

## Analysis of Local Hazard Vulnerability

An important element in determining the vulnerability of the state to various natural hazards is to examine how local jurisdictions assess and categorize their vulnerability to them. It also is a requirement of federal hazard mitigation planning regulations:

“The (State plan’s) risk assessment shall include ... an overview and analysis of the State’s vulnerability to the hazards ... based on estimates provided in the local risk assessments as well as the State risk assessment.” [CFR 201.4.c.2.ii]

Such an examination is important to updating the 2004 state plan because its risk assessment did not include information from local plans. This was due to the limited number of local plans approved at the time the state plan was being finalized (eight local plans approved as of December 31, 2003). The 2004 state plan noted that information from local plans that supplements and improves the accuracy and depth of the state plan’s hazard profiles and risk assessment would be added to the plan during its first revision (*2004 Washington State Enhanced Hazard Mitigation Plan, Risk Assessment, Tab 5*).

Reviewed for this analysis were the 55 local hazard mitigation plans available to the State Emergency Management Division (EMD)’s Mitigation and Recovery Section as of December 2005. A list of the plans and their categorization of vulnerability to hazards is in Table 3, pages 17-24 of this document. Each of the plans’ risk assessments were reviewed for specific local information that would improve the state plan’s assessment of vulnerability as well as determination of which jurisdictions were at greatest risk from the nine natural hazards addressed in the plan (see *State Plan Vulnerability Assessment*, below).

The following observations come from the review of the local plans:

- Much of the information contained in the local risk assessments that describe hazards and vulnerability mirrors that which appears in the state plan, though in much less detail.
- Many local plans used and attributed information from the state plan’s risk assessment, or used information from the same sources.
- Local plans in general did not appear to take advantage of information available from local planning departments regarding locations of frequently flooded areas and geologically hazardous areas. These are two of the six critical areas identified by state law that all cities, towns, and counties must develop land-use regulations to protect and limit development within.

As a result, this analysis focuses on how local jurisdictions categorized or rated their vulnerability to various natural hazards vis-à-vis the state plan, typically through a three-tier rating scale (see below).

Among the reviewed plans are 25 county plans, all but one of which is a multi-jurisdiction plan, and 27 plans from cities, school and utility districts, and other local taxing districts. The Tulalip Tribe’s local plan and the Lummi Tribe’s standard state plan also were part of this analysis, as was the Washington Department of Correction’s local

## Analysis of Local Hazard Vulnerability

plan. A handful of plans are review or pre-adoption drafts; notes following Table 3 provide those details. Collectively, these plans represent more than 495 local jurisdictions, covering about three-quarters of the state's population.

This analysis of local hazard vulnerability vis-à-vis findings of the state plan is limited to the natural hazards listed by more than two-thirds of the 55 local plans. These hazards are earthquake, flood, severe storms, landslide, volcano, and wildfire. This analysis also briefly examines what other hazards were addressed by the local plans; while federal regulations only require local plans to determine their vulnerability to natural hazards, at least a third also addressed man-made and technological hazards such as hazardous materials spills and terrorism.

The narrative below primarily highlights differences between the state plan and the 25 county plans, which represent about 80 percent of the local planning jurisdictions and the bulk of the covered population. Inclusion of other local plans in the analysis is as noted.

### State Plan Vulnerability Assessment

The state plan used a variety of criteria, varying by hazard, to determine which counties are most vulnerable to each of nine natural hazards addressed in the plan. These hazards are avalanche, drought, earthquake, flood, landslide, severe storm, tsunami, volcano, and wildland fire. Panels of hazard experts from state and federal government agencies and from academia reviewed and approved the vulnerability criteria used in the state plan. The criteria used to determine most vulnerable counties are in the individual hazard profiles found in the plan's Risk Assessment, Tab 5.

A determination of most vulnerable to a specific hazard only means that a group of counties is at greater risk to a particular hazard than the other counties according to the state plan criteria. For example, the criteria determined that 12 counties are most vulnerable to flooding. That is not to say that the remaining 27 counties are not vulnerable to the flood hazard – each of the state's 39 counties have received at least one Presidential Disaster Declaration for flooding since 1956 – but the state plan's criteria considered their vulnerability to be less significant.

### Local Plan Hazard Vulnerability Assessment

Local plans use a variety of methodology to categorize or rate their vulnerability to hazards. Most rated hazards through a three-tier, *high – medium or moderate – low* vulnerability system. Some methodologies were simple, using only probability of future occurrence, sometimes in combination with projected loss estimates, while others used a wide variety of social and economic factors along with probability of future occurrence. A few jurisdictions rated hazards using a numerical priority scale.

The hazards of greatest concern to local jurisdictions that developed hazard mitigation plans are (in order of concern): earthquake, flood, and severe storms. Earthquake is a concern because of the significant amount of damage it can cause. Severe storms and

## **Analysis of Local Hazard Vulnerability**

flooding are concerns because of their frequency of occurrence and propensity to cause damage; when plans determined vulnerability to one or more severe storm type, high wind storms and winter storms were listed most frequently.

Hazards of medium or moderate concern are wildfire/urban fire and landslides/earth movement.

Hazards of lesser concern are tsunami and volcanic eruption, primarily because their probability of occurrence is very low.

Overall, the combined vulnerability rankings of the 55 local plans is similar to the ratings made in the state's plan, which determined earthquake, flood, severe storm, and wildland fire to be the natural hazards of greatest concern. The state plan used a methodology borrowed from the British Columbia Provincial Emergency Preparedness office to rate Washington's vulnerability to nine natural hazards. This methodology considers a variety of factors including deaths and injuries, property damage, and impacts to the environment, economic and social fabric of affected communities, and the likelihood of occurrence.

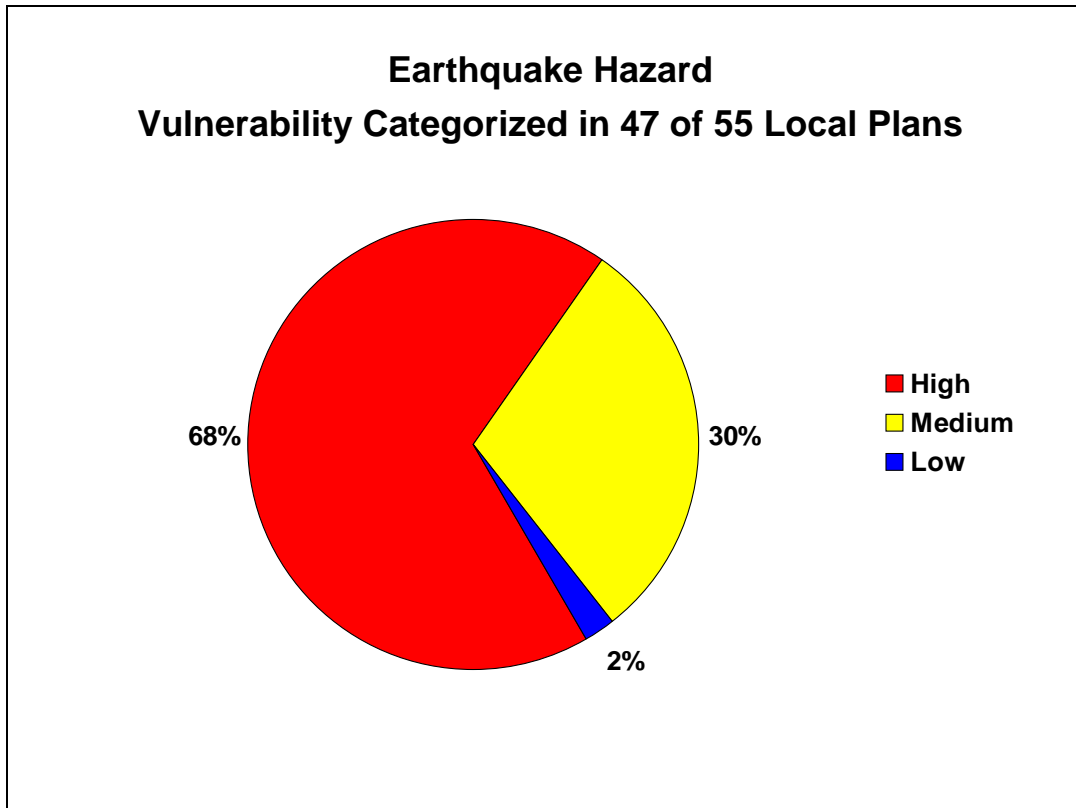
How local plans categorized vulnerability to various hazards is on Tables 1 and 2, pages 15-16 of this document.

## Analysis of Local Hazard Vulnerability

### Hazard-Specific Analysis

#### Earthquake:

Forty-seven of the 55 local plans listed earthquake as a hazard that would affect the local jurisdictions, with two-thirds rating their vulnerability as high. The state plan lists 24 counties as being most vulnerable to the earthquake hazard, based on projected annualized losses and a number of socio-economic factors.



The state plan's categorization of most vulnerable jurisdictions corresponds well with how local jurisdictions view their vulnerability to the earthquake hazard. The only apparent differences were with Pierce County jurisdictions – unincorporated Pierce County, Puyallup, Sumner – Bonney Lake Area, and Fire District #14. They categorized their vulnerability to the earthquake hazard as "medium," using a methodology from the Mitigation 20/20 software program in which a numerical score is developed after considering a number of socio-economic factors and probability of recurrence. The numerical scores developed by each of the planning teams did not reach the threshold for a high vulnerability rating for the earthquake hazard for any of the jurisdictions' plans.

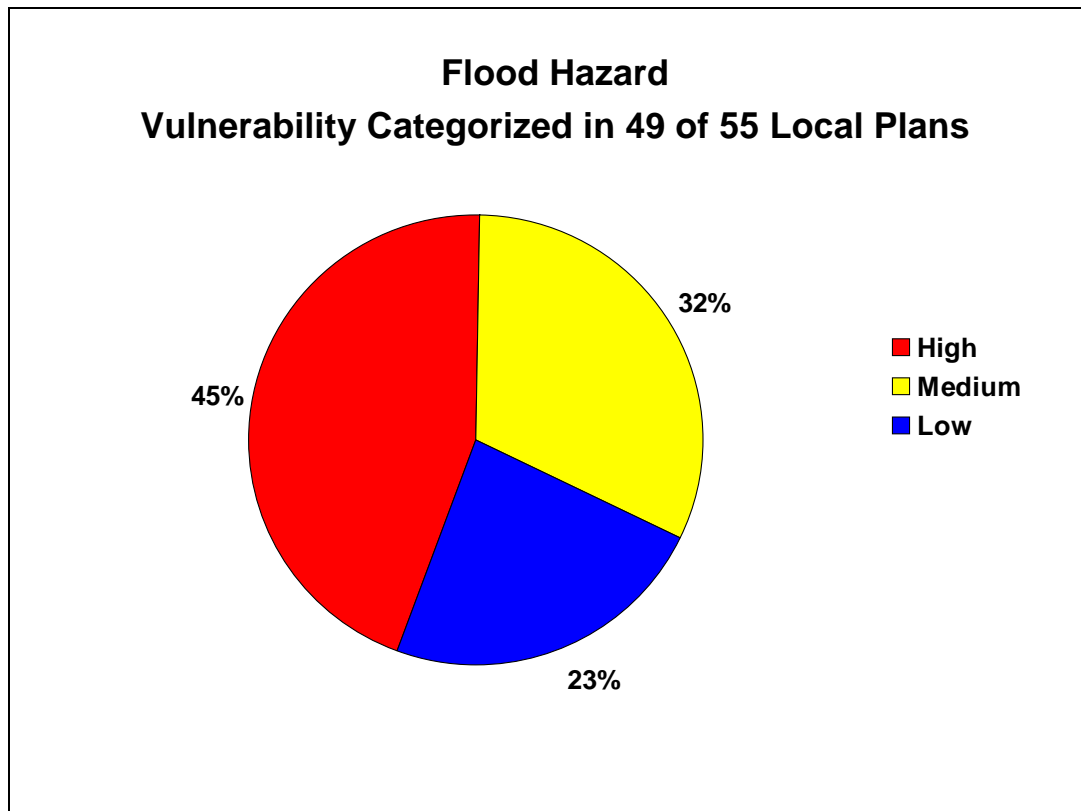
The narratives in each of the plans discuss the reasoning which went into the vulnerability ratings. These narratives list risk factors such as probability of recurrence, proximity to faults and areas of seismicity, presence of soft soils and areas at high risk to liquefaction, and age and type of buildings. For example, the Puyallup plan mentions

## Analysis of Local Hazard Vulnerability

the significant number of old buildings that are unreinforced in a valley area subject to liquefaction.

Flood:

Forty-nine of the 55 local plans listed flood as a hazard that would affect their local jurisdictions, with just under half rating their vulnerability to this hazard as high. The state plan lists 12 counties as being most vulnerable to the flood hazard, based on a scoring system that considered frequency of major flooding resulting in a disaster declaration since 1956, size of the floodplain in the county, and measures of the built environment in the floodplain.



The plans of seven counties not considered as most vulnerable to flooding by the state plan – Benton, Chelan, Clallam, Douglas, Ferry, Kitsap, and Yakima – consider their vulnerability to be high, primarily based on likelihood of future occurrence. For example:

- Benton County based its high rating on the likelihood of a flood occurring within the five-year life of its plan; the state plan shows that floods causing major damage occur there about every six years, based on previous flood events.
- Kitsap County used a 25-year threshold; the state plan shows major, damaging flooding occurring every seven years there. The state plan's scoring methodology gave the greatest number of points for major flooding that occurs every three years or less, on average.

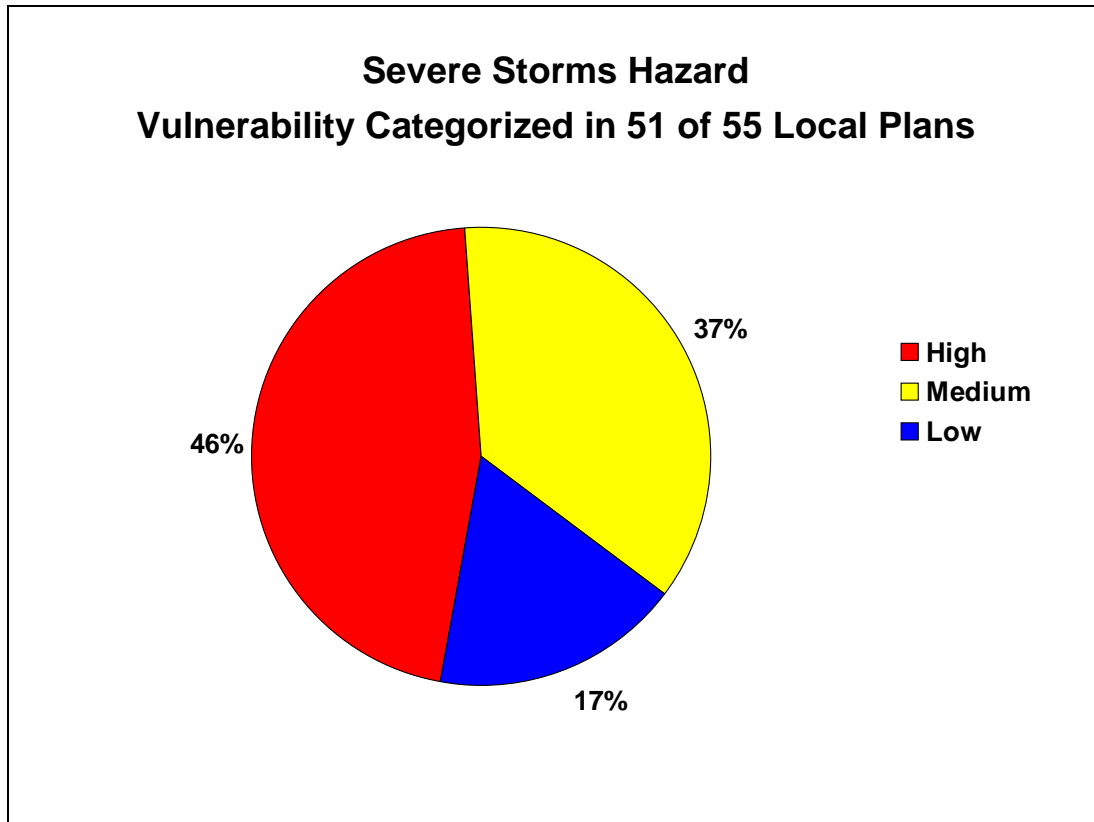
## Analysis of Local Hazard Vulnerability

- Yakima County used a methodology based on a variety of factors including historical occurrence, probability of future occurrence, and impacts to people, property and business.

Most of these plans also addressed flooding occurring on specific local rivers and streams.

Severe Storm:

Fifty-one of the 55 local plans listed severe storms as a hazard that would affect their local jurisdictions, with 60 percent rating their vulnerability as high. Seventeen plans categorized various severe storm types, with high winds and winter storm (or snow) listed most frequently (this analysis is limited to these storm types).

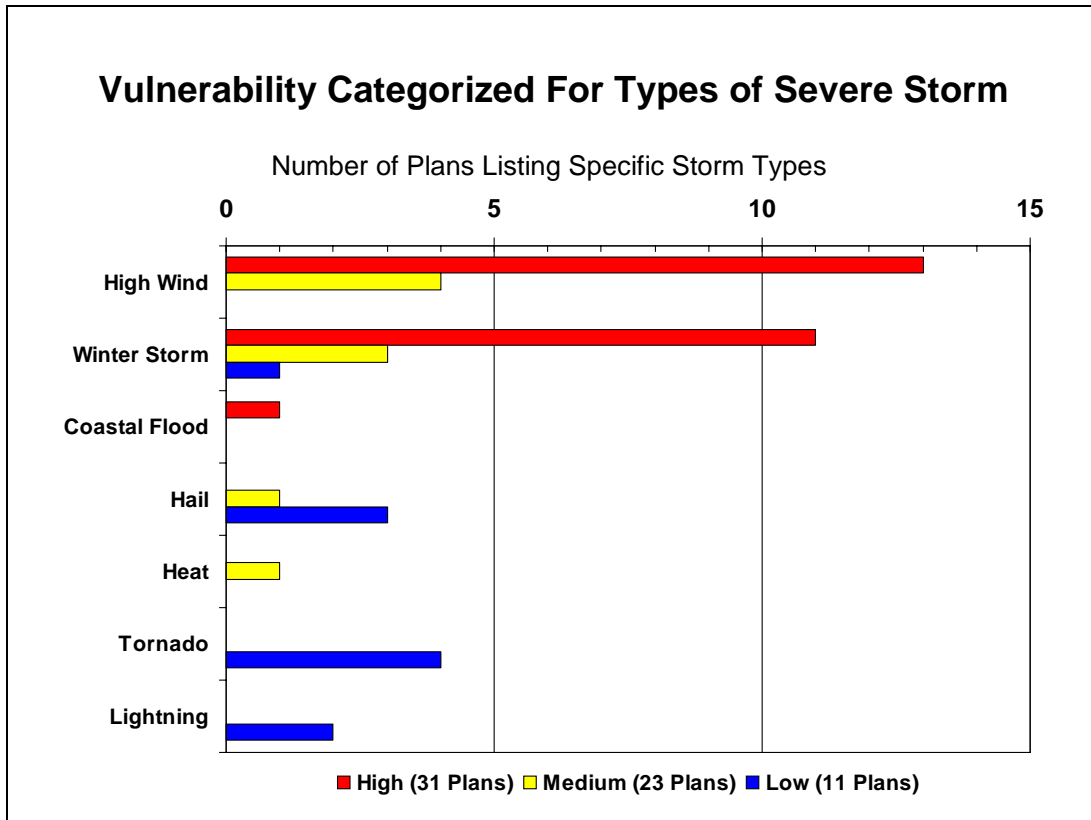


The state plan lists 22 counties as being most vulnerable to high winds based on their vulnerability to specific meteorological conditions and experiencing a damaging high wind event at least once every year, on average. The state plan lists 18 counties as being most vulnerable to winter storms based on their vulnerability to specific meteorological conditions and experiencing a damaging winter storm event at least once every two years, on average.

Of the 25 county plans reviewed, nearly all listed severe storm, or high winds or winter storm, as hazard(s) to which their jurisdictions were at high, medium or moderate

## Analysis of Local Hazard Vulnerability

vulnerability. Only five county plans differed substantially from the state plan in terms of categorizing vulnerability to severe storms, or high winds or winter storms.

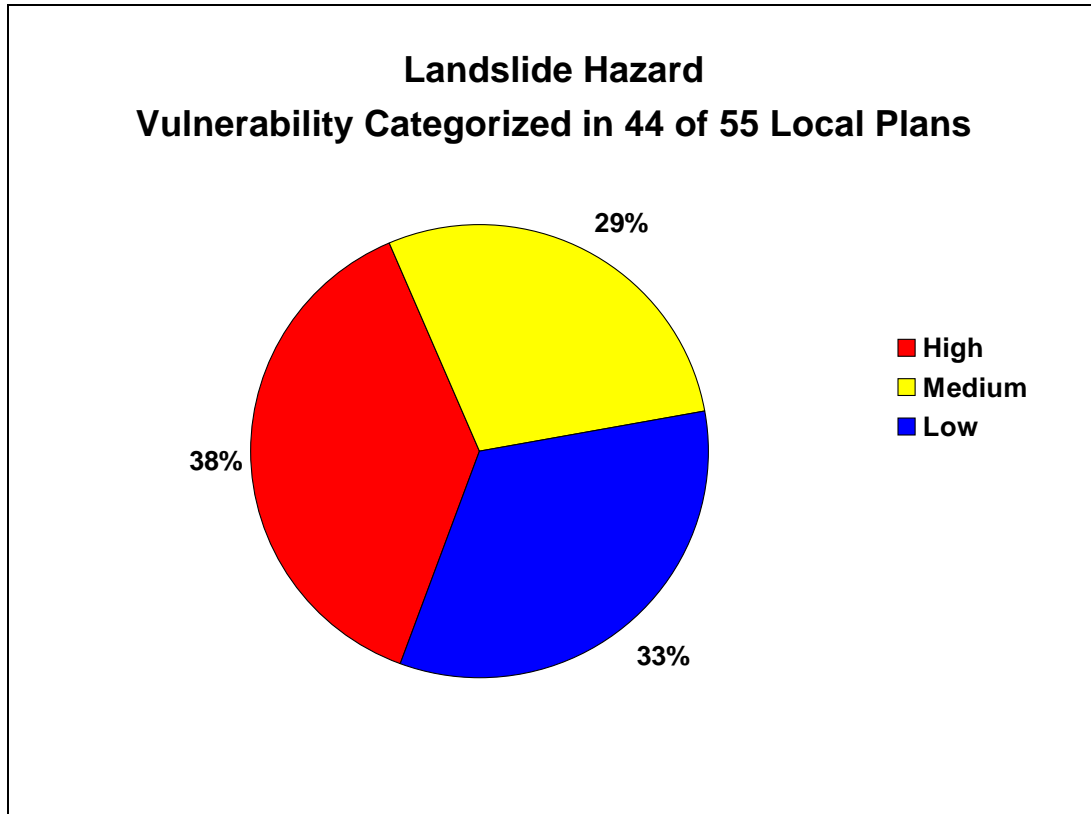


- The state plan did not determine Chelan and Ferry counties were among those most vulnerable to severe storms. Chelan County based its probability of recurrence rating of high on the likelihood of severe winter (snow) storms occurring every 5 to 10 years. Ferry County identified severe storms as a key hazard in its plan because cross-county roads and highways are vulnerable to damage from them and there is a high likelihood of occurrence.
- Pend Oreille County based its high vulnerability to winter storms on the state plan's determination that the county was among those most vulnerable to blizzards, which combine heavy snow fall with high winds; the state plan did not categorize this county as most vulnerable to winter storms (see Tab 5.7 pages 11 and 12 for definitions of these events).
- Pierce County based its low vulnerability rating on temperate climate conditions, types of storms to strike the county, and limited previous occurrences; the state plan rated the county as most vulnerable to both high winds and winter storms.
- Whatcom County did not identify severe storms among the six natural hazards that pose the greatest threat to the populated western portion of the county; the state plan rated the county as most vulnerable to both high winds and winter storms.

## Analysis of Local Hazard Vulnerability

### Landslide:

Forty-four of the 55 local plans listed landslide, or some sort of ground movement such as subsidence, as a hazard of concern; 16 local plans rated their vulnerability to landslide as high, 14 local plans rated their vulnerability as medium or moderate, and 14 rated their vulnerability as low.



The state plan listed 24 counties as most vulnerable to landslides, noting that part of the jurisdictions have one or more of the following areas prone to landslides:

- Shorelines of the Pacific Coast, Puget Sound and Hood Canal.
- Shorelines of Lake Roosevelt and the Columbia River Gorge.
- Slopes of the Blue, Cascade, and Olympic mountain ranges.
- Corridors of Interstate 5 and U.S. Highway 101.

Five county plans differed significantly from the state plan in their analysis of the landslide hazard; primarily, the county plans state that landslides threatened few people or structures.

- Columbia and Walla Walla counties did not list landslide as among the five hazards their plans addresses; their plans indicated that landslide posed little risk to people and property in their jurisdictions.
- Ferry County listed landslide as one of four key hazards, but determined that the likelihood of future occurrence and potential impact were low, while noting that

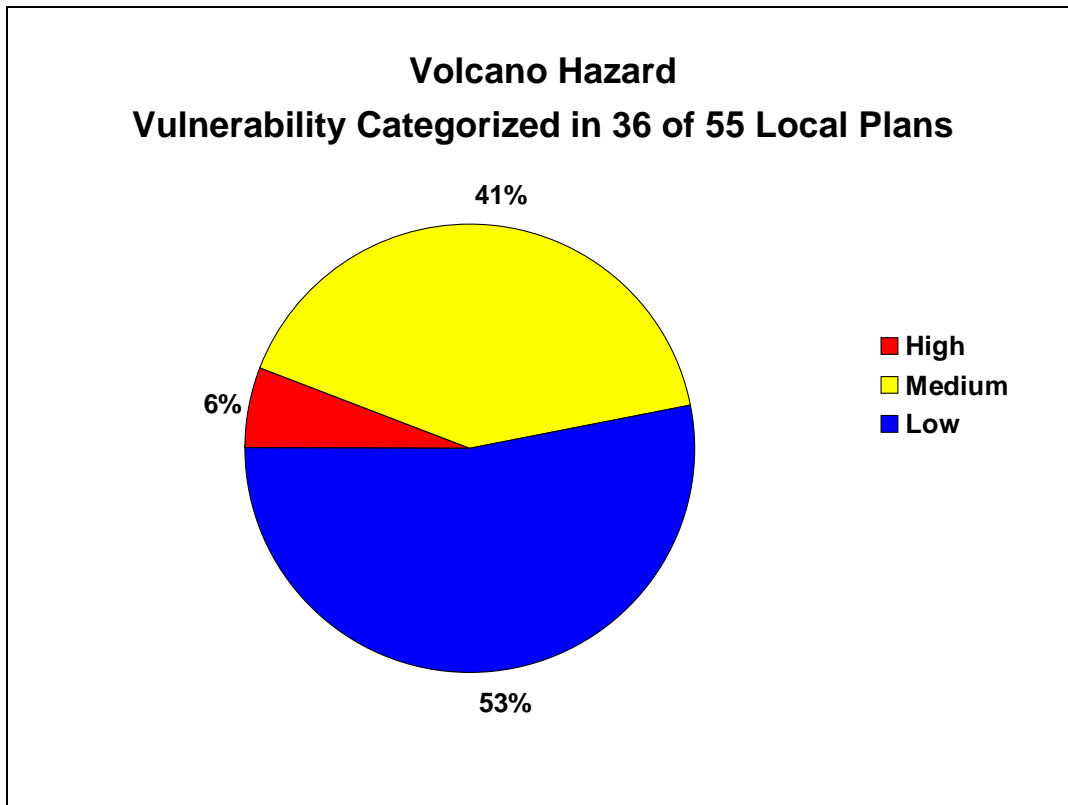
## Analysis of Local Hazard Vulnerability

landslides have impacted State Routes 20 and 21, key transportation corridors, in the past.

- Grays Harbor County ranked its vulnerability to landslide lower than several other hazards because it threatens few people or structures; the county's plan did note that landslides do threaten the three major highways that traverse the county, US Highways 8, 12 and 101.
- Pierce County rated its vulnerability to landslides as low based on limited exposure of people and property to vulnerable slopes or waterside terrain; the plan did note that development is increasingly encroaching on steep slopes throughout the county, however.

Volcano:

Thirty-six of the 55 local plans addressed the volcano hazard in some fashion. Two counties indicated that their vulnerability to the volcano hazard is high, 14 categorized their vulnerability as medium or moderate, and 20 categorized their vulnerability as low.



The state plan listed 11 counties as most vulnerable to lahars from five volcanoes in Washington and one in Oregon. The state plan based its evaluation of most vulnerable jurisdictions solely on the impact of lahars, as they pose a greater risk to life and property than any other volcanic hazard, according to U.S. Geological Survey hazard reports. Although the state plan did not consider ash fall as part of its risk assessment,

## Analysis of Local Hazard Vulnerability

the May 18, 1980 eruption of Mount St. Helens showed ash fall can affect human health, damage infrastructure, and have a temporary but significant and costly impact on the economy of affected areas.

Examined were eight county plans to analyze the differences in vulnerability as compared to the state plan.

- The state plan categorized Clark, King, Pierce, Snohomish, and Thurston counties as most vulnerable because of lahar inundation zones. These counties considered their vulnerability low because other hazards pose a greater risk primarily due to frequency of occurrence and potential impact on people and property.
- King and Thurston counties did not examine the volcano hazard for these reasons, but indicated they would do so in future years.
- The plans of Franklin, Grays Harbor, and Yakima counties considered their jurisdictions at high, medium or moderate vulnerability because of ash fall; as mentioned above, the state plan did not consider ash fall when determining which counties are most vulnerable to the volcano hazard. Yakima County noted in its plan that ash fall from the May 18, 1980 eruption of Mount St. Helens caused complete darkness in the county; it was one of the counties most significantly impacted by the eruption.

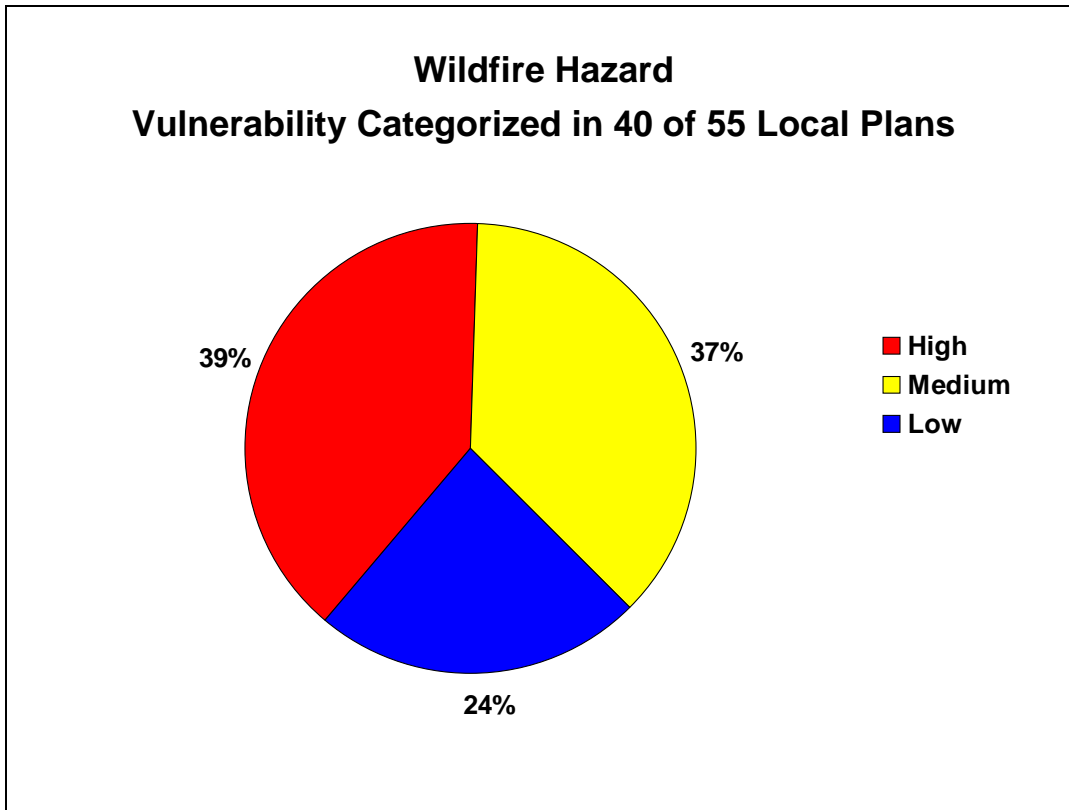
Most interesting was the medium vulnerability rating in the Grays Harbor County plan. While prevailing winds nearly always would carry ash fall east away from this county, its vulnerability determination appears based on the May 25, 1980 ash fall from Mount St. Helens. The county's plan stated this event deposited from one-quarter to three-quarters of an inch of ash in the east-county area leading to power outages, hazardous travel conditions, and stranded tourists.

### Wildland Fire:

Forty of the 55 local plans addressed the wildland fire hazard, with 16 indicating their vulnerability was high, 15 indicating their vulnerability was medium or moderate, and four indicating their vulnerability was low.

The state plan lists 34 counties as being most vulnerable to the hazard, based on findings by the Washington Department of Natural Resources categorizing 181 communities / zip codes within these counties as being at high-risk to a wildland / urban interface fire. The department developed the list of communities in conjunction with its federal and local partners based on national criteria (NFPA 299 Standard for Protection of Life and Property from Wildfire, 1997) that included fire behavior potential, fire protection capability, and risk to social, cultural and community resources. The list of at-risk communities was published in the Federal Register on August 17, 2001 and updated in a DNR progress report in 2002.

## Analysis of Local Hazard Vulnerability



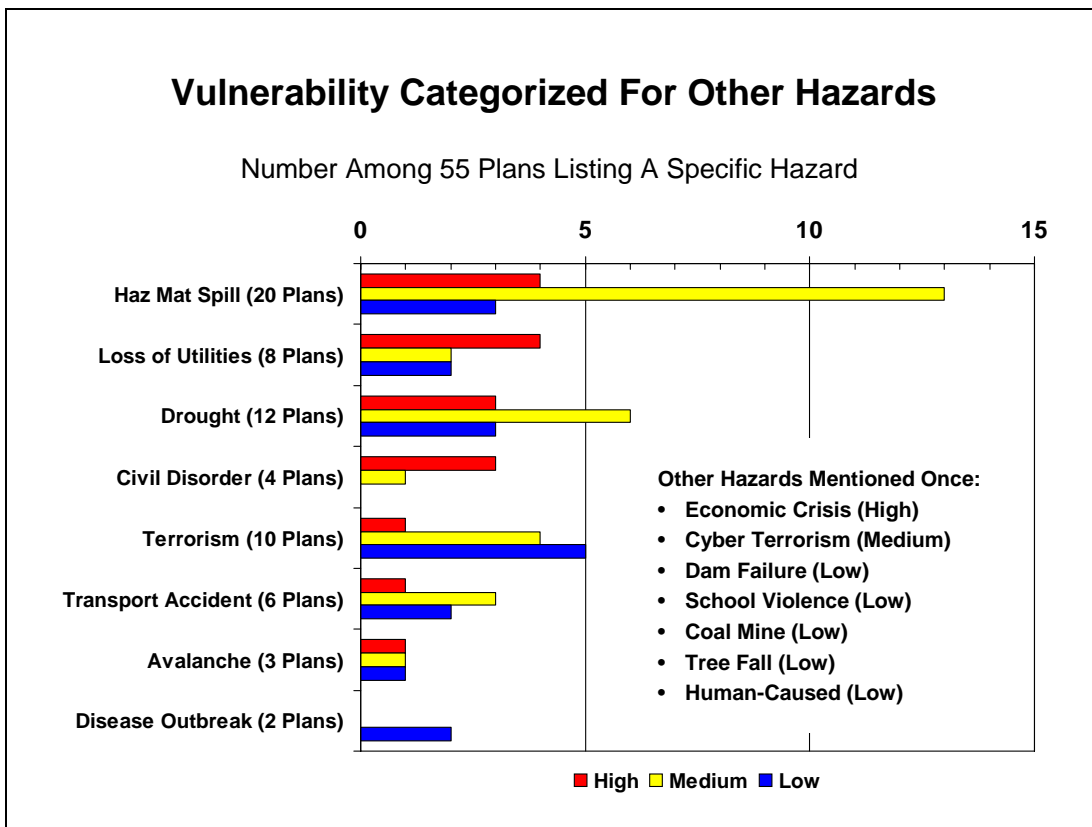
Examined were four county plans to analyze the difference in hazard categorization with the state plan.

- Douglas County, one of four not considered most vulnerable to the hazard by the state plan, rated the wildland fire hazard high in its plan. The plan states the probability of occurrence of wildfire is high, with a frequency of once every five years, but that it is not a natural hazard “most prevalent” in the county without giving further reasoning. The plan stated the county frequently experiences smoke that drifts in from large fires in neighboring counties.
- Franklin County rated its vulnerability as medium or moderate because of its dry climate and 85 percent of its land is agricultural and vulnerable to fire.
- Thurston County recognized that while wildland fire is one of the hazard its faces, it was not one of the four that it chose to analyze in the first edition of its plan because of resource constraints. The county chose to analyze earthquake, flood, storm and landslide because of the high probability of occurrence in the next 25 years, and the significant potential for damage to the built environment and for loss of life.
- Walla Walla County rated its vulnerability as medium or moderate based on a high probability of occurrence in the next 25 years but noted limited exposure of people, property and economy to the hazard.

## Analysis of Local Hazard Vulnerability

### Other Hazards:

The local plans also addressed three other natural hazards listed in the state plan and not addressed above – avalanche, drought, and tsunami. Only three of the 55 local plans categorized their vulnerability to avalanche, with King County’s plan listing vulnerability high; this is primarily due to the avalanche threat to Interstate 90 at Snoqualmie Pass, as the freeway is the state’s primary west-east transportation corridor. Twelve plans discussed vulnerability to drought; these plans primarily were from jurisdictions with a significant agriculture industry that is hurt when water supplies are limited. Nineteen plans addressed tsunami; with four plans – Grays Harbor, Jefferson, and Whatcom counties and City of Aberdeen – categorizing their vulnerability as high. City of Mercer Island listed its vulnerability as medium or moderate.



Sixteen plans addressed urban fire as a hazard of concern; the state’s plan did not address this hazard. Six local plans categorized their vulnerability as high, another five as medium or moderate, and five as low.

The local plans addressed a significant number of man-made or technological hazards; according to federal regulations on hazard mitigation planning, neither state or local plans were required to address these hazards [CFR 201.4.c.2.i, 201.6.c.2.i].

The man-made / technological hazards of greatest concern as identified in the local plans is hazardous materials spills; 20 plans addressed this hazard. Four plans – Renton, Aberdeen, City of Shoreline, and Yakima County – categorized local

## Analysis of Local Hazard Vulnerability

vulnerability as high to this hazard. Another 13 plans categorized their vulnerability as medium or moderate.

Other man-made / technological hazards addressed in local plans includes terrorism (10 plans, plus another plan addressed cyber-terror), loss of utilities (eight plans), transportation incident (six plans), and civil disorder (four plans). In its hazard mitigation plans, King County's plan rated its vulnerability as high to terrorism, while Seattle rated its vulnerability low; interestingly, Seattle was an initial recipient of Department of Homeland Security Urban Area Security Initiative grant funding in 2003.

### Conclusions and Recommendations:

As stated previously, the state hazard mitigation plan's determination of counties most vulnerable to various natural hazards generally correlated with the local plans' determination of vulnerability. For the upcoming revision of the state plan, the following actions are recommended:

- Drop avalanche and drought from the state plan's risk assessment; they will remain hazards addressed in the *Washington State Hazard Identification and Vulnerability Assessment* when it is updated in 2006. State and local jurisdictions have little infrastructure and few people vulnerable to avalanche, with the exception of transportation corridors through mountain passes. Additionally, very few local plans addressed the hazard. Drought primarily is an economic hazard to agriculture and timber interests rather than a hazard that damages property and threatens human life; on the other hand, hazard mitigation grant programs fund projects that minimize or eliminate the threat to life and property. Like avalanche, few local plans address drought as a hazard of concern.
- Make only minor changes as necessary to update the criteria used to determine most vulnerable counties for the earthquake, flood and landslide hazards.
- For severe storms, reduce the vulnerability assessment in the state plan to two storm types, high winds and winter storm. These storm types are of greatest concern to local planning jurisdictions and have the highest rate of occurrence. Reducing the state's assessment to two severe storm types will simplify the state plan's risk assessment for the hazard. Eliminated from assessment will be storm types such as tornado and severe thunderstorm, which occur less frequently and pose less threat, in general, to life and property.
- Incorporate ash fall into the state's vulnerability assessment for the volcano hazard. The assessment of counties most vulnerable to this hazard should include those jurisdictions whose annual probability of receiving 1 centimeter of ash fall from any major Cascade volcano in any year is 0.2 percent (1 in 500 probability of occurrence).

## **Analysis of Local Hazard Vulnerability**

- Make no change in the assessment for counties most vulnerable to the wildland fire hazard. The assessment already uses a national-standard methodology used by all states for purposes of identifying local jurisdictions at risk to wildland fire for purposes of the National Fire Plan.
- Include hazardous materials spill in the state plan's risk assessment, as there is considerable local interest in this hazard, as shown in approved local plans.
- Prepare hazard profiles for all other man-made and technological hazards for inclusion of an updated *Washington State Hazard Identification and Vulnerability Assessment* as well as consideration for inclusion in the *2010 Washington State Enhanced Hazard Mitigation Plan*.

## Analysis of Local Hazard Vulnerability

**Table 1. Analysis of How 55 Local Hazard Mitigation Plans Categorize Vulnerability to Natural Hazards**

<b>Rating</b>	<b>Earthquake (47 Plans)</b>	<b>Flood (48 Plans)</b>	<b>Severe Storms (51 Plans)</b>	<b>Tsunami, Seiche (19 Plans)</b>	<b>Wildfire (40 Plans)</b>	<b>Volcano (36 Plans)</b>	<b>Landslide (44 Plans)</b>	<b>Urban Fire (16 Plans)</b>
<b>High</b>	32	22 Riverine – 1	31 High Winds – 13 Winter Storm – 11 Coastal Flood – 1	4	16	2	16	6
<b>Medium / Moderate</b>	14	16 Riverine – 1	23 Hail – 1 Winter Storm – 1 High Winds – 4 High Heat – 1	1	15	14	14	5
<b>Low</b>	1	11 Flash – 2	11 Lightning – 2 Hail – 3 Tornado – 4 Winter Storm – 1	13	4	20	14	5

### Notes

- Fifty-five local plans categorized vulnerability using a high – medium / moderate – low or similar ranking scale; number under each hazard represents the number of local plans which ranked that hazard (earthquake hazard ranked in 47 of 55 plans that categorized vulnerability as listed). Five other plans discussed vulnerability to hazards in a way that a holistic scaled rating for all jurisdictions covered by the plan could not be determined.
- Some totals are greater than 55 because some jurisdictions rated multiple sub-hazards (i.e., flash flooding and riverine flooding, or high winds and winter storm) within a hazard category.

## Analysis of Local Hazard Vulnerability

**Table 2. Analysis of How 55 Local Hazard Mitigation Plans Categorize Vulnerability to Other Hazards**

Vulnerability Rating	Other Hazards Listed in Local Plans		
<b>High</b>	Haz Mat Spill – 4 Civil Disorder – 3 Loss of Utilities – 4	Drought – 3 Avalanche – 1 Terrorism – 1	Transportation Incident – 1 Economic Crisis – 1
<b>Medium / Moderate</b>	Haz Mat Spill – 13 Drought – 6 Terrorism – 4	Transportation Incident – 3 Loss of Utilities – 2 Cyber Terrorism – 1	Avalanche – 1 Civil Disorder – 1
<b>Low</b>	Terrorism – 5 Drought – 3 Haz Mat Spill – 3 Infestation / Disease Outbreak – 2 Loss of Utilities – 2	Transportation Incident – 2 Dam Failure – 1 School Violence – 1 Coal Mine – 1	Vandalism – 1 Tree Fall – 1 Avalanche – 1 Human-Caused – 1

Notes

- While not required to do so, some jurisdictions addressed and categorized vulnerability of a variety of man-made or technological hazards because of the methodology they used to develop their plans.

## Analysis of Local Hazard Vulnerability

**Table 3. Vulnerability to Hazards – As Listed in 55 Local Hazard Mitigation Plans**

Jurisdiction	Earthquake	Flood	Severe Storms	Tsunami, Seiche	Wildfire	Volcano	Landslide	Urban Fire	Other
Benton <sup>1</sup>		High	High – High Winds		High				
Chelan <sup>2</sup>	Medium	High	High		High	Low	Medium		Avalanche, Drought – High
Clallam <sup>3</sup>	Moderate	High	Moderate		Moderate		High	Moderate	
Clark <sup>4</sup>	High	Medium	Medium		Medium	Low	Medium		Haz Mat – Medium Terrorism – Low
Columbia <sup>5</sup>		Low – Flash Medium – River	Medium		Medium				Drought – Medium
Cowlitz <sup>6</sup>	High	High	High – Winter Storm, High Winds Low – Lightning, Hail, Tornado	Low	Medium	Medium	Medium	Low	Drought, Infestation/Disease – Low
Douglas <sup>7</sup>	Medium	High	High – Winter Storm, High Winds Medium – Hail		High	Low	Medium	High	Drought, Loss of Electrical Service – High Haz Mat, Loss of Water Service - Medium
Ferry <sup>8</sup>		High – Riverine	High		High		Low		
Franklin <sup>9</sup>	Moderate	Moderate	Moderate		Moderate	Moderate	Moderate		Drought – Moderate
Grays Harbor <sup>10</sup>	#2	#1	#3 – High Winds #4 – Winter Storm #7 – Tornado	#3	#7	#6 – Ash Fall	#6		#5 – Haz Mat
Island <sup>11</sup>	#2	#4	#1		#5		#3		
King <sup>12</sup>	High	Moderate	Moderate		Low		High	Low	Civil Disorder, Terrorism, Transportation – High Avalanche, Haz Mat, Cyber Terror – Moderate

### Analysis of Local Hazard Vulnerability

**Table 3. Vulnerability to Hazards – As Listed in 55 Local Hazard Mitigation Plans**

Jurisdiction	Earthquake	Flood	Severe Storms	Tsunami, Seiche	Wildfire	Volcano	Landslide	Urban Fire	Other
Kitsap <sup>13</sup>	#1	#4	#2	#6	#3	#7	#5		Drought, Tidal Flooding, Haz Mat also listed
Jefferson <sup>14</sup>	Very High	Low	High – High Winds, Coastal Flooding	High	High	Low – Ash Fall	High		Drought – Moderate
Lewis <sup>15</sup>	Plan does not categorize vulnerability to hazards, rather stating that flood, severe storm, earthquake, landslide, volcanic activity and major fires are the hazards most likely to affect Lewis County communities.								
Mason <sup>16</sup>	High	High	High		High		High		Terrorism – Moderate
North King / S. Snohomish <sup>17</sup>	100 yrs or less	Annually	Annually	Unknown, Rare	25 yrs or less	Unknown, Rare	25 yrs or less	25 yrs or less	
Pend Oreille <sup>18</sup>		#5	#1 – Winter Storm #3 – High Winds		#2				#4 – Loss of Electrical Service
Pierce	Medium	Medium	Low	Low	Low	Low	Low		
Skagit <sup>19</sup>	High	High	Moderate	Very Low	High	Moderate	Moderate		Drought – Low
Snohomish <sup>20</sup>	#1	#2	#3	#7	#5	#6	#4		
Thurston <sup>21</sup>	High	High	High				High		
Walla Walla <sup>22</sup>	Medium	Low – Flash Medium – River	Medium		Medium				
Whatcom <sup>23</sup>	High	High		High	High	High	High		
Yakima <sup>24</sup>	High	High	High – Winter Storms, High Wind		High	High	High		Haz Mat – High

City / Other	Earthquake	Flood	Severe Storms	Tsunami, Seiche	Wildfire	Volcano	Landslide	Urban Fire	Other
Aberdeen	High	High	Low	High	Moderate	Low	Moderate		Haz Mat – High School Violence - Low

### Analysis of Local Hazard Vulnerability

**Table 3. Vulnerability to Hazards – As Listed in 55 Local Hazard Mitigation Plans**

Jurisdiction	Earthquake	Flood	Severe Storms	Tsunami, Seiche	Wildfire	Volcano	Landslide	Urban Fire	Other
Bethel SD	High	Low	High		Moderate	Moderate	Low	Moderate	Haz Mat – Low Plane Crash – Moderate Terrorism – Moderate
Clover Park SD	Moderate	Moderate	Moderate		High			High	
Everett	High	High	High	Low		Low	Medium	High	Haz Mat – Medium
Highline Water	High	Low	Moderate – High Winds Low – Winter Storm			Moderate	Moderate	High	Prolonged Freezing, Vehicle Crash – Low Haz Mat, Air Crash – Moderate Treefall – High
Kent	High	High	High – Winter Storm, High Winds Low – Lightning, Hail	Low	Medium	Medium	High	Low	
Kittitas Water District #4	Low	Medium	High – High Winds Medium – Winter Storm Low – Tornado		High	Low	Low		Haz Mat, Drought – Medium Avalanche, Terrorism, Vandalism – Low
Lk. Wash. Tech. College	High		High – Winter Storm Medium – Extreme Heat Low – Hail			Medium			Drought – Medium
Lakehaven Utility Dist. <sup>25</sup>	#1	#9	High Winds – #2 Winter – #3			#5	#8	#10	Drought – #3 Power Outage, Haz Mat – #6
Lummi Island FD #11 <sup>26</sup>	Medium		High		High	Low	Medium		
Lummi Tribe	Plan does not categorize vulnerability to individual hazards, but identifies vulnerability by reservation areas.								

### Analysis of Local Hazard Vulnerability

**Table 3. Vulnerability to Hazards – As Listed in 55 Local Hazard Mitigation Plans**

Jurisdiction	Earthquake	Flood	Severe Storms	Tsunami, Seiche	Wildfire	Volcano	Landslide	Urban Fire	Other
(State Plan)									
Mercer Island	High		High	Moderate			High	High	
Newport SD			High – High Winds, Winter Storm		High				Economic Crisis, Crime - High
North River SD	High	High	High	Low	Moderate	Low	High		Human Caused – Moderate
Onalaska SD	High	Moderate	High – High Winds, Winter Storm			Moderate			Power, Phone Loss, Crime – High Haz Mat, Water Loss, Terrorism – Low
Puyallup	Medium	Low	Medium – High Winds Low – All Other		Very Low	Medium	Low		
Redmond	High	Moderate	Moderate – Winter		Moderate		High		Drought – Low Epidemic – Low Haz Mat – Moderate Terrorism – Moderate
Renton	High	Moderate	Moderate	Low	Low	Low	Low		Haz Mat – High Coal Mine – Low Terrorism – Moderate
Richland	Moderate	High	High – High Winds, Winter Storm		Moderate	Moderate	Low		
Riverside FD #14	Medium	Medium	Medium			Low	Low		
Roy / FD #17	High	Moderate	High		Moderate	Moderate	Low	Moderate	Haz Mat – Low Plane Crash – Moderate Terrorism – Low
Seattle	High	Moderate	High – Snow, High Winds	Low		Low	High	Moderate	Plane Crash – Low Civil Disorder – Moderate

## Analysis of Local Hazard Vulnerability

**Table 3. Vulnerability to Hazards – As Listed in 55 Local Hazard Mitigation Plans**

Jurisdiction	Earthquake	Flood	Severe Storms	Tsunami, Seiche	Wildfire	Volcano	Landslide	Urban Fire	Other
			Low – Tornado						Haz Mat – Moderate Terrorism – Low
Shoreline City	High	Medium	High	Low		Low	Medium	Medium	Haz Mat – High
Shoreline SD	High	Low	Medium	Low		Low	Low	Low	Haz Mat – Medium
Skyway Water-Sewer <sup>27</sup>	#1	#9	#4		#10	#5	#8	#10	Civil Unrest – #2 Loss of Utilities– #3 Drought – #6 Haz Mat – #7
Snoqualmie <sup>28</sup>	Moderate	High	Moderate – High Winds		Moderate		High		
South Bend City / SD <sup>29</sup>	High	High	High	Low	Low	Low	High		Human Caused (Terror, Technological) – Low
Sultan <sup>30</sup>	Medium	High	Medium			Low	High		Haz Mat – Medium Dam Failure – Low
Sumner / Bonney Lake	Medium	Medium	Medium		Low	Medium	Low		
Tulalip Tribe <sup>31</sup>	High	High	High	High	High		High		
WA Dept Corrections	Plan lists which facilities are at risk to various hazards; there is no overall categorization of vulnerability by hazard.								

### Notes

Vulnerability listed in table is as categorized by local plans as of December 2005. Unless otherwise described in table or noted below, vulnerability to hazards is categorized as High, Medium / Moderate, or Low. If vulnerability to a hazard is rated as “low to moderate” for example, the higher rating (“moderate”) was used in table above. No rating is listed for hazards which are not categorized.

- Counties with Plans under development as of December 2005 are Grant, Okanogan, Spokane, and Whitman. Cities with plans under development as of December 2005 include Steilacoom. Washington State University is developing a Local Plan.
- Counties without planning initiatives underway as of December 2005 are Adams, Asotin, Garfield, Kittitas, Klickitat, Lincoln, Pacific, Skamania, Stevens, and Wahkiakum.
- Columbia County Plan is a review draft as of December 2005

## Analysis of Local Hazard Vulnerability

- Everett Plan is a “pre-adoption” draft as of December 2005.
- Island County Plan is August 2004 draft.
- Lummi Tribal Plan is a State Standard Plan.
- Washington State Department of Corrections is a Local Plan; it is a “pre-adoption” draft as of December 2005.

---

<sup>1</sup> Benton County Hazard Mitigation Plan includes six participating local jurisdictions. Plan categorizes three hazards as priority with high probability of occurring within the next five years, and defines vulnerability by area of the city within the plan narrative; probability of occurrence within the next five years is listed in the table above.

<sup>2</sup> Chelan County Plan includes six participating local jurisdictions. Hazards are categorized by probability of recurrence.

<sup>3</sup> Clallam County Plan includes eight participating local jurisdictions.

<sup>4</sup> Clark County Plan includes eight participating local jurisdictions. Hazards are categorized by risk.

<sup>5</sup> Columbia County Plan includes three participating local jurisdictions. Plan categorizes hazards by probability of occurrence and risk to people and the built environment. Listed in the table above is the categorization of risk for the top five hazards.

<sup>6</sup> Cowlitz County Plan has 27 participating local jurisdictions.

<sup>7</sup> Douglas County Plan includes seven participating local jurisdictions. Each jurisdiction rated vulnerability to hazards based on a number of criteria. Ranking in table above is summary of risk covering all planning jurisdictions. Where a hazard received a multiple ratings, the majority rating was used (i.e., if a hazard was rated “high” by four or more jurisdictions, the rating in the table is listed as “high”). Where there was no majority rating for a hazard, the ratings were averaged for the listing appearing in the table above.

<sup>8</sup> Ferry County Plan categorizes hazards by likelihood of recurrence.

<sup>9</sup> Franklin County Plan has 12 participating local jurisdictions. Plan categorizes hazards by probability of occurrence and risk to people and the built environment. Hazards are categorized by risk.

<sup>10</sup> Grays Harbor County Plan ranked hazards based on likelihood of occurrence and impacts on people and the build environment. The hazards were ranked #1 through #7, and are listed as such in the table above.

<sup>11</sup> Island County Plan (draft) provides a risk rating number based on several factors and does not attempt to categorize hazards into high-medium-low. The table above reflects the hazard with the greatest risk rating as #1, the second highest as #2, and so on.

<sup>12</sup> King County Plan includes 37 participating local jurisdictions. The plan categorizes hazards by probability of occurrence and impact (i.e., (high probability, moderate impact”). The table above lists the rating for hazard impacts.

<sup>13</sup> Kitsap County Plan includes 36 participating local jurisdictions. The plan categorizes hazards by probability of occurrence, and each participating jurisdiction provides a priority ranking of hazards. The rating in the table uses the average priority ranking of hazards.

## Analysis of Local Hazard Vulnerability

---

- <sup>14</sup> Jefferson County Plan includes 19 participating local jurisdictions. Plan ranks risk and vulnerability to hazards from very high to very low.
- <sup>15</sup> Lewis County Plan includes 47 participating local jurisdictions.
- <sup>16</sup> Mason County Plan includes six participating local jurisdictions. Plan lists hazards most threatening to participating local jurisdictions.
- <sup>17</sup> North King / South Snohomish Plan includes 10 participating local jurisdictions. Each jurisdiction rated vulnerability to hazards based on a number of criteria. Ranking in table above is probability of occurrence on regional basis covering all planning jurisdictions; where a hazard included multiple ratings, the higher rating was used in the table above.
- <sup>18</sup> Pend Oreille County Plan includes 11 participating local jurisdictions. Table lists the top five hazards as identified in the plan, based on composite scores developed by participating jurisdictions.
- <sup>19</sup> Skagit County plan includes 52 participating local jurisdictions.
- <sup>20</sup> Snohomish County Plan has 45 participating local jurisdictions. All jurisdictions individually rank hazards by priority based on projected estimated loss and probability of occurrence. The rating in the table uses the average priority ranking of hazards.
- <sup>21</sup> Thurston County Plan has 15 participating local jurisdictions. The plan addresses four hazards that have a high probability of occurring within 25 years, have a high potential for significant damage to the built environment and for loss of life; these hazards are listed as “high” in the table above.
- <sup>22</sup> Walla Walla County Plan includes six participating local jurisdictions. Plan addresses five hazards, whose risk rating appears in the table above.
- <sup>23</sup> Whatcom County Plan included eight participating local jurisdictions. Plan identifies six hazards as “specifically hazardous to the populated western areas of Whatcom County.” They are identified in the table above with a “high” designation.
- <sup>24</sup> Yakima County Plan includes 26 participating local jurisdictions. Each jurisdiction rated vulnerability to hazards individually based on a number of criteria. The plan identified 54 hazards / hazard agents to which the county and its jurisdiction is vulnerable; those that pose the greatest threat to people are rated as “high” in the table above.
- <sup>25</sup> Lakehaven Utility District Plan provides a risk rating number based on several factors and does not attempt to categorize hazards into high-medium-low. The table above reflects the hazard with the greatest risk rating as #1, the second highest as #2, and so on.
- <sup>26</sup> Lummi Island Fire District 11 Plan categorizes hazards by probability of occurrence, and provides a general narrative of vulnerability.
- <sup>27</sup> Skyway Water and Sewer District Plan provides a risk rating number based on several factors and does not attempt to categorize hazards into high-medium-low. The table above reflects the hazard with the greatest risk rating as #1, the second highest as #2, and so on.
- <sup>28</sup> Snoqualmie Plan categorizes hazards by Probability of occurrence, and provides a general narrative of vulnerability.
- <sup>29</sup> South Bend City / School District Plan categorizes hazards by probability of occurrence, and provides a general narrative of vulnerability.

## Analysis of Local Hazard Vulnerability

---

<sup>30</sup> Sultan Plan categorizes hazards by probability of occurrence, and provides a general narrative of vulnerability.

<sup>31</sup> Tulalip Tribe Plan identifies and describes the impact of six hazards that could affect the tribe's reservation, assets, and people; the plan does not categorize the tribe's vulnerability as high-medium-low. In the table above, these six identified hazards are listed as "high."