enough to reduce soil moisture and water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems.

2. History

Fourteen instances were identified by the State of Washington's HIVA from 1902 to 1977. 2006 was one of the driest years recorded. The City of Woodinville has no known droughts on record to date that significantly impacted residents and businesses. The following table shows the ranking in the Seattle area of least precipitation from 1949 – 2006¹.

Seattle (1949-2006)		
Rank	Year	Precipitation
1	1987	0.84"
2	2003	0.89"
12	2006	2.12"
Normal		3.30"

3. Hazard Identification and Vulnerability Assessment.

In a drought, the reduction of the amount of available water in reservoirs intensifies the debate over water allocation. Woodinville water is dependent upon the snow pack from the Cascade Mountains. Weather pattern changes and lack of snowfall in the mountain regions may increase the likelihood of future water conservation measures. The City of Woodinville has a contract with Seattle City Light and receives one hundred percent (100%) of its water through contracted negotiation.

Secondary Impacts from Drought

Secondary natural hazards may be triggered by a drought, including:

1. Urban interface fires, and
2. Reduced stream flows negatively affect the environment.

¹ [Office of the Washington State Climatologist](#)

Potential manmade hazards related to a drought include:

1. Reliance on the supplier for water, and
2. Local wells may have reduced water levels.

Potential systems vulnerabilities include:

1. Possible increase cost of water supplies.

4. Conclusion

History suggests a low probability of occurrence. Although the entire population of the City is vulnerable to the effects of drought, severity has historically been low. However, as growth places more pressure on limited local resources, future impacts may be assessed, suggesting low vulnerability. A low risk rating is assigned.

5. Resources

OWSC, <http://www.climate.washington.edu/outlook.html>

Climate Impacts Group, <http://www.cses.washington.edu/cig/pnwc/aboutpdo.shtml>

Office of the State Climatologist, <http://www.climate.washington.edu/>

B. EARTHQUAKE

1. Definition

An earthquake is a naturally induced shaking of the ground. Earthquakes are caused by the fracture and sliding of rock within the earth's crust. The earth's crust is divided into eight major pieces (or plates) and many minor plates. These plates are constantly moving, very slowly, over the surface of the globe. As these plates move, stresses are built up in areas where the plates come into contact with each other. Woodinville can be vulnerable to three types of earthquakes: deep plate from Juan De Fuca (Oceanic) sinking below the shallow North American (Continental) Plate, shallow earthquakes which include the Seattle Fault upon which Woodinville sits and subduction off the coast (Cascadia).

Deep Earthquakes. Deep earthquakes occur within the subducting Juan De Fuca Plate as it bends beneath the continental plate. These deep earthquakes are approximately 25 – 100 kilometers (approximately 30 miles or greater) in depth with magnitudes up to 7.5² and could last 15 – 30 seconds of strong shaking. Due to their depth, aftershocks are typically not felt in association with these earthquakes. History indicates that these earthquakes do not occur east of the Cascade Mountains.

Shallow Earthquakes. Shallow (crustal) earthquakes occur within the North America plate. This type of earthquake has occurred throughout Washington, and most parts of Oregon. These earthquakes are primarily shallow with depths of less than 30 Kilometers (<15 miles) and less than 8 in magnitude.

Subduction Earthquakes. Subduction earthquakes occur along the Cascadia Subduction Zone, as a direct result of the convergence of these two plates. It lies 50 miles offshore and extends from the middle of Vancouver City in British Columbia in a southerly direction past Washington and Oregon stretching to Northern California. Although no large earthquakes have occurred along the offshore Cascadia Subduction Zone since historic records began in 1790, similar subduction zones worldwide do produce "great" earthquakes – magnitude 8 plus and 20 miles or less in depth. A subduction earthquake would be centered off the coast of Washington and Oregon where the plates converge. Such earthquakes typically have a minute or more of strong ground shaking, and are quickly followed by damaging tsunamis and numerous large aftershocks.

² USGS (www.ess.washington.edu/SEIS/PNSN/CascadiaEQs.pdf)

2. History

Each year over one thousand earthquakes are recorded in Washington State. Fifteen to twenty of these earthquakes are strong enough to be felt.

Woodinville FEMA's reimbursements totaled \$30,000 from the Nisqually Earthquake disaster.

Date	Location	Damage
February 28, 2001	Woodinville	Nisqually Earthquake: Disaster \$30,000.

Table 6 Historical Events – Earthquake

3. Hazard Identification and Vulnerability Assessment

Time, location, magnitude and depth of an earthquake will greatly affect the vulnerability of Woodinville. The portion of land on the city that is soft, making it susceptible to ground shaking are the erosion and landslide areas, see the Erosion, Slope and Landslide Hazard Maps. These designated areas have potential liquefiable based soil type and ground surface settlement due to earthquake induced ground motions.

Building materials will greatly affect the impact of an earthquake on a structure; masonry structures that are not reinforced are the most vulnerable while wood frame structures typically perform well in earthquakes. Additionally, individual buildings have different natural frequencies of vibration that depend on their height and structural design, amplification may affect some buildings more than others. Strong shaking is a hazard both near the epicenter of an earthquake and in areas where amplification occurs. See the Seismic Hazard map.

The effects of an earthquake could also vary widely by the buildings and infrastructure first damaged. Damage to buildings that house emergency services such as fire stations, medical clinics, and hospitals (located off the city) could lessen emergency response capabilities. Breaks in the street, bridge, and overpass network can also impair the delivery of emergency services.

The potential coexistence of other secondary disasters with earthquakes, such as fires, hazardous materials releases, ground failures, landslides, and liquefaction add to the difficulty in predicting losses.

Secondary Impacts from an Earthquake

Many secondary natural hazards may be triggered by an earthquake, including:

1. Liquefaction and subsidence of soils.
2. Landslides impacting transportation, homes, and public infrastructure.
3. Fires from gas pipeline ruptures.

The severity of soil-related natural hazards and ground failure phenomena often depends on status of groundwater, rainy seasons, and drought conditions.

Potential manmade hazards related to an earthquake event include:

1. People stranded if transportation or other lifeline networks fail. Woodinville may be unsupported if the disaster is region-wide.
2. Chimneys, bricks, unsupported fascia, trees, displacement of homes, bridges, and non-reinforced structures.
3. Elevated concrete or brick walkways.
4. Cracks in roads could cause accidents.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

History suggests a high probability of occurrence. Historical damage and cumulative costs of destructive earthquakes suggest high vulnerability. Accordingly, a high risk rating is assigned.

It is important to protect the City's economic base. The functionality of critical facilities and lifelines such as hospitals, fire stations, schools, power, communications, transportation, fuel delivery systems, dams, etc. are vitally important more so than the immediate dollar losses following a major earthquake. Over the years population and development have grown and without mitigation the City will expect higher losses due to greater exposure. This requires a focus on implementing mitigation measures in the community in all areas of livelihood, including home, school, business, and government:

- Examine, evaluate, and enforce building and zoning codes.
- Identify geologically hazardous areas and adopt land use policies.
- Provide public information on actions to take before, during, and after an earthquake.
- Develop and maintain mitigation, preparedness, response, and recovery programs.

5. Resources

- Washington State Emergency Management Division
- Washington State Department of Natural Resources, Geology and Earth Resources Division
- Washington State Department of Transportation
- University of Washington Geophysics Program
- United States Geological Survey
- Federal Emergency Management Agency

C. EPIDEMIC

1. Definition

Epidemics are outbreaks of disease that affect, or threaten to affect, a significant portion of a population in a relatively short period of time. Although usually referring to human contagious disease, epidemics can also affect domestic, wild animals, and crops. Epidemic diseases are usually introduced into an area from remote regions and inflict devastation because there is no natural or induced immunity. Epidemics are a possible recurring anomaly once introduced to a region.

2. History

Woodinville has not suffered an epidemic to date. This is due to our northern locale, a hostile environment to many of the world's most contagious diseases, low population density, clean water and food supplies, effective sewage and waste disposal, a high incidence of inoculations, and aggressive monitoring and treatment of potential disease outbreaks by public health officials. We are not immune, however, and disease events emerging in other parts of the country or world could affect us in the future. Food borne illness also poses a risk of epidemic with possible serious gastrointestinal problems.

During a worldwide influenza outbreak in 1918 and 1919, an estimated 20 million people died. A 1946 polio epidemic in the United States killed approximately 25,000 people. The 1976 outbreak of Legionnaire's Disease in Philadelphia, PA claimed 30 lives. Additionally, there is growing concern that tropical diseases are moving in new areas with an increasingly mobile world population.

The epidemic outbreak in the 2002 – 2003 Severe Acute Respiratory Syndrome (SARS) originated in China and spread to other nations via air travel with 24 suspect cases in King County³ totaling 30 cases in Washington State alone.⁴ Over 19,000 people were quarantined in Toronto, Ontario from SARS.

West Nile Virus is a flavivirus which is carried by mosquitoes. Flavivirus is a family of viruses transmitted by mosquitoes and ticks. It is transmitted when a mosquito bites an infected bird, and then bites another animal or human. West Nile virus, West Nile fever, and West Nile encephalitis are different terms describing the same virus but refer to different medical states. Originally found in Africa, West Asia and the Middle East, West Nile virus was first confirmed in the United States in 1999. [The CDC has a map showing the worldwide distribution as of 2000.](#) West Nile Virus is characterized by flu-like symptoms which last just a few days. Symptoms normally show up 3 – 15 days

³ King County Public Health

⁴ Centers for Disease Control ([CDC.gov](http://www.cdc.gov))

after a mosquito bite. West Nile Virus grew from an initial U.S. outbreak of 62 disease cases in 1999 to 4,156 reported cases, including 284 deaths, in 2002.⁵

Since 2003 Bird Flu or Influenza A also called “H5N1 virus” has progressed towards North America⁶ and is an influenza A virus subtype that occurs mainly in birds, is highly contagious among birds, and can be deadly to them. H5N1 virus does not usually infect people, but infections with these viruses have occurred in humans. Most of these cases have resulted from people having direct or close contact with H5N1 infected poultry or H5N1 contaminated surfaces with a ~50% mortality rate.

Drug-resistant tuberculosis (XDR TB) poses a grave and growing threat to global public health. The reality remains that some people are suffering from a very serious form of multi-drug resistant tuberculosis (MDR TB)⁷.

Food borne illnesses has become more prevalent in 2006 and 2007 to include Botulism and Salmonella (4 cases in 2007 in Washington State)⁸. Food born chemicals such as Pesticides have the potential for causing harm. The Environmental Protection Agency estimates that 10,000-20,000 physician-diagnosed pesticide poisonings occur each year among the approximately 3,380,000 U.S. agricultural workers.⁹

3. Hazard Identification and Vulnerability Assessment

The entire population is vulnerable to an epidemic and life threatening diseases. Depending on the disease, there could be short or long term debilitation and massive loss of life. Lost productivity and efficiency could have a devastating impact on the economy and on the provision of essential public safety and health services.

Secondary Impacts from Epidemics

Secondary environmental hazards may include:

1. Pets may contract bacteria and viruses.
2. Wildlife may also contract and spread bacteria and viruses.
3. Rodents may spread disease, especially highly contagious diseases.

⁵ [Center for Disease Control \(CDC\)](#)

⁶ [Emergency Email and Wireless Network](#)

⁷ [Center for Disease Control \(CDC\)](#)

⁸ [Center for Disease Control \(CDC\)](#)

⁹ [Center for Disease Control \(CDC\)](#)

Potential manmade hazards related to an epidemic event include:

1. Quarantine of homes and buildings due to epidemic or impact of biological weapons of mass destruction.

Potential systems vulnerabilities include:

1. Overloaded medical system, e.g. hospitals, clinics.
2. Overloaded medical transport systems.
3. Business interruption and resulting losses in sales, wages, and profits from employee illness.
4. Impacts to local economy if economic processes break down.

4. Conclusion

History suggests a moderate probability of occurrence. However, because the potential impact is so great due to air travel, terrorism, and bioterrorism, there is high vulnerability. A moderate/high risk rating is assigned.

5. Resources

- Washington State Emergency Management Division
- Federal Emergency Management Agency
- Havaria Information Alert Map,
<http://viz.rsoe.hu/alertmap/index.php?smp=&lang=eng>

D. FLOOD AND WASHOUTS

1. Definition

Generally there are three types of flooding specific to Woodinville: stream building floods, drainage sub basin overflows, and flooding from large water main breaks.

Stream building floods: These floods occur because of prolonged heavy rainfall. Actual duration and rainfall amounts needed to cause flooding depend on the initial condition of the stream, groundwater conditions, and runoff conditions.

Drainage sub basin: A manmade earth basin, generally 50 – 100 feet in diameter. Used as an overflow for prolonged heavy rainfall.

Large water main failures: A pipeline generally over 10 inches in diameter.

2. History

Floods do not commonly affect Woodinville. The Federal Emergency Management Agency (FEMA) on June 30, 1997 classified the community as Zone C (minimal flood hazard). Woodinville can experience two or three days of rainfall averaging 2 – 5 inches per day for stream building type of flooding to occur. Actual duration and rainfall amounts needed to cause flooding depend on the initial condition of the stream, groundwater conditions, and runoff conditions. Historically flooding has occurred due to overflow of sub basins, pipeline failure and high flows in Little Bear Creek.

Date	Location	Damage
November 2006	Eastern end of 19495 – 144 th Ave NE	Flooding, damage cost \$43,656
December 2006	15300 block of SR 202	Flooding, damage cost \$4,000, under the trestle (tressel). Closed on several locations during the winter. About 2 ft deep. Flooding runs down the street. <u>Bottle Relief Project</u> .
December 2006	148 Ave NE North of NE 145	Flooding, damage cost \$500
December 2006	13460 block of 143 rd St	Washout, damage cost \$1,000

Date	Location	Damage
	NE	
December 2006	124 th Ave and 173 rd PL	Washout, damage cost \$20,000

Table 7 Historical Events – Flood

3. Hazard Identification and Vulnerability Assessment

Minimal flood plains are found on the city. The greatest potential is with high water content in the soil causing landslides or localized flooding of Little Bear Creek and the Sammamish River. However, the River has been well confined within steep banks in the Woodinville area and, considering that the 100-year floodplain extends only a short distance from the river edge, serious flooding is unlikely. Flooding that does occur along these areas may result both from excess stream flows and from excess storm water volume. The City is also vulnerable to significant water runoff from steep slopes during heavy rainfall.

Other vulnerabilities are the drainage sub basins. If breaks occur in the sub basin, homes could become damaged. Residential housing can also be flooded due to the close proximity of culverts, catch basins and drainage systems overflowing. Localized flooding may occur due to debris blockage of storm drains and gutters, as well as from overflow when runoff volumes exceed drain and culvert capacities. Overflowing storm sewers and unchanneled runoff could block roads, wash out roadways, and undermine culverts and bridges. A stream channel and runoff culvert at 148th Avenue NE and 146th Place NE makes a sharp right turn to the north; large-volume runoff at this point has compromised the adjacent road surface in the past and remains a matter for concern.

Secondary Impacts from Floods

Secondary environmental hazards may include:

1. Landslides and soil movement.

Potential manmade hazards related to floods include:

1. Building structure or interior damage.
2. Life safety due to people wading and driving in flooded streets

Potential systems vulnerabilities include:

1. Obstructed and damaged access routes.
2. Impairment of transportation around impacted area.

4. Conclusion

Historically, natural flooding has little impact but secondary impacts of heavy rainfall are landslides. Man made structures such as drainage sub basins can cause flooding to homes within the vicinity. This suggests a moderate probability of occurrence. Because of the relative land area and population affected and man made structures causing localized flooding, the city is exposed to high vulnerability. This suggests the assignment of a moderate risk rating.

5. Resources

- Washington State Emergency Management Division
- Federal Emergency Management Agency

E. HEAT WAVE

1. Definition

A heat wave is generally characterized by five or more consecutive days of unusually hot weather. Locally, the National Weather Service considers hot weather to be 90 degrees or higher. Mean Heat Index is used to measure how hot the temperature actually feels to a person over the course of the day. It is an average of the Heat Index from the hottest and the coldest times of each day. It combines factors such as surface and ambient heat with humidity and other environmental factors.¹⁰ See also National Oceanic and Atmospheric Administration's National Weather Service Heat Index at <http://www.nws.noaa.gov/om/heat/index.shtml>.

2. History

There have been no recorded heat waves affecting the City of Woodinville. However, the unpredictable weather of recent history suggests the possibility of future occurrences. In 2006 the Seattle area temperatures reached 100 and 99 in July and August respectively.

3. Hazard Identification and Vulnerability Assessment

Woodinville normally experiences temperatures in the upper-70s to mid-80s during the hottest months of June, July, and August. Because of our mild marine climate, most residents are not acclimated to hot weather and many do not have air conditioning in their homes or vehicles. Senior citizens, infants, and the infirm would be most susceptible to heat and its effects. Those living alone, without family or friends to help, would be even more susceptible.

A heat wave could have local impact similar to that experienced by Chicago in 1995. Heat fatigue, heat stroke, respiratory distress, dehydration, and other heat related conditions could cause deaths and/or injuries.

Secondary Impacts from a Heat Wave

Secondary environmental hazards may include:

1. Lake and stream temperature rising.

Potential manmade hazards related to a heat wave include:

¹⁰ National Oceanic Atmospheric Administration (NOAA)

1. Non air-conditioned homes and vehicles could cause human illness from the heat.
2. People overweight or on medication could be susceptible.
3. Overexposure to the sun could cause a rise in heat strokes.
4. Increased potential of drowning as people seek relief in area waters.

Potential systems vulnerabilities include:

1. Greater impact on production of electricity to support air conditioning and refrigeration.

4. Conclusion

No known heat waves have affected Woodinville within the last 20 years suggesting a low probability of occurrence. The susceptible population suggests low vulnerability. A low risk rating is assigned.

5. Resources

- Washington State Emergency Management Division
- Federal Emergency Management Agency

F. LANDSLIDE

1. Definition

Landslides are the release of rock, soil, or other debris and its subsequent movement down a slope or hillside. They are generally caused or controlled by a combination of geology, topography, weather and hydrology and can be influenced by development practices. Landslides vary greatly in size and composition: from a thin mass of soil a few yards wide to deep-seated bedrock slides miles across. The travel rate of a landslide can range from a few inches per month to many feet per second depending on the slope, type of material, and moisture content.

2. History

Woodinville has a limited history of landslides. The largest documented landslide occurred in January 2007, some minor landslides have occurred however, only 20 to 30 yards of material were moved.

The City contains areas that are susceptible to landslides, as identified on the King County Sensitive Areas Map Folio. Landslide hazard areas are defined as areas with a combination of slopes with greater than a 15 percent gradient, impermeable soils, and groundwater seepage. These unstable slopes are a major hazard to people, structures, roads, and pipelines.

The Slope Hazards Map identifies landslide-prone areas on the slopes along both sides of the Sammamish north of the 145th Street Bridge. The City also contains areas that are prone to erosion activity, including the slide areas just discussed and areas along Little Bear Creek.

Date	Location (Woodinville)	Damage
January 2007 ¹¹	14400 block of 137 th PL NE	Damage cost \$6,000

Table 8 Historical Events – Landslide

3. Hazard Identification and Vulnerability Assessment

The State of Washington rates landslide losses second to flood losses for the state as a whole with the Puget Sound basin having the greatest vulnerability. This is because of increased population density and development on and below bluffs and slopes.

¹¹ See Natural Disasters Map

Historically, landslides in Woodinville have had localized impact and as development continues in high risk areas, vulnerability may increase. The greatest risk is to individual residential structures on or below bluffs or slopes, roads, pipelines, and electrical and communications distribution lines.

Landslides are also a secondary hazard to earthquakes (e.g. 2001 Nisqually Earthquake), severe storms and high rain fall preceded by a cold spell. The identification of areas susceptible to land sliding is necessary to support grading, building, foundation design, housing density, and other sustainable land development regulations in reducing the risk of property damage and personal injury.

Secondary Impacts from Landslides

Secondary environmental hazards may include:

1. Loss or damage of natural habitat impacting streams and animals.

Potential manmade hazards related to landslides include:

1. Loss or damage of homes, private property, public buildings and commercial enterprises.
2. Lifelines and infrastructure may be blocked or damaged.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

Woodinville has a low history of landslides suggesting a low probability of occurrence. Landslides tend to occur along the roadways of developed areas suggesting moderate vulnerability. Because of the low probability of occurrence and the trend appearing to stay the same, a low risk rating is assigned.

G. SEVERE STORM

1. Definition

Destructive storms come in several varieties: wind, rain, ice, snow and a combination. Nearly all destructive local storms occur from November through April when the jet stream is over the United States west coast and Pacific low-pressure systems are more frequent. The more southerly storms bring heavy rains while the more northerly ones bring cold air and a potential for snow and ice. Any winter storm, regardless of its trajectory, can pack high winds. Generally, winds above 30 miles per hour can cause widespread damage and those above 50 miles per hour can be catastrophic. High winds of short duration, such as tornados and strong gusts from thunderstorms, can also be destructive though generally not as widespread.

2. History

Since 1972, King County has dealt with the impact of severe storms. The majority of these were combination events with high winds, heavy rain, snow or ice, and subsequent flooding.

King County has reported three tornadoes all of which were in the decade of the 1960's. Tornado funnel shaped clouds generally affect areas of three-quarters of a mile wide and 16 miles long. Tornadoes are produced by strong thunderstorms that generate damaging hail, heavy rain, and wind. The storms occurrences were in the months of August, September, and December. There were no deaths associated with the storms and in total one person was injured. The tornado ratings were F0 (winds from 40 – 72 mph), F1 (winds from 73 – 112 mph), and F3 (winds from 158 – 206 mph) for the three separate events. Small funnel clouds have been seen in the local area of Puget Sound. Due to these sightings there is the possibility of impact to the City of Woodinville in the future.

Recent storms of major impact, other than flooding causing washouts in November 2006, include the January 1993 Inaugural Day Storm, the Windstorm of December 1995, and the Ice and Windstorm of December 1996.

The most recent wind storm was in December 2006 causing significant power outages and damage from falling trees and debris with winds gusting to 60 mph. As a result, more than 1.5 million customers were without power throughout western Washington and Oregon – some for longer than a week. Similar storm systems moved through other parts of the nation that week, killing more than 60 people in 11 states.

Date	Location	Damage
November 2006	Woodinville	Severe rainstorm, damage costs \$43,656.
December 2006	Woodinville	Snow and wind with power failures and blackout for over one week, damage costs \$48,000.

Table 9 Historical Events – Severe Storms

3. Hazard Identification and Vulnerability Assessment

The entire city is vulnerable to the effects of a storm. Lifeline infrastructure may be compromised such as limited access to roads, power and communications. Widespread business interruption and economic losses would be expected. High winds can cause widespread damage to trees and power lines and interrupt transportation, communications, and power distribution. Prolonged heavy rains cause the ground to be saturated, and streams to rise, and may result in landslides and falling trees.

Ice storms occur when rain falls from a warm atmospheric layer into a cold one near the ground. The rain freezes on contact with cold objects including the ground, trees, structures, and power lines, causing roofs to collapse and power lines to break.

Snow storms primarily impact the transportation system and the availability or timing of public safety services, stranding residents for up to several days. Even a small accumulation of snow can cause havoc due to a lack of snow removal equipment and to inexperienced drivers on the roadways. Snow accumulations can also cause structural collapse. Snow accompanied by high winds is a blizzard which can affect visibility, cause large drifts and strand residents for up to several days. Melting snow adds to river loading and can turn an otherwise benign situation into a local disaster.

Tornadoes may strike anywhere in the City of Woodinville and could traverse across the city and produce a limited damage path. Unlike storms in the Midwest of the country Pacific Northwest tornadoes tend to be weaker and less destructive.

Parts of Woodinville have limited routes of ingress and egress. These could easily be rendered impassable by bad weather (snow, flooding, etc.), trapping residents already suffering from a loss of electric power. Also, some services are limited in various areas of Woodinville, and residents may be forced to do without until roads become passable again. Floods, excessive runoff, and washouts could create problems on steeper road sections of the City.

Each type of storm when in combination with any secondary failures or if accompanied by freezing temperatures can exacerbate a storm's impact. Isolated residents without power are more likely to use wood fires to stay warm or to cook, possibly resulting in an increase of fire hazards and the potential for carbon monoxide poisoning. Residents without food or water may attempt to use impassable roads and thereby increase the number of potential rescues.

The windstorm of December 14-15, 2006 was the strongest storm to hit western Washington since 1993. Puget Sound Electric (PSE) took a direct and sustained hit, which put a significant strain on many utility resources. Several factors led to this windstorm becoming the Pacific Northwest's most damaging storm in 15 years – one that caused the most damage ever sustained by electric infrastructure of PSE.¹²

Much of the Woodinville area experienced several days and some parts over a week of power outage from the impact. This storm began with heavier than predicted rain, and then high winds, resulting in heavy damage to the power grid. Some citizens were without power for nine (9) days. The resulting power outage created food and gasoline shortages as the commercial business district was without power for several days.

Secondary Impacts from Severe Storms

Secondary environmental hazards may include:

1. Local flooding and landslides.
2. Waste water overflows (public sewer and private septic systems).
3. Pipeline failures.

Potential manmade hazards related to severe storms include:

1. Inclement weather affecting people.
2. People traversing or working in Woodinville stranded and in need of shelter.
3. Winter storms creating icy roads and walkways.
4. Falling trees and debris from high winds impacting homes, businesses, blocking roads.
5. Power and communication line outages.
6. Snow accumulations could cause structural collapse and impassable roadways.

Potential systems vulnerabilities include:

¹² PSE <http://www.pse.com/InsidePSE/lessonsLearned.aspx>

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

Storm history suggests a high probability of occurrence. Historical damage and cumulative costs of destructive storms in King County suggest high vulnerability. Accordingly, a high risk rating is assigned.

H. VOLCANO

1. Definition

A volcano is a vent in the earth's crust through which magma (molten rock), rock fragments, gases, acidic rain, and ashes are ejected from the earth's interior. A volcanic mountain is created over time by the accumulation of these erupted products on the earth's surface. Though there are no volcanoes within Woodinville, active volcanoes exist in the Cascade Range: to the southeast Mount Rainier, to the south Mount St. Helens and Mount Adams, and north Mount Baker and Glacier Peak. These Cascade volcanoes tend to erupt explosively due to internal pressure from gas and molten rock.

2. History

Cascade Range volcanoes have erupted more than 200 times during the past 12,000 years for an average of nearly two eruptions per century. At least five eruptions have occurred during the past 150 years. The last major eruption of Mount Rainier was 500 years ago in the form of lahars.

Lahars are mudflows or debris flows from the flanks of a volcano that behave like flowing concrete¹³. Mount Rainier is capped by glacier ice and has steep slopes making it prone to landslides and lahars. It is in close proximity to a large population center residing on deposits of previous lahars. "Mount Rainier is far more unstable than previously thought, Volcanologists determined in the late 90's."¹⁴ Lahars reach Puget Sound lowlands every 500-1000 years. Mount Rainier is one of the most hazardous volcanoes in the U.S.¹⁵

The most recent eruptions in the Cascade Range are the well-documented 1980 – 1986 eruptions of Mount St. Helens which claimed 57 lives and caused nearly a billion dollars in damage and response costs. The effects were felt throughout the northwest. Woodinville was affected in 1980 by ash fall which caused some damage to internal combustion engines, transportation problems due to reduced visibility, and was a general nuisance. There was also an economic impact resulting from the closure of Interstate-5 (I-5). Over the past 200 years, Mount St. Helens has erupted three times suggesting a recurrence interval of about 70 years.

¹³ USGS Fact Sheet 034-02

¹⁴ Quote from the Washington Post, 8/11/03

¹⁵ USGS

Date	Location	Damage
1980	Mount St. Helens	Ash fall

Table 10 Historical Events – Volcano

3. Hazard Identification and Vulnerability Assessment

An eruption of Mount Rainier could seriously impact Woodinville. The greatest local threat to the City is ash. Mud, debris, melting glaciers, lahars and pyroclastic flows could inundate nearby surrounding valleys and severely impact life, property, the environment and the economic stability of the region. Overflow into the rivers could have significant impact on other local communities especially destructive lahars that are able to maintain their identity as debris flows causing damage approximately 70 miles downstream thus reaching Puget Sound, Port of Tacoma, Seattle’s Duwamish, and Lake Washington in as little as 40-50 minutes.¹⁶ A devastating collateral effect is the potential destruction of water reservoirs and dams which could impede water supplies. A large earthquake could also trigger Mount Rainier lahars impacting water supplies.

Another eruption of Mount St. Helens would likely have an impact similar to that experienced in 1980. Additional impacts could result if the prevailing winds are toward the City of Woodinville. Ash could potentially disrupt transportation and other essential services and particulates, toxic gases and acid rains could affect public health, water supplies, and aquatic life.

Secondary Impacts from Eruptions

Secondary environmental hazards may include:

1. High speed avalanches of hot ash and rock.
2. Landslides, possibly 10 miles downstream.
3. Mudflows of volcanic ash and debris (lahars), possibly 50-75 miles downstream.
4. Falling ash, toxic gases, and acid rain impacting public health and the environment.

Potential manmade hazards related to an eruption include:

1. People stranded if transportation or other lifeline networks fail. Woodinville may be unsupported if the disaster is region-wide.

¹⁶ Pierce County HIVA: Volcanic.pdf

2. Wildfire or urban interface fires due to hot ash and lava flows.
3. Water and gas pipelines may be impacted and possibly other utilities.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.
3. Ash can cause disruption to ground and air transportation and can cause damage to electronics and machinery.

4. Conclusion

History suggests a low probability of occurrence. Due to potential impact on the local area environmentally and economically, there is a moderate vulnerability. Mount Rainier has been quiet for the past 500 years; this hazard is assigned a moderate risk rating.

II. Technological Hazards (Man made)

A. CIVIL DISTURBANCE

1. Definition

Civil unrest or disturbance is a result of individuals or groups within the population feeling their needs or rights are not being met by society, a segment of it, or the current political system. Civil unrest spans a variety of actions including labor unrest, strikes, civil disobedience, demonstrations, riots, and rebellion. Events that could trigger these actions include racial tension, unemployment, unpopular political actions, and a decrease in the supply of essential goods or services. Additionally, civil disturbances may arise from celebrations, or festivals, which become uncontrolled and participants become destructive in nature, leading to riots, vandalism and looting.

2. History

Woodinville does not have a history of civil disorders. However, civil disorders could occur in the future due to growth of the city.

As recently as 1999, Seattle experienced an episode of civil disturbance that launched the city into the international spotlight. The World Trade Organization (WTO) conference November 1999 was the site of massive demonstrations, where thousands of protesters paralyzed downtown and harassed delegates.

3. Hazard Identification and Vulnerability Assessment

The location and type of the incident may determine the impact or disruption to the city community in its entirety. Because of the socioeconomic and demographic composition of Woodinville, it is unlikely that the city would experience large racial riots that have exploded in other parts of the country.

Secondary Impacts from Civil Disturbance

Secondary environmental hazards may include:

1. Damage or destruction to landscaping and vegetation.
2. Possible contamination of water and other natural habitats.

Potential manmade hazards related to civil disturbance include:

1. Homes, businesses, schools, and government buildings could be damaged.
2. Public transportation and communications could be impacted.

3. Specific industries could be targeted and damaged.
4. Specific political and social groups and nationalities could also be targeted.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

History suggests a low probability of occurrence, and is deemed low vulnerability; a low risk rating is assigned.

B. WATER STORAGE FACILITIES

1. Definition

Water storage failures include dams, water storage tanks and water wells. Dam and water storage tanks are the uncontrolled release of impounded water resulting in downstream flooding and lack of water supply, which can affect life and property. Failures can be caused by flooding, earthquakes, blockages, landslide, lack of maintenance, improper operation, poor construction, vandalism, and terrorism. Local water well is a below ground well used for emergency purposes for potable water and regulated by the Woodinville Water District.

2. History

The Woodinville Water District provides water supply and wastewater services to the City of Woodinville, as well as to several other communities to the south. Fresh water is purchased from the City of Seattle through nine taps on the Tolt Pipeline. Water is stored in and dispensed through eight water tanks and standpipes, ranging in capacity from 1.1 million gallons to 2.8 million gallons. These structures are being upgraded to meet current seismic standards. Some water storage tanks are outside the city limits of Woodinville, two are inside the city limits. Although mostly gravity-fed, the water system has four pump stations, each with a backup power source.¹⁷

The South Fork Tolt River Dam owned by Seattle Light and Power is located in the Cascade Mountains, approximately 30 miles due east of Woodinville. The dam project consists of an earthfill dam, a storage reservoir, a pipeline from the reservoir to a regulating basin about five miles downstream, and another pipeline from the regulating basin to Lake Forest Reservoir. The Tolt River Dam produces electricity and drinking water for the region. Failure of the Tolt River Dam will cause major inundation of the Cities of Carnation and Duvall, and the Snoqualmie River Valley. The Tolt Reservoir can hold over 18 billion gallons of water and its regulating basin can hold over 280 million gallons. Inundation maps indicate that major flooding will occur as far east as Snoqualmie Falls, and as far west as Everett.

Loss of water supply from the Tolt Pipeline due to pipe or dam failure will lead to an immediate shutdown of the Woodinville Water District system in order to preserve water storage, provide a limited supply of fresh water, and ensure fire flow. The District also has a well which could supply a limited quantity of potable water.¹⁸

¹⁷ Woodinville Water District

¹⁸ Woodinville Water District

Three incidents have occurred in King County; accounting for all lives lost due to dam failure in the state.

3. Hazard Identification and Vulnerability Assessment

Dam and tank failures can be caused by nature, such as flooding or an earthquake, but mostly they are caused by human error such as poor construction, operation, maintenance or repair. The effects of a dam failure are highly variable depending on the dam, the amount of water stored behind the dam, the current stream flow, and the size and proximity of the downstream population. The immediate impact may be a shutdown of the City's water supply. Other effects of a major dam failure include: loss of life, destruction of homes and property, damage to roads, bridges, power lines, and other infrastructure, loss of power generation and flood control capabilities, disruption of fish stock and spawning beds, and the erosion of stream and river banks outside the City of Woodinville.

Failure of the above ground water storage facilities would impact the areas on a downhill slope from the tanks affecting city property including residential, businesses and industrial.

Secondary Impacts from Water Storage Facilities

Secondary environmental hazards may include:

1. Direct impact to the natural habitat, including loss of marine life.
2. Damage to natural habitat along the creeks.
3. Natural habitat within the inundation areas damaged or destroyed.

Potential manmade hazards related to dam and water storage facility failure include:

1. Sewer, water, and gas lines may be damaged.
2. Sewer pump stations possibly damaged.
3. Possible culvert damage.
4. Roadways.
5. Private homes and businesses.

Potential systems vulnerabilities include:

1. Sewer, gas, and water lines may be impacted.
2. Business interruption and resulting losses in sales, wages, and profits.

3. Impacts to local economy if economic processes break down.
4. Local transportation routes closed.

4. Conclusion

History suggests a low probability of occurrence. The failure of water storage facility would suggest moderate vulnerability. Because they are well maintained and operated providing no reason to suspect a compromise in structural integrity barring a catastrophic natural disaster or terrorist action, a low risk rating is assigned.

C. HAZARDOUS MATERIALS/ACCIDENT

1. Definition

Hazardous materials include chemicals used in manufacturing, household chemicals, crude oil and petroleum products, pesticides, herbicides, fertilizers, paints, medical wastes, radioactive materials and a host of other substances. Manufacture, transport, storage, use and disposal of hazardous materials place the public, property, and environment at risk from their inadvertent or intentional release. Exposure can produce a wide range of adverse health effects. The effects are dependent on the toxicity of the exposure, nature plus extent of exposure to that substance.

2. History

Woodinville has businesses storing and using chemicals that include manufacturing facilities, gas stations with highly flammable petroleum and other by products, one waste water treatment plant (currently under construction) north of the City, sewage pump stations at various locations throughout the city, and petroleum gas pipeline, a natural gas pipeline East of the City, and SR 522 transportation route.

Woodinville is dissected by a major east-west state highway SR 522 and could also be impacted from I-405 incidents. Statistics show that nearly half of all hazardous materials incidents occur during transit. Although there are no known official commodity flow study of the transport of hazardous material in Woodinville, the frequent sighting of hazardous material placards on trucks, suggest a substantial movement into and through the city.

SR 202 also passes through the City carrying traffic in hazardous materials. An accident on either SR 522 or SR 202 routes could release air toxics or inhalation hazards that could then be carried by prevailing winds into the City. Such releases could require evacuation or other protective actions to limit exposure of City residents. Hazardous cargo shipments through the City could increase as shippers seek alternate routes to avoid congestion or as traffic is diverted from SR 522 due to an auto accident.

Two sets of Burlington Northern Santa Fe (BNSF) tracks enter the City from Snohomish County parallel to SR 522, cross the river in the downtown area, and continue south on the west side of the river. According to information provided by the BNSF, one of the lines is closed to traffic. The other carries three freight trains per week carrying feed grain, wallboard and lumber, aircraft components, and sand. No hazardous cargoes are carried on these tracks. Although the BNSF has an excellent safety record, a derailment or other accident could affect the central and western portions of the City. Tracks are inspected on a regular basis by transiting train crews and by track inspectors.

The following Tier II reports from the King County Local Emergency Planning Committee (LEPC) data base of SARA Title III facilities indicates those facilities that have quantities of hazardous materials on-site at or above the Threshold Planning Quantity (TPQ).¹⁹

<i>FACILITY CONTACT INFO</i>	<i>CONTACT POINT</i>	<i>ADDRESS</i>	<i>PHONE</i>	<i>CHEMICALS</i>
Bluelinx Co.	Jeff Gelenaw	12815 NE. 178th, 98012	(425) 402-6484	Diesel, Propane
BP - TOSCO	Sara Quintani	14002 NE 175TH, 98072	487-0404	Diesel, Gasoline
Chateau Ste Michelle	Tom Sommerfeldt	14111 NE 145TH, 98072	(425) 415-3657	Ammonia, Sulfur Dioxide
Chemgrate Corp.	Rich Hasslinger	19240 144TH NE, 98072	483-9797	Styrene
Columbia Winery		14030 NE 145th Street, 98072	(425) 488-2776	Ammonia, Sulfur Dioxide
Consolidated Freight	Mike La Ponte	18707 139TH AVE NE, 98072	(425) 483-3633	Diesel Fuel
Cottage Lake Park Pool	Bob Regan	18831 NE Woodinville-Duvall Rd, 98072	(206) 296-4270	Chlorine
Cuizina Italia, Inc	Ric Ferrera	18744 142nd Ave NE, 98072	(425) 486-7000	Ammonia
Georgia Pacific	Jeff Gelenaw	12815 NE 178TH, 98072	483-0400	Diesel, Propane
Jiffy Lube Store 2596	Jerry Nichols	13444 NE 175th Street, 98072		Motor Oil
Lowell DeYoung Co., Inc.	John Deyoung	13621 NE 175TH, 98072	(425) 483-2504	Sodium Selenite, CAL,
				Lignosulphonate, Copper Sulfate,

¹⁹ TPQ Reporting - The TPQ for Tier II chemicals is: **either** 500 pounds **or** the TPQ listed (**whichever is lower**) for the 356 chemicals listed under Section 302, also known as Extremely Hazardous Substances (EHS); **or** 10,000 pounds for any other chemical. Exception: In 1999, EPA excluded gasoline held at most retail gas stations from EPCRA 311/312 reporting for gasoline and/or diesel, if stored in underground tanks.

<i>FACILITY CONTACT INFO</i>	<i>CONTACT POINT</i>	<i>ADDRESS</i>	<i>PHONE</i>	<i>CHEMICALS</i>
				Pentahydrate, Limestone, Urea,
				Carbamide, Molasses
Lowell DeYoung Co., Inc.	Lowell DeYoung	13608, NE 177th Pl, 98072	(425) 485-8282	LS Diesel#2, Gasoline
NW Boring Co.	Don Gonzales	13248, NE 177TH PL, 98072	(206) 947-3489	Gasoline, Diesel, Propane, Lube Oil
PRC DeSoto International PPG	Shawn Peck	14126 NE 190th St., 98001	(425) 398-2239	Butyl Acetate* Methanol*
Redhook Ale Brewery, Inc.	Naomi Graf	14300 NE 145TH ST., 98072	(425) 483-3232	Sulfuric Acid, Carbon Dioxide,
				Carbonic Anhydride Carbon,
				Heat Transfer Fluid,
				Dioxide, Propylene Glycol, Dowfronst
Spears Oil Co 6190	Paul Spears	13002 NE 177TH PL, 98072	(425) 483-1400	Gasoline, Propane, Kerosene
Super Rent (Sunbelt Rental)	Brent Anderson	19265, HWY 9, 98072	(425) 277-5828	Thinner, Propane, Diesel, Helium, Oil,
				Waste Oil, Lacquer , Acetylene
TEXACO	Robin Lane	18800 Woodinville-Duvall, 98072	889-3253	Gasoline, Diesel
Universal Mfg. CORP.	Greg Jenkins	14410 NE Woodinville Way, 98072	(425) 483-0277	Sulfuric Acid, Nitric Acid, Formaldehyde
Verizon North Valley	Manager on Duty	16029 Woodinville-Red RD, 98072	(888) 696-3973	Sulfuric Acid
Verizon Woodinville RSU 2301 (WA2301)	Dean Christianson	13905 NE 168TH, 98072	(888) 696-3973	Sulfuric Acid
ZIP BP GAS	R Flewelling	15606 NE Woodinville, 98072	483-3696	Gasoline

Table 11 List of organizations with major Hazardous Substances

The listing in the LEPC data base only indicates that these chemicals are kept in excess of the quantities listed. Actual quantities on site may vary. Storage and use of more than 10,000 pounds of ammonia would trigger extensive planning requirements under Section 112r of the Clean Air Act (EPA Risk Management Program). There are other businesses in Woodinville that have hazardous materials below the threshold amounts and, therefore, are not required to make reports. There are, for example, other wineries in the area that may use some quantities of ammonia (for refrigeration) and sulfur dioxide.

The [Toxics Release Inventory Program \(TRI\)](#) does not show any releases for the City of Woodinville or surrounding area. The closest release found was a Bothell facility in 2005. This is a publicly available EPA database that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990.

The greatest immediate hazard in the event of a release is posed by the inhalation hazards of ammonia and sulfur dioxide. These chemicals could spread quite rapidly and extensively if released, depending on wind and other weather conditions, and pose a severe hazard to people. Corrosives, on the other hand, are easily contained if spilled. These chemicals would pose a hazard primarily in the event of a fire at the facility.

Retail quantities of hazardous substances (pesticides, for example) in local stores do not pose a serious threat. However, food borne chemicals such as pesticides contaminating food do have the potential for causing harm. Agricultural workers, groundskeepers, pet groomers, fumigators, and a variety of other occupations are at risk for exposure to pesticides including fungicides, herbicides, insecticides, rodenticides, and sanitizers.²⁰

Date	Location	Damage
2004 or 2005	Cuizina Italia, Inc.	Small ammonia release resulting in several employees being symptomatic.

Table 12 Historical Events – Hazardous Materials/Accident

²⁰ [Center for Disease Control \(CDC\)](#)

3. Hazard Identification and Vulnerability Assessment

An incident involving hazardous materials can occur anytime and any place and could affect the air and water supply. Hazardous materials can be flammable, explosive, poisonous, caustic, acidic, suffocating, carcinogenic, and radioactive or have a combination of these characteristics. Populations downwind from and in the periphery of the released substances from other jurisdictions are particularly vulnerable.

The City of Woodinville would be vulnerable to hazardous materials released in transportation accidents. SR 522 and SR 202 both pass through the City carrying traffic with hazardous materials. An accident on either route could release air toxics or inhalation hazards that could then be carried by prevailing winds into the City. Such releases could require evacuation or other protective actions to limit exposure of City residents. Hazardous cargo shipments through the City could increase as shippers seek alternate routes to avoid congestion or as traffic is diverted from SR 522 due to an auto accident.

The Brightwater waste water treatment plant currently being constructed consists of a wastewater treatment plant at the intersection of State Route 9 and SR-522 north of Woodinville, a 13-mile conveyance pipeline system along SR-522, 195th Street and the King-Snohomish County line, and an outfall in Puget Sound off Point Wells. When it comes online in 2010, Brightwater will be the third regional plant in King County's wastewater treatment system. Brightwater is the first major expansion of the system since the South Plant in Renton and the West Point in Seattle were built in the 1960s. It has the potential of an airborne release of ammonia and chlorine. Truck accidents hauling waste could impact the city and transportation routes. An earthquake could impact the facility including failure of piping of any kind, and structural failure of the treatment ponds releasing contaminated wastewater. Studies conducted by King County, the U.S. Geological Survey, and the City of Woodinville confirm that active and inferred strands of the South Whidbey Island Fault extend across the proposed treatment plant site. A fault in the Puget Sound region is considered active if it has moved within the past 16,000 years. The probability of an earthquake on the treatment plant site during the 50-year design life of the facilities has been rated as extremely remote. See the [Environmental Impact Statement](#) for full details and maps of the region.²¹

The potential impact of chemical accidents depends on the nature of the material, conditions of the release, weather at the time of release and area involved. Releases may be small, easily handled and with negligible impact or catastrophic, with immediate impact and long-term public health, habitability and environmental consequences.

Secondary Impacts from Hazardous Materials/Accident

²¹ King County Environmental Impact Statement, 206-684-6799, Email: brightwater@metrokc.gov, <http://dnr.metrokc.gov/WTD/brightwater/env/seis02.htm>

Secondary environmental hazards may include:

1. Air, water, and soil contamination.

Potential manmade hazards related to hazardous materials/accident include:

1. Industrial and urban fires and explosions.
2. Transportation corridors temporarily shut down.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.
3. Widespread evacuations.

4. Conclusion

The number of industrial facilities with hazardous materials and transport into and through the city via SR 522, suggests a moderate probability of occurrence. A hazardous material release or spill generally impacts a relatively small area, but if that area is a high density urban area or a critical wildlife habitat, the impact could be significant, suggesting high vulnerability. Because of the magnitude of the potential risk posed by industrial facilities close to or within the city limits and the transport of hazardous materials, a high risk rating is assigned.

D. PIPELINE FAILURE

1. Definition

Pipelines are transportation arteries carrying water, sewage, and liquid or gaseous fuels. Pipelines are buried underground or above ground.

2. History

Water Lines: The largest water lines are owned by the Seattle Public Utilities and crisscross Woodinville. The Tolt Pipeline No 1 and 2 run east/west and the Tolt Eastside Supply Line runs south from the Tolt Pipeline No 1.

The Woodinville Water District provides water supply and wastewater services to the City of Woodinville, as well as to several other communities to the south. Fresh water is purchased from the City of Seattle through nine taps on the Tolt Pipeline. Water is stored in and dispensed through eight water tanks and standpipes, ranging in capacity from 1.1 million gallons to 2.8 million gallons. These structures are being upgraded to meet current seismic standards. Although mostly gravity-fed, the water system has four pump stations, each with a backup power source.²² The District also has a well which could supply a limited quantity of potable water.

Sewer Lines: The primary sewer lines are owned by King County traversing the City via the railroad tracks and SR 522 and another line somewhat parallel to the City's southeast boundary. The Brightwater waste water treatment plant currently in the process of being constructed may have vulnerability to earthquakes and washouts impacting their sewage lines.

Fuel Lines: Woodinville has one major fuel pipeline in the city the Olympic Pipeline. This fuel line runs north/south on the westside of the city. Woodinville relies on Puget Sound Energy to supply natural gas to the city.

The BP/Olympic Pipe Line company's pipeline is a 400-mile system carrying gasoline, diesel, and aviation fuel at pressures of 1,400 pounds per square inch. The lines travel from refineries in Whatcom and Skagit counties south to Renton, SeaTac Airport, Tacoma, Olympia, and Portland, Oregon. The high pressure petroleum lines are 16" and 20" and carry approximately 14 million gallons a day. Three Block Valves are within the City limits and are used as main line shut off valves.²³

²² Woodinville Water District

²³ BP/Olympic Pipe Line, Office 425-235-7767, Cell 206-510-5388, Fax 425-271-5320

The BP/Olympic Pipe Line company maintains very strict safety standards and have many safety devices (including the block valves) to insure that the pipelines are as safe as possible. They also inspect the pipelines visually by air once a week and run internal inspections with very sophisticated electronic equipment on a regular schedule.²⁴

Williams Northwest Pipeline has two high pressure natural gas transmission mains that travel through the Woodinville Duvall corridor parallel to 216th Ave NE running north-south. These mains are 36” and 30” with 2 shutoff valves located north of the Woodinville-Duvall Road and Novelty Hill Road. They are marked with standard pipeline markers showing their approximate location underneath the ground. There has not been any unscheduled outages, or any failures in the area.²⁵

Puget Sound Energy natural gas pipeline connects with the Williams Northwest Pipeline off the I-5 corridor and running north-south. It is located east of the City near 212 Ave NE and the NE Woodinville-Duvall Road.

Throughout Western Washington regional pipeline failures have occurred. Major pipelines and those that traverse the City of Woodinville are close enough to impact the City. On February 8, 1997, a natural gas pipeline caught fire and exploded near Everson in remote, wooded, mountainous terrain and former glacier slide area. A 26 – inch pipe carrying natural gas failed because of ground movement of water-saturated soil. On February 9, 1997, another natural gas pipeline caught fire and exploded near Kalama in a remote area. Ground movement caused a natural gas pipeline break at a weld and an explosion resulted. On June 10, 1999, a gasoline pipeline leak caught fire and exploded at Whatcom Falls Park in the City of Bellingham. Two 10-year-old boys burned to death. An 18-year old man was killed after fumes overcame him; he fell in Whatcom Creek and drowned. The ruptured gasoline line spewed 277,000 gallons of gas into the creek bed.

²⁴ BP/Olympic Pipe Line

²⁵ Williams Northwest Pipeline <http://www.williams.com/williamsinwashington/northwest.asp>

Date	Location	Damage
1996-97 Winter Storm	Little Bear Creek	Flooding - scoured out soil around water pipes, and caused breakage.
Late 1980s ²⁶	Tolt Pipeline	Failure near 240 Ave NE and NE 132.
1999	Williams Northwest Pipeline	Accident during maintenance caused major leak resulting in evacuation of immediate neighborhood.

Table 13 Historical Events – Pipeline Failure

3. Hazard Identification and Vulnerability Assessment

Buried and exposed pipelines are vulnerable to breaks and punctures caused by earth movement, material failure, operator error, construction defects, and tampering. Fuel leaks cause hazardous materials spills, fires, and explosions. Most pipelines are buried; however, there are exposed areas. When crossing streams, gullies, and lakes, the lines are either attached to a crossing structure or buried below the flood area.

If a pipeline moves during land movement, it can shear. When the shear moves across abrasive materials or comes in contact with an ignition source, then sparks can cause the fuel to explode or burn. Monitoring markers are used to denote creeping soil movement for potential strain on the pipe.

Water Lines: The water distribution system is looped and inter-connected, allowing breaks to be isolated and bypassed to keep the water flowing. Buried water pipes are somewhat less susceptible to moderate earthquake effects, but large-scale earth movements could fracture the pipe or break joints in multiple locations, making repair difficult and time-consuming. Buried pipes are also vulnerable to displacement or scour caused by flooding, which could then cause stress and breakage to the pipe. This happened during the 96-97 Winter Storm, when Little Bear Creek went over its banks, scoured out soil around water pipes, and caused breakage.²⁷

Perhaps the most vulnerable components of the water system are 45 Pressure Reducing Valve Stations, each station containing 3 Pressure Reducing Valves. If one or more of these valves are damaged by an earthquake, the resulting overpressure in

²⁶ Drinking Water Division - Transmission and Distribution Seattle Public Utilities, 700 5th Ave., Suite 4900, PO Box 34018, Seattle, WA 98124-4018 (206) 684-0589, Fax (206) 684-4133

²⁷ Drinking Water Division - Transmission and Distribution Seattle Public Utilities

the pipes could cause damage to the remaining valves and other parts of the system. Loss of water supply from the Tolt Pipeline would lead to an immediate shutdown of the District system in order to preserve water storage, provide a limited supply of fresh water, and ensure fire flow.²⁸

Sewer Lines: Sewer lines are subject to failure similar to the water pipelines.

Fuel Lines: In 1999 the Williams natural gas pipeline east of Woodinville experienced a major leak due to an accident during maintenance activities. Evacuation of several residences was required, sending people to Woodinville and Duvall. The accident did not result in a fire or explosion.

As of 1998, the BP/Olympic Pipe Line company had 42 spills in 32 years. Many were small, but 17 spills were over 2,000 gallons. The 1999 227,000-gallon gasoline spill in Bellingham killing three people was the largest. In 2001 the Nisqually Earthquake precariously exposed the Olympic Pipeline in Bellevue, which took nearly 3 days to shore up.

Large distribution fuel lines could have an impact on the City of Woodinville as the Olympic pipeline travels north – south through the City on the west side with the potential impacts in the area of 124th Ave and Kingsgate. PSE's natural gas line also runs north south with potential impacts in the area of 212 Ave NE and the NE Woodinville-Duvall Road. Catastrophic failures could impact the city with explosion, seismic ground action, fire, debris, loss of fuel, and environmental impacts to the air and endangered species.

Secondary Impacts from Pipeline Failure

Secondary environmental hazards may include:

1. Possible contamination of air, water and soil.

Potential manmade hazards related to a pipeline failure include:

1. Pipeline fire.
2. Closure of transportation highways.
3. Shortages of water and gas.
4. Failure to eliminate sewage.

Potential systems vulnerabilities include:

²⁸ Drinking Water Division - Transmission and Distribution Seattle Public Utilities

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

History suggests a low probability of occurrence. However, because the potential impact is so great, there is high vulnerability. A moderate risk rating is assigned.

E. SHORTAGE

1. Definition

A severe shortage of essential needs for human sustenance. Shortages can include fuel, water, food, electricity, and natural gas. The focus of this hazard is energy (natural gas and electricity) and water shortages.

2. History

Electricity: The City of Woodinville receives its electricity from Puget Sound Energy and serves over 6,000 electricity customers on the city. Most of the power lines are above ground. These above ground lines are susceptible to high winds and interference from trees and other vegetation.

King County has a history of major power outages, typically caused by large storm events. The three most recent events affecting King County were the December 14, 2006 Winter Storm, the 1993 Inaugural Day Storm and the 1990 Arctic Express. The windstorm of December 14-15, 2006 was the strongest storm to hit western Washington since 1993 with the Puget Sound area exposed to storm force winds for more than 24 hours. Wind gusts were recorded at 69 miles per hour at SeaTac. Some businesses and residents were without power for nine days. The Inaugural Day storm brought sustained winds of 65 mph and gusts up to 80 mph. Both floating bridges were closed, 50 transmission lines were down, 120 sub stations were damaged, and 450 distribution circuits were down or damaged leaving more than 282,000 King County customers without power. The Arctic Express hit first on December 18, 1990 and then again 10 days later reversing most of the restorations work that had been done. Seventy-three thousand (73,000) customers were without power following this event and damages totaled \$17 million.

Utility outages could also be caused by equipment failure or damage, one example being Seattle's Great Blackout of 1988. During this event a construction crew hit an unmarked buried Seattle City Light electric cable. This caused a short circuit which started a fire at a nearby underground utility vault. Over 50 blocks of downtown were without power for four days. The area incurred significant economic losses as many restaurants and retail shops were unable to open for Labor Day weekend. Seattle City Light spent \$730,000 repairing the fire damage.

A seemingly new kind of outage was prevalent during the summer of 1996 when problems with line loading caused major regional power outages along the west coast. Washington State is connected to a western regional electrical transmission grid which has major connections with other grids out-of-region, including British Columbia, Montana, California, and other southwest states. In general, even if Washington is short of electricity, (due to drought, for example), it can be purchased from elsewhere. The result is higher cost electricity, rather than inadequate supply; however blackouts within the western grid can occur.

Natural Gas: Puget Sound Energy’s natural gas services are quite different. Most of their infrastructure is located underground in the form of pipelines. (See the section on Pipeline Failure).

Water: Woodinville’s source of water is from the Tolt Reservoir. Two main water lines run from the east to the west traversing Woodinville. One of the lines supplies a connecting line running south along the 132nd Avenue NE road. Both pipelines feed water storage facilities (or reservoirs, see Water Storage Facility) and are subject to failure by a disaster such as a large earthquake. One line is for emergency use. Woodinville has one well.

Date	Location / Event	Damage
December 14 th 2006	Winter Storm	Power outages for up to 9 days

Table 14 Historical Events – Shortage

3. Hazard Identification and Vulnerability Assessment

Electricity: Seattle City Light and Puget Sound Energy electric power transmission lines (115 KV and 230 KV) transit the City north to south following the same right-of-way traversed by the Olympic Pipeline along the ridgeline west of the river. Transmission lines and towers are quite robust, but if they are damaged the areas along the right-of-way could become dangerous and require evacuation of adjacent structures, and the streets would be unusable until the circuits are rendered safe.

King County is not generally affected by lack of power as most out-of-region power is thermal (from power plants: coal, oil and natural gas based). A shortage of electricity is a minor concern in Western Washington. This is because a substantial amount of electricity is transmitted from Canada to California via Washington and Oregon, therefore providing easy access to external power supplies.

Storms can cause major outages such as the December 14, 2006 Winter Storm, the 1993 Inaugural Day Storm and the 1990 Arctic Express. The windstorm of December 14-15, 2006 was the strongest storm to hit western Washington since 1993 with the Puget Sound area exposed to storm force winds for more than 24 hours. Wind gusts were recorded at 69 miles per hour at SeaTac. Some businesses and residents within the City were without power for nine days. Power outages have secondary impacts, such as a shortage of refrigerated and/or frozen food and other products, with a severe loss of inventory to local grocery stores and other businesses that require refrigeration. Impacted residents also lost all refrigerated and frozen foods due to lack of power.

Growth management is also a constraint which could possibly lead to outages or shortages. Most new development expects access to electricity but does not want to

be in close proximity to sub stations. The political difficulty in sighting these sub stations make it difficult for the utility to keep up with regional growth.

Natural Gas: Submerged natural gas supply pipelines supplied by PSE via the Williams natural gas pipeline traverse Woodinville from the north. The vulnerabilities of the natural gas system are quite different than the electric energy system. Because the natural gas infrastructure is underground, this area is not as susceptible to major gas outages like those associated with electricity. In fact a natural gas outage to households is an extremely rare event.

This area's natural gas system is vulnerable to earthquake damage, third party damage and landslide damage in certain locations. Earthquake damage could include catastrophic systems failure in which ground movement causes a pipeline to sever allowing gas to escape. Puget Sound Energy is less concerned with gas escaping in non-urban settings, where life and property are not threatened. This is because natural gas is lighter than air and will quickly dissipate, minimizing risks. Gas escaping into buildings or heavily populated areas is a bigger concern. The current infrastructure does include control valves for shutting down pipelines in the event of such problems.

Third party damage is the most common natural gas related problem reported by Puget Sound Energy. This damage typically occurs when contractors dig into gas lines. Puget Sound Energy works closely with local fire departments in responding to these incidents. Additionally, PSE is training contractors in system design so that they will be more aware of where pipelines are likely to be.

Individual customer systems are vulnerable to flood damage and earthquake damage. Floods can put pilot lights out which can lead to leaking. Earthquakes can cause water heaters to fall over, causing leaking or fires. Puget Sound Energy is attempting to educate the public with regards to water heater safety, encouraging customers to strap down water heaters and consider the option of earthquake protection valves which stop the flow of gas when the earth shakes.

King County is also vulnerable to energy shortages. Natural gas shortages are rare but tend to occur during cold weather. These shortages are a function of infrastructure and demand. During unusually cold weather events the demand for natural gas can exceed the carrying capacity of Puget Sound Energy's pipeline infrastructure. Puget Sound Energy has cold weather policies in place to minimize the effects of these shortages.

Water: Woodinville has two main water lines traversing east to west with one of which supplies a connecting line going south. Failure of any of these lines would significantly impact the water supply of Woodinville. See Pipeline Failures.

Overall Woodinville is vulnerable to localized, short term energy emergencies brought about by accidents and storms. Most of these emergencies are handled by the affected industry but could last for several days. The effects of energy shortages could include the reduction or stoppage of retail sales, reduced heating and lighting capability, reduced production in all sectors, potential failure of transportation, water

and waste, communication, information, and banking systems. Secondary hazards associated with these events could include traffic accidents as traffic lights are out, limited patient care at local medical clinics and hospitals due to power capacities of back-up generators, injuries due to downed power lines, and fires due to gas leaks.

Secondary Impacts from Shortages

Secondary environmental hazards may include:

1. Water shortage would possibly affect the vegetation.

Potential manmade hazards related to a shortage include:

1. Lack of water, gas or electricity.
2. Shutdown of private and public wastewater treatment.
3. Lack of heat causing potential sheltering needs.
4. Vulnerable populations needing assistance.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

History suggests a high probability of occurrence. Because the potential impact is so great, there is high vulnerability. A high risk rating is assigned.

F. TERRORISM

1. Definition

Domestic or international terrorism is the unlawful use of force or violence against persons or property to intimidate or coerce a government or civilian population, in furtherance of political or social objectives.

2. History

Of the 25 terrorist incidents reported by the Federal Bureau of Investigation (FBI) from January 1990 through December 1997, four occurred in Washington State. Two of these incidents were in Tacoma in July 1993. The American Front Skinheads detonated pipe bombs in Tacoma on July 20 and July 22. The Phineas Priesthood exploded a pipe bomb at the Valley Branch offices of The Spokane-Review newspaper on April 1, 1996, and robbed a branch of the US Bank in Spokane ten minutes later. The Phineas Priesthood repeated this mode of operation three months later when they placed a pipe bomb at a Planned Parenthood office in Spokane on July 12. They then robbed the same branch of the US Bank using an AK-47, a 12-gauge shotgun, a revolver, and a 25-pound propane tank bomb.

In addition to reported terrorist incidents, the FBI and Bellingham police prohibited a group of terrorists affiliated with the Washington State Militia from carrying out their plans in July 1996. The group planned to bomb various targets, including a radio tower, bridge, and a train tunnel, while the train was inside. More recently, the FBI and Seattle police and fire responded to a hoax, bioterrorism incident on September 19, 1999. The incident involved an Internet company that received a letter containing white powder and claiming the powder was anthrax.

More recently, the spectrum of international terrorism surfaced in Washington State in December 1999 when a 33-year-old Algerian man was arrested by U.S. Customs officials while entering the United States in Port Angeles, Washington, aboard a ferry from Victoria, British Columbia. The man was charged with smuggling explosive material into the United States.

During the Year 2000 New Year's Eve celebration at the Space Needle law-enforcement officials investigated the possibility of a terrorist bombing. New Year's Eve celebrations at the Space Needle traditionally draw tens of thousands of revelers.

Eco terrorist have been active in the region, setting arson fires at construction sites and laboratories. These groups include Earth Liberation Front (ELF) and Animal Liberation Front (ALF).

3. Hazard Identification and Vulnerability Assessment

Woodinville could be vulnerable to terrorist activity although highly unlikely due to lack of incidents in small cities within King County. Targets could include religious civic centers, schools, churches and corporate executives. Terrorism can be internationally sponsored or the outgrowth of a frustrated, extremist fringe of polarized and/or minority groups of people. Extremists have a different concept of morality than mainstream society. Terrorists groups include:

- Ethnic, separatists, and political refugees,
- Left wing radical organizations,
- Right wing racists and anti-authority survivalist groups,
- Extremist issue-oriented groups such as animal rights, environmental, religious and anti-abortionists.

Communities that are vulnerable to terrorist incidents generally have high visibility with vulnerable targets. These critical facilities, sites, systems, and special events in a community are usually located near routes with high transportation access. Examples include:

- Government office buildings, court houses, schools, and shopping centers,
- Water supplies, power distribution systems,
- Interstate highways, bridges, pipelines,
- Recreational facilities such as high school stadiums, theaters, parks, concert areas,
- Financial institutions and banks,
- Sites of historical and symbolic significance,
- Scientific research facilities,
- Telecommunications, newspapers, radio stations,
- Business offices,
- Law, fire, emergency medical services and responder facilities, and dispatch centers,
- Special events, parades, religious services, festivals, celebrations, and
- Residential properties.

Critical facilities, sites, and special events become more appealing during visits by high profile personalities and dignitaries. Sporting events such as the Olympic Games and World Cup increase the probability of terrorist targeting. Additionally, international meetings and conventions provide terrorists an excellent environment in which to articulate their cause through violence. Terrorists have introduced two new wrinkles, which are of growing concern: targeting first responders with secondary devices and Weapons of Mass Destruction (WMD) hoaxes.

Terrorists will go to great lengths to ensure an event produces the intended impact, even if it means destroying an entire structure or killing thousands. Commercially available materials agents can be developed into WMD. Science and the Internet have made information relating to WMD technology available to an ever-widening audience,

and terrorists and other would-be criminals are using it for WMD experimentation. Experts generally agree that there are five categories of terrorist incidents: chemical, biological, radiological, nuclear, and explosive (CBRNE).

Chemical agents are compounds with unique chemical properties that can produce lethal or damaging effects in humans, animals, and plants. Chemical agents can exist as solids, liquids, or gases depending on temperature and pressure. Most chemical agents are liquid and can be introduced into unprotected population relatively easily using aerosol generators, explosive devices, breaking containers, or other forms of covert dissemination. Dispersed as an aerosol, chemical agents have their greatest potential for inflicting mass casualties. The City of Woodinville does have businesses, which have hazardous material on their premises; this includes the dry cleaners, hardware stores, photography-developing studios, pest control, grocery stores, freezer and refrigeration units, paint manufacturer, biological lab, and gas stations. The most prominent chemical within or close to the city is ammonia from the wineries, fuel from gas stations and chlorine.

Biological agents pose a serious threat because of their accessible nature and the rapid manner in which they spread. These agents are disseminated by the use of aerosols, contaminated food or water supplies, direct skin contact, or injection. Several biological agents can be adapted for use as weapons by terrorists. These agents include anthrax (sometimes found in sheep and cattle), tularemia (rabbit fever), cholera, the plague (sometimes found in prairie dog colonies), and botulism (found in improperly canned food). A biological incident will most likely be first recognized in the hospital emergency room, medical examiners office, or within the public health community long after the terrorist attack. The consequences of such an attack will present communities with an unprecedented requirement to provide mass protective treatment and decontamination to exposed populations, mass patient care, mass fatality management, and environmental health clean-up procedures and plans.

Radiological weapons are generally felt to be suitable largely for terror, political, and area denial purposes, rather than mass killings. Unlike nuclear weapons, they spread radioactive material contaminating personnel, equipment, facilities, and terrain. The radioactive material acts as a toxic chemical to which exposure eventually proves harmful or fatal.²⁹ In the case of a radiological incident, the onset of symptoms requires days to weeks and there typically will be no characteristic signatures. Radiological materials are not recognizable by the senses, and are colorless and odorless. Specialized equipment is required to determine the size of the effected area and if the level of radioactivity presents an immediate or long-term health hazard. Because of the delayed onset of symptoms in a radiological incident, the affected area may be greater due to the migration of contaminated individuals.³⁰ Of concern is the increasing

²⁹ [Radiological Weapons as Means of Attack by Anthony H. Cordesman](#)

³⁰ [Chemical, Biological and Radiological \(CBRN\) Subcommittee, June 1995](#)

frequency of shipments of radiological materials throughout the world. The city has four animal hospitals, numerous dentist offices and an Orthopedic Clinic which contains x-ray equipment. This equipment has radioactive components.

Nuclear threat is the use, threatened use, or threatened detonation of a nuclear bomb or device. At present, there is no known instance in which any non-governmental entity has been able to obtain or produce a nuclear weapon. The most likely scenario is the detonation of a large conventional explosive that incorporates nuclear material or detonation of an explosive in close proximity to nuclear materials in use, storage, or transit. A concern is “dirty bombs” these devices are explosive in nature surrounded by radiological contaminated materials.

Explosive incidents account for 70 percent of all terrorist attacks worldwide. Bombs are terrorist’s weapon of choice. The Internet and local libraries provide ample information on the design and construction of explosive devices. The FBI reported that 3,163 bombing incidents occurred in the United States in 1994, 77 percent were due to explosives. Residential properties are the bombers’ most common targets. Incendiary devices are also a type of explosive device and are either mechanical, electrical, or chemical used to intentionally initiate combustion and start fires. Their purpose is to set fire to other materials or structures. These devices maybe used singularly or in combination.

Cyber terrorism is a relatively new phenomenon used to potentially disrupt our society and exploit our increasing reliance on computers and telecommunication networks. Cyber terrorism threatens the electronic infrastructure supporting the social, health, and economic well being of Washington’s citizens. Interlinked computer networks regulate the flow of power, water, financial services, medical care, telecommunication networks, and transportation systems. The public and private sectors’ unprecedented dependence on information and communications systems, computers, and networks, demonstrate three realities:

- a. Computer networks (generally called cyber terrorism) are vulnerable to attack from any source, whether it is a foreign intelligence agency or a teenager with a personal computer. The result of a youthful hacker could be as devastating as that of a sophisticated terrorist group seeking to intentionally disrupt our way of life. The ability to distinguish a singular hacker-type incident from a cyber terrorist attack may not be readily evident.
- b. The tools for conducting cyber terrorism are widely available, broadly advertised, and easily used. Entire web sites are devoted to the identification and use of hacking tools. Potential attackers only require access to a computer and a telecommunications network. The “Blaster” worm affected thousands of computer systems nationwide in August 2003.
- c. Only with sophisticated methods and efforts can the source of the attack potentially be identified and tracked. As with any terrorist activity, the use of intelligence to uncover potential threats is the best means to avoid the disruption

and chaos that could result from a cyber attack. Increased network security can significantly help users avoid less sophisticated attacks.

Secondary Impacts from Terrorism

Secondary environmental hazards may include:

1. Possible contamination of air, water and soil.

Potential manmade hazards related to a terrorism event include:

1. Infrastructure failures.
2. Structural failures.
3. Transportation failures.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

History suggests a low probability, but because of the general increase in terrorist activity in Washington State, a moderate probability of occurrence is suggested. Terrorists tend to chose relatively easy targets and activities; their impact could affect a large segment of the community suggesting moderate vulnerability. Accordingly, a moderate risk rating is assigned.

G. TRANSPORTATION

1. Definition

The transportation systems in and through Woodinville include road, rail and air. Use of these systems and supporting transportation vehicles create the opportunity for accidents, emergencies, and disasters. Transportation hazards are natural or human caused.

2. History

Road: The Interstate 405 freeway is a major thoroughfare in close proximity to Woodinville running north south on a daily basis and connects with SR-522 via a major junction. SR-522 runs east west through Woodinville and could be a cause for serious traffic accidents. Accidents involving multiple vehicles and semi-trucks may close freeways and highways and detour traffic thus clogging other roadways, overwhelming local emergency response capabilities.

Date ³¹	Location	Damage
2002	I-405 Junction SR-522	65 accidents
2002	City Streets	209 accidents
2002	SR-522 (within city limits)	80 accidents
2003	I-405 Junction SR-522	60 accidents
2003	City Streets	157 accidents
2003	SR-522 (within city limits)	69 accidents
2004	I-405 Junction SR-522	75 accidents
2004	City Streets	199 accidents
2004	SR-522 (within city limits)	62 accidents
2005	I-405 Junction SR-522	77 accidents

³¹ State of Washington – Department of Transportation Standard Collision Summary Report

2005	City Streets	181 accidents
2005	SR-522 (within city limits)	80 accidents
2006	I-405 Junction SR-522	98 accidents
2006	City Streets	205
2006	All State Routes (within City limits)	75 accidents

Table 15 Historical Events – Road Transportation Accidents

Rail: Woodinville has experienced one rail accident in the past and one deceased person found on the tracks.

Date	Location	Damage
2004	Woodinville	Deceased person found on the railroad tracks.
2006	Woodinville	Freight train derailed.

Table 16 Historical Events – Rail Accidents

Air: Woodinville has experienced one balloon accident in the past. One small plane emergency landed on the sod farm south of NE 145th in August 2007.

Date	Description	Damage
Sept 2006	Woodinville	Balloon failure, turned over to FAA
August 2007	South of NE 145 th , Sod Farm	Small plane emergency landing.

Table 17 Historical Events – Air Transportation Accident

3. Hazard Identification and Vulnerability Assessment

Road: The Interstate 405 corridor parallels Woodinville on the West and SR 522 through the northeast section of the city. Privately owned vehicles and buses provide transportation for individuals using this corridor. Trucks and trailers carry interstate and intrastate cargo. Hazardous materials incidents are created from fuel spills and

dangerous cargo. The Brightwater waste water treatment plant once completed will be transporting waste through the City of Woodinville. Interstate vehicle accidents caused by fog, rain, high speeds, and heavy traffic are possible.

Rail: The Dinner Train has been discontinued as of 2007. This leaves the freight train owned by Burlington Northern. Two sets of Burlington Northern Santa Fe (BNSF) tracks enter the City from Snohomish County parallel to SR 522, cross the river in the downtown area, and continue south on the west side of the river. According to information provided by the BNSF, one of the lines is closed to traffic. The other carried the Dinner Train, as well as three freight trains per week carrying feed grain, wallboard and lumber, and sand. No hazardous cargoes are carried on these tracks. Although the BNSF has an excellent safety record, a derailment or other accident could affect the central and western portions of the City. Tracks are inspected on a regular basis by transiting train crews and by track inspectors.

Air: There are no airports close to the vicinity of the City of Woodinville although one small plane emergency landed on the grounds of the Sod Farm south of NE 145th. Hot air balloons are a tourist attraction and used frequently. There has been one accident on record since hot air balloons have been used in the vicinity.

Secondary Impacts from Transportation Incidents

Secondary environmental hazards may include:

1. Air, water, and soil contamination.

Potential manmade hazards related to a transportation incident include:

1. Transportation detours from accidents.
2. Highway and overpass damage.
3. Multiple vehicle accidents resulting in mass causality incidents
4. Rail blockages with possible transportation routes impacted.

Potential systems vulnerabilities include:

1. Business interruption and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

History suggests a high probability of occurrence. Because the potential impact is great where major transportation corridors are concerned, there is high vulnerability. A high risk rating is assigned.

H. URBAN FIRE

1. Definition

Woodinville experiences two types of fire threats: structure fires and urban interface fires.

Structure Fires: Typically are not city wide emergencies except when the fire can potentially spread to adjoining structures.

Urban Interface Fires: Occur where “combustible vegetation meets combustible structures” and therefore combine the hazards associated with both forest/parks and structure fires. Most fire fighters are trained to fight either wildfires or structure fires. Interface fires require both skills.³²

2. History

In Washington State, thirty-eight percent (38%) of identified structure fires occur where people live and seventy-five percent (75%) of all fire deaths occur in homes. People are more at risk from a fire in their residence. The leading causes of residential fires in Washington State are from heat from improperly operating electrical equipment, matches or lighters, electrical short-circuit or arc, and heat from wood/paper fueled equipment.

Heat from improperly operating electrical equipment includes electric stoves, electric heaters, and other electrical appliances. Cooking is a leading cause of residential fires and home heating is the second leading cause, as reported to the United States Fire Administration³³ through the National Incident Reporting System.³⁴ In Washington State, more than 24 percent of residential fires start in the kitchen cooking area. Fires caused by home heating are usually caused by portable space heaters. In Washington State, fires from wood or paper fueled equipment are also significant. The chimney is the third leading area of fire origin.

Of the homes where fire deaths occurred, seventy-five percent (75%) had smoke detectors. However, only ten percent (10%) were known to be working. Despite the presence of working smoke detectors, ten fatalities occurred because elderly, disabled, mentally handicapped, and alcohol-impaired citizens were unable to escape fires in their homes.

³² United States Fire Administration

³³ <http://www.usfa.fema.gov/>

³⁴ <http://www.usfa.fema.gov/nfdc/nfirs.htm>

Greenbelts hold a potential for wildfire with industrial fire the largest threat, although the vast majority of the light industrial and industrial have sprinklers. The local lumber yard has a potential for a devastating fire.

Date	Location	Damage
2004	Woodinville Fire and Life Safety District	172 total fires this includes structural, wildland, vehicle and other. Approximately 60% are within the city limits amounting to a total loss of \$350,835.
2005	Woodinville Fire and Life Safety District	153 total fires this includes structural, wildland, vehicle and other. Approximately 60% are within the city limits amounting to a total loss of \$968,382.
2006	Woodinville Fire and Life Safety District	187 total fires this includes structural, wildland, vehicle and other. Approximately 60% are within the city limits amounting to a total loss of \$643,835.

Table 18 Historical Events – Urban Fire Woodinville

Arson is a violent crime against people and property. Arson, when combined with suspected arson, was the leading cause of fire deaths in Washington State in 1998. Arson and suspected arson killed one of every eight people who died in a structure fire during that year. There were a total of 1,113 arson fires in Washington State in 1998. To date Woodinville has a record of approximately 26 suspicious or arson fires from January of 2004 to July of 2007.

Date	Location	Damage
2004-2006	Woodinville Fire and Life Safety District	Approximately 6 per year. Included in Table 18 Urban Fire.

Table 19 Historical Events – Arson Woodinville

In Washington State, seven percent (7%) of all fires involve vehicles, an increasingly large share of total fires. Fires occurring in the engine, running gear, and passenger

areas account for seventy-seven percent (77%) of vehicle fires. Vehicle fires start in engine compartments, brake systems and by driver or passenger smoking.

3. Hazard Identification and Vulnerability Assessment

Homes, commercial buildings, public buildings and other structures tucked in amongst trees and brush are at a greater risk for urban interface fire. Landscaping in Woodinville often encourages the planting and growth of combustible vegetation immediately surrounding the structure. Disruption to business, economic and resident's daily activities is a systemic vulnerability. If the city's residents needed to evacuate, traffic congestion and access in and out of Woodinville could be very significantly compromised, creating greater risk to human life.

Secondary Impacts from Urban Fire

Secondary environmental hazards may include:

1. Contamination of the air.
2. Possible destruction of the local habitat including parks and trails.
3. Land and soil erosion due to loss of foliage.
4. Landslides and mudslides due to loss of foliage.

Potential manmade hazards related to an urban fire include:

1. Possible destruction of buildings and homes.

Potential systems vulnerabilities include:

1. Business interruption or loss, and resulting losses in sales, wages, and profits.
2. Impacts to local economy if economic processes break down.

4. Conclusion

Historically, Woodinville urban fires occur every year, suggesting a high probability of occurrence. Because of the relative land area and population affected, the city is exposed to moderate vulnerability. Although the vulnerability is moderate, the frequency of fires, the potential for simultaneous events, plus the historical record of fires and cumulative costs, all suggest the assignment of a high risk rating.

III. Local Hazards

A. ENVIRONMENTAL–SALMON

1. Definition

Threatened Species: Salmon. Pacific salmon belong to a group called anadromous fish that includes Atlantic salmon, sturgeon, lampreys, shad, herring, sea- run cutthroat trout, and steelhead trout.

2. History

Woodinville is home to four creeks which are salmon migration runs. Pacific salmon encounter increasing human-caused hazards in their migrations to and from spawning grounds. All salmonids require pure, well-oxygenated cold water and are one of the first species to suffer when water quality is degraded. Many salmon stocks are seriously threatened by what are called the "four H's": Habitat destruction, Hydroelectric dams on migratory rivers, over-Harvest of rare stocks, and competition with Hatchery fish. Some stocks are so severely reduced that they have been listed as endangered or threatened species under the Endangered Species Act. Endangered means they are likely to become extinct. Threatened means they are likely to become endangered in the near future.

3. Hazard Identification and Vulnerability Assessment

The winter-run chinook salmon was classified as threatened in 1999 with King County responding to the listing of chinook salmon under the Endangered Species Act (ESA) with a conservation plan aimed at saving the salmon and ensuring continued success of the area's vibrant economy.³⁵

Secondary Impacts from the Environment

Secondary environmental hazards may include:

1. Loss of habitat and population of native salmon.

Potential manmade hazards related to the environment include:

1. Manmade pollution, structures and infrastructure impacting creeks and streams.
2. Over fishing.

³⁵ King County News Release: <http://www.metrokc.gov/exec/news/1999/031699.htm>

Potential systems vulnerabilities include:

1. Economic impacts to the fishing industry.

4. Conclusion

History suggests a low probability of occurrence of salmon destruction due to regulatory action. However, because the potential impact is possible due to increasing manmade pollution and infrastructure there is moderate vulnerability. A low risk rating is assigned.

IV. Hazard and Impact Matrix

PURPOSE

This Matrix is a tool to link hazards that may affect jurisdictions, agencies, and business and possible related adverse impacts to life, property, and the environment. Across the top are the major hazards present in Woodinville. The left column is an alphabetical listing of adverse impacts that may affect jurisdictions, agencies, and business. With proper planning and action, communities can mitigate against, prepare for, respond to, and recover from adverse impacts of hazards.

USE

The Impact Matrix is a subjective estimate of the possible adverse effects on the community by a hazard based on historical experience. Marking the intersection of the hazard and the impact(s) with an “x” identifies these effects.

Table 20 Hazard and Impact Matrix

Hazard and Impact Matrix	Drought	Earthquake	Epidemic	Flood	Heat Wave	Landslide	Severe Storm	Volcano	Civil disturbance	Hazardous Materials/Accident	Pipeline Failure	Urban Fire	Water Storage Facilities	Shortage	Transportation	Terrorism	Environmental
Acid Rain								X									X
Ash Cloud								X									
Communication loss		X		X		X	X	X	X	X		X		X		X	
Contamination-air		X				X	X	X		X	X	X				X	X
Contamination-ground		X		X		X	X	X		X	X	X	X		X	X	
Contamination-water	X	X	X	X		X	X	X		X	X	X	X	X		X	X
Evacuation		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
Fire-urban	X	X			X		X	X	X	X	X	X			X	X	X
Flood-urban		X		X		X	X	X			X		X				
Fuel		X		X		X	X	X	X	X	X	X	X	X	X	X	
Hostage									X							X	
Failure-bridges		X		X		X	X	X	X	X	X	X			X	X	
Failure-buildings		X		X		X	X	X	X	X	X	X			X	X	
Failure-road		X		X		X	X	X	X	X	X	X			X	X	
Landslide		X		X		X	X	X			X	X	X				
Medical emergency	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Mud/rock flow		X		X		X	X	X			X	X	X				
Riot/looting									X							X	
Sabotage									X	X	X	X			X	X	
Strikes									X								
Transportation-air							X	X		X					X	X	
Transportation-marine		X		X			X	X	X	X	X	X	X	X	X	X	
Transportation-road		X		X		X	X	X	X	X	X	X			X	X	
Utilities-electric	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Utilities-natural gas		X		X		X	X	X	X	X	X	X	X	X	X	X	
Utilities-sewer		X		X		X	X	X		X	X	X			X	X	
Utilities-telephone	X	X		X	X	X	X	X	X	X	X	X	X			X	
Utilities-water	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	

V. Hazard and Emergency Support Function Matrix Instructions

PURPOSE

This Matrix is a tool to link hazards that may affect jurisdictions, agencies, and business and the related Emergency Support Functions (ESF). ESFs provide a functional approach to assistance and operational support necessary to mitigate against, prepare for, respond to, and recover from hazards that endanger life, property, and the environment. Across the top are the major hazards that may occur in Woodinville. The left column is a listing of ESFs based on the National Response Plan.

USE

The ESF Matrix is a subjective estimate of what assistance and operational support is necessary to deal with a historical hazard. Marking the intersection of the hazard and ESF(s) with an “x” identifies areas that may require assistance or operational support.

Table 21 Hazard and Emergency Support Function Matrix

Hazard and Emergency Support Function (ESF) Matrix	Drought	Earthquake	Epidemic	Volcano	Flood	Heat Wave	Landslide	Severe Storm	Civil disturbance	Hazardous Materials/Accident	Pipeline Failure	Shortage	Terrorism	Transportation	Urban Fire	Water Storage Facilities	Environmental
1 – Transportation		X		X	X		X	X	X	X	X		X	X	X	X	
2 – Communication, Information Systems & Warning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3 – Public Works & Engineering		X		X	X		X	X	X	X	X		X	X	X	X	X
4 – Firefighting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5 – Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6 – Mass Care, Housing & Human Services		X	X	X		X	X	X	X	X			X		X		
7 – Resource Support	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8 – Public Health, Medical Services	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9 – Search & Rescue		X		X			X	X	X				X		X	X	
10 – Hazardous Materials Response		X		X	X		X		X	X	X		X	X	X		
11 – Agriculture and Natural Resources	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12 – Energy	X	X		X	X	X	X	X	X	X	X	X	X		X	X	
13 – Public Safety, Law Enforcement, & Security	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14 – Long Term Recovery																	
15 – Public Affairs																	
20 – Defense Support to Civil Authorities (DSCA)		X	X	X			X	X	X	X			X			X	
Terrorism Annex			X						X	X	X		X		X	X	

VII. Definitions

ACCESS CONTROL POINTS – Road intersections or other logistically viable points on the relocation and food control boundaries which enable law enforcement and other emergency workers to maintain access control of the respective area(s). It involves the deployment of vehicles, barricades, or other measures to deny access to a particular area.

CHEMICAL AGENT (LETHAL) – A chemical substance that is intended for use in military operations to kill, seriously injure, or incapacitate a person through its physiological effects. Excluded from consideration are riot control agents, chemical herbicides, smoke, and flame.

CHEMICAL HAZARD – The release of toxic agents into the atmosphere that can harm population, animals, and food supplies.

CIVIL DISTURBANCE – Any incident that disrupts a community where intervention is required to maintain public safety.

DAM FAILURE – The uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property.

DISASTER – An event expected or unexpected, in which a community's available, pertinent resources are expended; or the need for resources exceeds availability; and in which a community undergoes severe danger; incurring losses so that the social or economic structure of the community is disrupted; and the fulfillment of some or all of the community's essential functions are prevented.

DROUGHT – A condition of climatic dryness that is severe enough to reduce soil moisture and water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems.

EARTHQUAKE – The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth, called a fault.

EMERGENCY – An event, expected or unexpected, involving shortages of time and resources; that places life, property, or the environment, in danger; that requires response beyond routine incident response resources.

EMERGENCY MANAGEMENT or COMPREHENSIVE EMERGENCY MANAGEMENT – The preparation for and the carrying out of all emergency functions, other than functions for which the military forces are primarily responsible, to mitigate, prepare for, respond to, and recover from emergencies and disasters, and to aid victims suffering from injury or damage, resulting from disasters caused by all hazards, whether natural

or technological, and to provide support for search and rescue operations for persons and property in distress.

EMERGENCY OPERATIONS CENTER (EOC) – A designated site from which government officials can coordinate emergency operations in support of on-scene responders.

FAULT – An abrupt shift of rock along a fracture in the earth.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) – Agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery. Federal Emergency Management Agency manages the President’s Disaster Relief Fund and coordinates the disaster assistance activities of all federal agencies in the event of a Presidential Disaster Declaration.

FLOOD – An inundation of dry land with water. Types of floods in Washington State are primarily river, surface water, flash, and tidal.

FOREST FIRE (Wildfire) – The uncontrolled destruction of forested lands by wildfires caused by natural or human-made events. Wildfires occur primarily in undeveloped areas characterized by forest lands.

HAZARDOUS MATERIALS – Materials, which, because of their chemical, physical, or biological nature, pose a potential risk to life, health, or property when released.

INGESTION EXPOSURE PATHWAY – When human beings are exposed to radioactive or hazardous materials from a facility through consumption of water and food stuffs, including dairy products. Emergency planning and protective actions are designed in part, to eliminate or reduce to the minimum exposures due to ingestion of contaminated materials in the area surrounding a facility.

LAHAR – Hot rock and gas melts snow and ice, creating surges of water that eroded and mixed with loose rock and debris, also known as a mudflow.

LANDSLIDE – Landslide is the sliding movement of masses of loosened rock and soil down a hillside or slope.

LAVA – Molten rock that flows onto the earth’s surface.

MAGMA – Molten material beneath or within the earth’s crust from which igneous rock is formed.

MAJOR DISASTER – As defined in federal law, is any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other technological or human caused catastrophe in any part of the United States which, in the determination

of the President, causes damage of sufficient severity and magnitude to warrant major disaster assistance... in alleviating the damage, loss, hardship, or suffering caused thereby.

MITIGATION – Actions taken to eliminate or reduce the degree of long-term risk to human life, property, and the environment from natural and technological hazards. Mitigation assumes our communities are exposed to risks whether or not an emergency occurs. Mitigation measures include, but are not limited to, building codes, disaster insurance, hazard information systems, land use management, hazard analysis, land acquisition, monitoring and inspection, public education, research, relocation, risk mapping, safety codes, statues and ordinances, tax incentives and disincentives, equipment or computer tie downs, and stocking emergency supplies.

PIPELINES – Transportation arteries carrying liquid and gaseous fuels.

PREPAREDNESS – Actions taken in advance of an emergency to develop operational capabilities and facilitate an effective response in the event an emergency occurs. Preparedness measures include, but are not limited to, continuity of government, emergency alert systems, emergency communications, emergency operations centers, emergency operations plans, emergency public information materials, exercise of plans, mutual aid agreements, resource management, training response personnel, and warning systems.

PRESIDENTIAL DECLARATION – Formal declaration by the President that an Emergency or Major Disaster exists based upon the request for such a declaration by the Governor and with the verification of Federal Emergency Management Agency preliminary damage assessments.

PYROCLASTIC FLOW – Hot avalanches of lava fragments and gas formed by the collapse of thick lava flows and eruption columns.

RADIOLOGICAL HAZARD – The uncontrolled release of radioactive material that can harm people or damage the environment.

RECOVERY

a. Activity to return vital life support systems to minimum operating standards and long-term activity designed to return life to normal or improved levels, including some form of economic viability. Recovery measures include, but are not limited to, crisis counseling, damage assessment, debris clearance, decontamination, disaster application centers, disaster insurance payments, disaster loans and grants, disaster unemployment assistance, public information, reassessment of emergency plans, reconstruction, temporary housing, and full-scale business resumption.

b. The extrication, packaging, and transport of the body of a person killed in a search and rescue incident.

RESPONSE – Actions taken immediately before, during, or directly after an emergency occurs, to save lives, minimize damage to property and the environment, and enhance the effectiveness of recovery. Response measures include, but are not limited to, emergency plan activation, emergency alert system activation, emergency instructions to the public, emergency medical assistance, staffing the emergency operations center, public official alerting, reception and care, shelter and evacuation, search and rescue, resource mobilization, and warning systems activation.

SEVERE STORM – An atmospheric disturbance manifested in strong winds, tornadoes, rain, snow, or other precipitation, and often accompanied by thunder or lightning.

SUBDUCTION ZONE – A convergent boundary between an oceanic plate and a continental plate.

TEPHRA – Clastic volcanic material.

TERRORISM – The unlawful use of force or violence against persons or property to intimidate or coerce a government or civilian population, in furtherance of political or social objectives.

TORNADO – A localized violently destructive windstorm occurring over land and characterized by a long funnel-shaped cloud that extends to the ground.

URBAN FIRE – Urban fire occurs primarily in cities or towns with the potential to rapidly spread to adjoining structures.

VOLCANO – A vent in the earth's crust through which molten rock, rock fragments, gases, and ashes are ejected from the earth's interior.

WILDLAND FIRE – Uncontrolled destruction of forests, brush, field crops and grasslands caused by nature or humans.

VIII. Appendix Acronyms

CEMP – Comprehensive Emergency Management Plan

EMD – Washington Military Department, Emergency Management Division

EOC – Emergency Operations Center

FBI – Federal Bureau of Investigation

FEMA – Federal Emergency Management Agency

HIVA – Hazard Identification and Vulnerability Assessment

LEPC – Local Emergency Planning Committee

IX. Resources

Canadian Wildlife Service

Centers for Disease Control (CDC)

City of Woodinville

City of Redmond HIVA

City of Seattle HIVA

Crew.org

Environmental Protection Agency (EPA)

Federal Emergency Management Agency

King County, Brightwater Environmental Impact Statement

King County Emergency Management

King County HIVA

King County Public Health

King County Regional Public Information Network

King County, LEPC Report for City of Woodinville

National Center for Missing and Exploited Children

National Weather Service

Puget Sound Energy

The Washington Post

Thurston County HIVA

United States Army Corps of Engineers

United States Department of Agriculture

United States Department of Justice

United States Forest Service

United States Geological Survey, David A. Johnston Cascade Volcano Observatory

University of Washington, Geophysics Program

USGS

USGS Cascades Volcano Observatory

Washington State Emergency Management Division

Washington State Department of Fish and Wildlife

Washington State Department of Natural Resources, Geology & Earth Resources
Division

Washington State Department of Transportation

Washington State HIVA

Washington State – Urban Fire