

Oregon City, Oregon

Natural Hazards Mitigation Plan Addendum

Prepared for:

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In cooperation with

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Natural Hazards Mitigation Plan Addendum

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Section 1: Planning Process

The Oregon City Natural Hazards Mitigation Plan Addendum includes resources and information to assist city residents, public and private sector organizations, and others interested in participating in planning for natural hazards. The mitigation plan provides a list of activities that may assist Oregon City in reducing risk and preventing loss from future natural hazard events. Oregon City has developed this plan as an addendum to the multi-jurisdictional Clackamas County Natural Hazards Mitigation Plan in an effort to take a more regional approach to planning for natural hazard scenarios.

1.1 Development of the Addendum

In 1998, Oregon City hired a consulting company to create an addendum to the Clackamas County Natural Hazards Mitigation Plan. Upon completion, the addendum did not satisfy all FEMA requirements and was not approved.

From fall 2002 to summer 2003, a Clackamas County Emergency Management representative worked with Oregon City staff to update the consultant's work on the city addendum. Again, the addendum came close to completion but was never submitted to FEMA for approval.

In the fall of 2008, Clackamas County partnered with the Oregon Partnership for Disaster Resilience (OPDR) and Resource Assistance for Rural Environments (RARE) to update existing city addenda and develop new city addenda to the Clackamas County Natural Hazards Mitigation Plan. RARE provided a volunteer ('RARE Participant') to document and facilitate each of the cities' planning processes. The RARE Participant was hired with funds made available through the Hazard Mitigation Grant Program.

From November 2008 through March 2009, Clackamas County Emergency Management and the RARE Participant worked with the City of Oregon City to facilitate and document the completion of Oregon City's addendum to the Clackamas County Natural Hazards Mitigation Plan.

1.1.1 Who Participated in Developing the Addendum?

The Oregon City Natural Hazards Mitigation Plan Addendum is the result of a collaborative effort between Oregon City public agencies, non-profit organizations, the private sector, and regional and state organizations. A Hazard Mitigation Plan Committee (HMPC) guided the process of developing the addendum. The HMPC was comprised of the following representatives:

<u>2003 Effort</u>

- Michele Beneville, Community Representative
- Kevin Donegan, Clackamas County Fire District #1
- Rob Guttridge, Citizen Involvement Committee
- Jason Frazier, Oregon City Public Works

- Nancy Kraushaar, Oregon City Public Works
- Lynda Orzen, Community Representative
- Guy Sperb, Oregon City Community Development
- Ron Stewart, Oregon City School District

2008 Effort

- Laura Butler, Oregon City Community Development
- John Collins, South Fork Water Board
- Kevin Donegan, Clackamas Fire District #1
- Kathy Griffin, Oregon City Public Works
- Alice James, McLoughlin Neighborhood Association
- David Knoll, Oregon City Community Development & GIS
- Nancy Kraushaar, Oregon City Public Works
- Julie Paulsen, Oregon City Chamber of Commerce
- Tim Powell, McLoughlin Neighborhood Association
- Laurel Reimer, Resource Assistance for Rural Environments
- Guy Sperb, Oregon City Community Development
- Pete Walter, Oregon City Community Development

The RARE Participant and Clackamas County Emergency Management developed and facilitated three planning meetings with the Hazard Mitigation Plan Committee (HMPC) on November 5th, November 19th, and December 10th, 2008. Minutes from each meeting of the HMPC can be found in Appendix A. The following is a summary of the 2008 planning process.

November 5th, 2008: The RARE participant met with members of the HMPC to review the planning process and requirements. The RARE Participant provided a rough agenda for the two subsequent planning meetings and explained what assistance she would need. The group also discussed potential members to add to the HMPC.

November 19th, 2008: The RARE Participant and the Oregon City HMPC discussed portions of Section 1: Planning Process, Section 3: Hazard Assessment and a portion of Section 4: Natural Hazards. The group decided on their coordinating body and convener, agreed on the mission and goals, and described plan adoption and public involvement. The group then reviewed and added to a list of Oregon City's community assets compiled by the RARE Participant. Finally, the group identified hazard events that occurred between September, 2003 and November, 2008, as the previous draft only documented events prior to 2003. The RARE Participant documented the damages and mitigation efforts that resulted from each hazard event. Additionally, the HMPC did a vulnerability assessment for each hazard to create a mitigation planning priority system.

December 10th, 2008: The RARE Participant presented Section 2: Community Profile to the HMPC and gathered feedback. The Oregon City HMPC then finished discussing Section 4: Natural Hazards by developing action items to address the city's

vulnerabilities that were addressed in the November 19th risk assessment meeting. The group reviewed the action items developed in 2003 planning effort, and created new action items where needed. The group also discussed the final portions of Section 1: Planning Process by creating a plan maintenance and formal review process.

1.2 Multi-Jurisdictional Planning Effort

Oregon City is dedicated to taking a regional approach to planning for natural hazards. Oregon City has representation on the Clackamas County Hazard Mitigation Advisory Committee to ensure that Oregon City's interests are represented in the larger scale planning effort. The city will partner with Clackamas County in implementation of appropriate action items, and will work with other jurisdictions to reduce losses from future natural hazards.

1.3 What is the Addendum Mission?

The City of Oregon City concurs with the mission statement of the Clackamas County Natural Hazards Mitigation Plan:

> The mission of the Clackamas County Natural Hazards Mitigation Plan is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

1.4 What are the Addendum Goals?

The City of Oregon City concurs with the goals of the Clackamas County Natural Hazards Mitigation Plan:

The addendum goals describe the overall direction that Clackamas County agencies, organizations, and citizens can take to work toward mitigating risk from natural hazards. The goals are stepping-stones between the broad direction of the mission statement and the specific recommendations outlined in the action items.

Protect Life and Property

- Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural hazards.
- Reduce losses and repetitive damages for chronic hazard events while promoting insurance coverage for catastrophic hazards.
- Improve hazard assessment information to make recommendations for discouraging new development and encouraging preventative measures for existing development in areas vulnerable to natural hazards.

Promote Public Awareness

- Develop and implement education and outreach programs to increase public awareness of the risks associated with natural hazards.

- Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

Enhance Natural Systems

- Balance watershed planning, natural resource management, and land use planning with natural hazard mitigation to protect life, property, and the environment.
- Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.

Encourage Partnerships and Implementation

- Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation.
- Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

Augment Emergency Services

- Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
- Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.
- Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

1.5 How Will the Addendum be Implemented, Monitored, and Evaluated?

To ensure plan sustainability, the plan includes a schedule for implementation, monitoring, and evaluation. This plan addendum will additionally be reviewed in coordination with the county's plan update cycle.

1.5.1 Plan Adoption

The City Commission of Oregon City will be responsible for adopting the multi-jurisdictional Clackamas County Natural Hazards Mitigation Plan and the Oregon City Addendum. This governing body has the authority to promote sound public policy regarding natural hazards.

1.5.2 Coordinating Body

The Oregon City Hazard Mitigation Plan Committee (HMPC) will be responsible for coordinating implementation of plan action items and undertaking the formal review process.

The convener will assign representatives from appropriate city agencies, including, but not limited to, the current Hazard Mitigation Plan Committee members. In order to make this committee as broad and useful as possible, the HMPC will engage other

relevant organizations and agencies as technical advisers in hazard mitigation as needed.

1.5.3 Convener

Oregon City's City Engineer/Public Works Director will serve as a convener to facilitate the Hazard Mitigation Plan Committee meetings and will assign tasks to the members. Plan implementation and evaluation will be a shared responsibility among all of the Hazard Mitigation Plan Committee members.

1.5.4 Implementation through Existing Programs

Oregon City addresses statewide planning goals and legislative requirements through its Comprehensive Plan, Municipal Code, Capital Improvement Plan, Building Codes, and development regulations (zoning, subdivision and related ordinances). The addendum provides a series of recommendations that are closely related to the goals and objectives of these existing programs. Oregon City will implement mitigation action items through existing programs when possible.

1.5.5 Economic Analysis of Mitigation Projects

FEMA's approach to identify the costs and benefits associated with natural hazard mitigation actions, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. Conducting a benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analyses evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Given federal funding, the Hazard Mitigation Plan Committee will use a FEMA-approved benefit/cost analysis approach to identify and prioritize mitigation action items. For other projects and funding sources, the Hazard Mitigation Advisory Committee may use other approaches to understand the costs and benefits of each action item and develop a prioritized list. For more information regarding economic analysis of mitigation action items, please see Appendix C of the Clackamas County Natural Hazards Mitigation Plan.

1.5.6 Formal Review Process

The HMPC will meet semi-annually to identify funding for the implementation of mitigation actions, evaluate the effectiveness of the plan, develop new mitigation actions to reduce losses from natural hazards, and to reflect changes in land development or programs that may affect mitigation priorities. The first meeting will be held in the spring, and the second meeting will be held in the fall. At the spring meeting the group can reflect on the previous winter season and prepare for hazards related to summer, such as wildfires. During the fall meeting the group can prepare for winter related hazards, such as winter storms and floods. A new list of members will be generated at the beginning of each year to ensure the committee remains relevant.

The HMPC will review the goals and action items to determine their relevance to changing situations in the city, as well as changes in state or federal policy, and to ensure they are addressing current and expected conditions. The committee will also review the hazard assessment portion of the plan to determine if this information should be updated or modified, given any new available data. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, the success of coordination efforts, and strategies that should be revised.

Every five years, the convener or designee will submit an updated plan to the State Hazard Mitigation Officer and the Federal Emergency Management Agency for review and approval. The HMPC will be responsible for updating the addendum prior to its submission. The HMPC will begin working on the 5-year update one year before the update is due to ensure the addendum will be prepared and approved before it expires. The city will follow the county's five-year plan update schedule, meaning Oregon City's next addendum update will be conducted by September 2012.

During future addendum updates, the following questions will be asked to determine what actions are necessary to update the addendum:

- Have public involvement activities taken place since the addendum was adopted?
- Are there new hazards that should be addressed?
- Have there been hazard events in the community since the addendum was adopted?
- Have new studies or previous events identified changes in any hazard's location or extent?
- Has vulnerability to any hazard changed?
- Have development patterns changed? Is there more development in hazard prone areas?
- Do future annexations include hazard prone areas?
- Are there new high risk populations?
- Are there completed action items that have decreased overall vulnerability?
- Did the addendum address National Flood Insurance Program repetitive loss properties?
- Did the addendum identify the number and type of existing and future buildings, infrastructure, and critical facilities in hazards areas?
- Did the addendum identify data limitations?
- Did the addendum identify potential dollar losses for vulnerable structures?
- Are the addendum goals still relevant?
- What is the status of each action item?
- Are there new actions that should be added?
- Is there an action dealing with continued compliance with the National Flood Insurance Program?
- Are changes to the action item prioritization, implementation, and/or administration processes needed?

- Do changes need to be made within the five year update schedule?
- Is mitigation being implemented through existing planning mechanisms (such as comprehensive plans or capital improvement plans)?

1.5.7 Continued Public Involvement

Oregon City is dedicated to involving the public in the review and ongoing development of the Natural Hazards Mitigation Plan Addendum. During the addendum development process, OPDR's website (www.OregonShowcase.org) served as an outreach tool to the community. OPDR's website was used to provide local contact information and updates on the planning process. Additionally, drafts of Oregon City's addendum were posted on OPDR's website to facilitate HMPC review. Once the HMPC created a final draft of the addendum, a press release was posted on the city's website (see language below), as well as a copy of the draft addendum. Oregon City allowed for three weeks of local review, and no comments were received.

Oregon City Natural Hazards Mitigation Plan - Comments Encouraged

What does a mitigation plan do?

A natural hazards mitigation plan provides a community with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. The process of developing a mitigation plan can also forge new partnerships among community organizations, businesses, and local citizens. These partnerships can lead to the development and implementation of risk reduction strategies that assist the community in reducing losses from any future natural disaster events.

Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

In 2000, Congress approved the Disaster Mitigation Act of 2000 (DMA2K). DMA2K set forth requirements for communities to develop and adopt local natural hazard mitigation plans to become eligible for mitigation grant funding, including FEMA's Hazard Mitigation Grant Program (HMGP), and Pre-Disaster Mitigation (PDM) Grant Program.

How has Clackamas County helped with this process?

Clackamas County adopted their Natural Hazard Mitigation Plan in 2002 and updated it in 2007. Each city under their jurisdiction is encouraged to prepare an addendum to the County's Plan. To assist in this process, Clackamas County partnered with the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon to hire a Resource Assistance for Rural Environments Participant (RARE Participant). The RARE Participant was hired using funds made available through the Hazard Mitigation Grant Program and is working with each participating city in developing an addendum to Clackamas County's Natural Hazards Mitigation Plan. The planning processes will occur between February and August 2009.

What has Oregon City done?
City of Oregon City staff and other volunteers worked with the RARE Participant to develop a draft addendum to the County's Natural Hazards Mitigation Plan. The draft addendum is now available on-line for review and comment by citizens.
View the Plan in Adobe PDF

Comments can be sent by e-mail to City staff. Thanks in advance for your interest in this document.

The City of Oregon City will ensure continued public awareness over the next five years by presenting the addendum to City Commission for discussion and adoption. City Commission meetings are open to the public and are accessible on the web in real-time. As such, community members can watch the presentation of the plan to the City Commission and participate in later discussions of the plan. The complete plan will be available for viewing on the city's website, the county's Emergency Management website, and through the University of Oregon's online Scholar's Bank. The city will send out press releases detailing the plan and advertising where the plan can be accessed. Similarly, brochures about the plan will be made available at the front desk of the City Hall building. The *City of Oregon City Trail News*, published quarterly, will include information about the plan and links to the website. Lastly, the city may call a public meeting when deemed necessary, such as after a natural hazard.

Oregon City has the option to advertise the plan through many local organizations as well. Willamette Falls TV, the local television network, can advertise the plan using free public service announcements. The Chamber of Commerce can advertise the plan using their e-blast system, newsletters, website, and "Good Morning Oregon City" events. Finally, the Neighborhood Associations and Citizen Involvement Council can advertise the addendum their newsletters.

1.6 What are the Mitigation Actions Identified by the City of Oregon City?

The *action items* are a listing of activities in which city agencies and citizens can be engaged to reduce risk. Each action item includes an estimate of the timeline for implementation. *Short-term action items (ST)* are activities that agencies may implement with existing resources and authorities within one to two years. *Long-term action items (LT)* may require new or additional resources or authorities, and may take between one and five years to implement. The action items are organized within the following matrix, which lists all of the multi-hazard and hazard-specific action items included in the mitigation plan addendum.

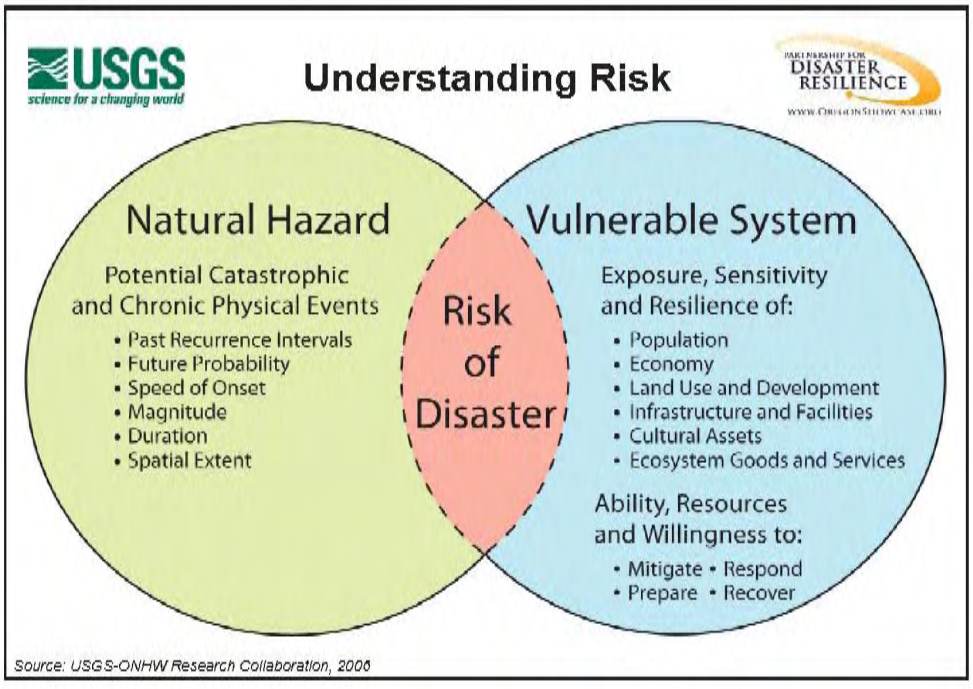
Action Item	Action Item Title	Coordinating Organization	Timeline	Alignment with Plan Goals				
				Protect Life and Property	Promote Public Awareness	Enhance Natural Systems	Encourage Partnerships and Implementation	Augment Emergency Services
ST Flood #1	Promote the use of naturally flood prone open space or wetlands as flood storage areas.	Public Works Department, Community Development	Short Term Ongoing	X		X	X	X
ST Flood #2	Continue to implement and enhance the flood public education program	Public Works Department, Community Development Department, Clackamas Fire District #1	Short Term Ongoing	X	X	X	X	X
ST Flood #3	Continue participating in the National Flood Insurance Program and develop strategies to reduce property damage and related financial impacts due to flooding	Building Department, Community Development Department	Short Term Ongoing	X		X	X	
LT Flood #1	Complete periodic updates of the Surface Water Management Master Plan	Public Works Department	Long Term 5 Years	X		X	X	X
ST Landslide #1	Continue to implement Municipal codes and policies mitigating future landslide damage	Public Works Department, Community Development Department	Short Term Ongoing	X		X	X	X
ST Landslide #2	Maintain an inventory of streets and properties threatened by landslides	Oregon City Geographic Information Systems, Public Works Department, Community Development Department	Short Term Ongoing	X		X	X	X
ST Landslide #3	Educate the community about landslides, their associated risks, and ways of reducing vulnerability	Oregon City Geographic Information Systems, Public Works Department, Community Development Department	Short Term Ongoing	X	X			X
ST Wildfire #1	Enhance outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing public exposure to hazards	Clackamas Fire District #1, Oregon City Geographic Information Systems	Short Term Ongoing	X	X	X	X	X
LT Wildfire #1	Complete periodic updates of the Water Master Plan	Public Works Department	Long Term 5 Years	X		X	X	X
LT Wildfire #2	Promote fire-resistant strategies for new developments	Community Developemtn Department, CFD#1	Short Term Ongoing	X	X	X	X	X

Action Item	Action Item Title	Coordinating Organization	Timeline	Alignment with Plan Goals				
				Protect Life and Property	Promote Public Awareness	Enhance Natural Systems	Encourage Partnerships and Implementation	Augment Emergency Services
LT Severe Storm #1	Reduce power outages from windstorm and severe winter storm hazard	Public Works Department	Short Term Ongoing	X		X	X	X
LT Earthquake #1	Conduct seismic evaluations on identified community assets for implementing appropriate structural and non-structural mitigation strategies	Community Development Department, Public Works Department, Clackamas Fire District #1	Short Term Ongoing	X	X		X	X
ST Multi-Hazard #1	Participate with Clackamas County and regional partners to identify and coordinate building officials that are qualified to conduct damage assessments	Oregon City Emergency Management, Clackamas Fire District #1	Short Term 1 Year	X			X	X
ST Multi-Hazard #2	Continue to update and improve hazard assessments in the Oregon City Natural Hazard Mitigation Plan	Oregon City Geographic Information Systems, Hazard Mitigation Plan Committee	Short Term Ongoing	X	X	X	X	X
ST Multi-Hazard #3	Integrate the goals and action items from the Oregon City Natural Hazard Mitigation Plan into existing regulatory documents and programs, where appropriate	Community Development Department, Public Works Department	Short Term Ongoing	X	X	X	X	X
ST Multi-Hazard #4	Identify and pursue funding opportunities to develop and implement hazard mitigation activities	Community Development Department, Public Works Department	Short Term Ongoing	X	X	X	X	X
ST Multi-Hazard #5	Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing risk	Hazard Mitigation Plan Committee	Short Term Ongoing	X	X	X	X	X
LT Multi-Hazard #1	Update the Oregon City Emergency Operations Plan to provide a comprehensive multi-hazard emergency response program	Clackamas Fire District #1, Oregon City Police Department, Oregon City Commission	Long Term 5 Years	X	X	X	X	X
LT Multi-Hazard #2	Improve vegetation management throughout Oregon City	Community Services Department, Community Development Department	Long Term Ongoing	X		X	X	X

Section 2: Community Profile

The following section describes the City of Oregon City from a number of perspectives in order to help define and understand the city's sensitivity and resilience to natural hazards. Sensitivity factors can be defined as those community assets and characteristics that may be impacted by natural hazards, (e.g., special populations, economic factors, and historic and cultural resources). Community resilience factors can be defined as the community's ability to manage risk and adapt to hazard event impacts (e.g., governmental structure, agency missions and directives, and plans, policies, and programs). The information within this section represents a snapshot in time of the current sensitivity and resilience factors in Oregon City when the addendum was developed. The information documented below, along with the hazard assessments located in Section 4: Natural Hazards should be used as the local level rationale for the city's mitigation action items. Identifying actions that reduce Oregon City's sensitivity, thereby increasing its resilience, assist in reducing overall risk as identified on the area of overlap in Figure 1 below.

Figure 1 Understanding Risk[1]



2.1 Geography and the Environment

Oregon City has benefited from its natural setting. Its location on the Willamette and Clackamas Rivers supplied an abundant power source and bolstered an economy based on manufacturing, timber, and commerce. This prime location drew settlers from around the nation and helped Oregon City become the first incorporated city in Oregon. In the shadow of Mount Hood and surrounded by forests, Oregon City is a scenic settlement built on the "solid ground" of the valleys and hillsides.

These natural features also present a variety of hazards. The natural forces that created Mount Hood and the Cascade Range also cause earthquakes and volcanoes. Heavy precipitation can result in floods in the valleys and landslides on the hillsides. Weather extremes of cold, wind, heat and drought create winter storms and make conditions ripe for wildfires.

It is a well-accepted tenet that natural activities, such as rain, cold and heat are by themselves beneficial or, at worst, benign. They are part of the natural order. Floods replenish floodplains with nutrients and recharge aquifers and wildfires. Additionally, floods help preserve and restore appropriate plant life. These "hazards" do not cause problems, except when humans or structures are negatively impacted.

Disasters occur when natural hazards affect human development, especially in urban areas. More and more, we are realizing the danger in urbanizing areas such as floodplains and steep hillsides, as well as construction practices that do not account for natural activities such as earthquakes, erosion, wind and wildfires.

2.2 Significant Waterways

Oregon City contains a number of significant waterways, which are defined as anadromous fish-bearing streams. The city planning division reviews development within 200 feet of these waterways to ensure the riparian functions, habitat and benefits are not impaired.

Willamette River

The Willamette River flows along the northwestern boundary of the city limits for 15,027 centerline feet. It travels 19,158 centerline feet along the northwestern boundary of Oregon City's Urban Growth Boundary. For more information regarding the Willamette River, see page 2.2 of the 2002 Clackamas County Natural Hazards Mitigation Plan.

Clackamas River

The Clackamas River flows along the northern boundary of the city limits and Oregon City's Urban Growth Boundary for 9,328 centerline feet. For more information regarding the Clackamas River, see pages 2.2-2.3 of the 2002 Clackamas County Natural Hazards Mitigation Plan.

Abernethy Creek

Abernethy Creek is a tributary of the Willamette River and has a drainage area of 30 square miles. It flows through the city limits for 6,118 centerline feet. It travels 17,255 centerline feet through Oregon City's Urban Growth Boundary.

Newell Creek

Newell Creek is a tributary to Abernethy Creek within Newell Creek Canyon outside of the Urban Growth Boundary. It is a significant open space area within Metro's jurisdiction with a drainage area of 30 square miles and approximately 3 miles of sensitive stream habitat and wetlands within a steep ravine.

2.3 Minerals, Soils and Other Significant Geologic Features

The natural features and processes that shape the topographic, scenic, and natural resources of Oregon City present a variety of hazards to people and human activities, such as flooding, rock falls, landslides, wildfires, and earthquakes. Some of the hazards are related to steep topography, saturated soils and bedrock, and bare soil and rock that have been exposed by removing vegetation, movement of the earth, and erosion. The City of Oregon City maintains accurate and detailed contour data generated from LIDAR (light detection and ranging) surveys and regulates development in geologic hazard and steep slope areas through administration of a geologic hazard overlay zone district.

A Title 3 Map showing Oregon City's parks, open spaces, Newell Creek Basin, and Title 3 riparian zones can be found at the end of this section.

2.4 Population and Demographics

Portland State University's Population Research Center estimates Oregon City's 2008 population to be 30,405. Like many other communities in the Willamette Valley, Oregon City's population grew more quickly than expected in the 1990s and early 2000s, nearly doubling in size. Table 2.1 shows Oregon City's population growth between 1988 and 2008.

Table 2.1 Oregon City's Population 1988 to 2008

Year	Population	Change from previous year	
		Number	Percentage
1988	15,030		
1989	14,975	–55	–0.4%
1990	16,100	+1,125	+7.5%
1991	16,760	+660	+4.1%
1992	16,810	+50	+0.3%
1993	17,315	+505	+3.0%
1994	17,545	+230	+1.3%
1995	18,980	+1,435	+8.2%
1996	20,410	+1,430	+7.5%
1997	21,895	+1,485	+7.3%
1998	22,560	+665	+3.0%
1999	23,405	+845	+3.7%
2000	24,940	+1,535	+6.6%
2001	26,200	+1,260	+5.1%
2002	26,680	+480	+1.8%
2003	28,100	+1,420	+5.3%
2004	28,370	+270	+1.0%
2005	28,964	+594	+2.1%
2006	29,540	+576	+1.9%
2007	30,060	+520	+1.7%
2008	30,405	+345	+1.1%

Source: Portland State University Population Research Center

Disaster impacts in terms of loss and the ability to recover vary among population groups following a disaster. Historically, 80% of the disaster burden falls on the

public. Of this number, a disproportionate burden is placed upon special needs groups, particularly children, the elderly, the disabled, minorities, and low income persons. Portions of Oregon City's residents fall into these special needs populations. In 2007 approximately 11.7% of Oregon City's population had an income below the poverty level. According to the 2000 Census, roughly 18% of households have one or more people over the age of 65, and about 4.5% of Oregon City's population speaks English less than "very well." [2] More information on Oregon City's special needs populations are shown in Tables 2.2 and 2.3.

Table 2.2 Population by Race in 2000

Race	Population
White	23,212
Hispanic or Latino	1,283
Asian	283
American Indian and Alaska Native	240
Black or African American	143
Native Hawaiian and other Pacific Islander	26
Some other Race	8
Two or more Races	559

Source: US Census 2000

Table 2.3 Disabled Population in 2000

Age	Number of People
5 to 15	406
16 to 64	4,648
65 and older	2,152
Percent of Population with a Disability	28.2%

Source: US Census 2000

A Vulnerable Populations Map showing the locations of schools, hospitals, and other vulnerable populations in Oregon City can be found at the end of this section.

2.5 Employment and Industry

Oregon City's long history has seen many shifts in its economic base. In the late 1840s to 1860s industry boomed as a number of mills were established to support the need for lumber and flour. River transportation developed as a new industry in 1850 when the first steamboat on the Willamette River was built. In the 1860s the economy shifted from a service and shipping based economy to a manufacturing based economy. The Imperial Flour Mills were built from 1863 to1864 and the Oregon Manufacturing Company was established in 1864. The first paper mill was founded in 1866. From the 1880s to 1910s the timber and wood products industries prospered and became the largest employers in the county.[3]

Today, Oregon City's economy is primarily service based, including government and education. Major taxpayers include Portland General Electric, Blue Heron Paper Company, Quantum Management (property management), Metropolitan Life Insurance Company, Qwest Corporation (telecommunications), NW Natural (natural gas utility), Berryhill Limited Partnership (Property Management), Deloitte & Touche

(LLC), and Willamette Falls Hospital. Table 2.4 shows the five largest employers in the city in 2007.

Table 2.4 Five Largest Employers in 2007

Employer	Product/Service	Number of Employees
Clackamas County	Government	2,100
Clackamas Community College	Education	1,102
Oregon City School District	Education	800
Willamette Falls Hospital	General Medical and Surgical Hospital	760
Blue Heron Paper Company	Newsprint Paper Mill	372

Source: City of Oregon City

Median income can be used as an indicator of the strength of the region's economic stability. In 2007, the median household income was estimated at $56,321, more than $8,900 above the state average of $47,385.[4] Although median income can be used to compare the city as a whole, this number does not reflect how income is divided among area residents.

The Economic & Populations Centers Map at the end of this section illustrates the locations of some of these large employers and economic centers.

2.6 Housing

Housing type and age are important factors in mitigation planning. Certain housing types tend to be less disaster resistant and warrant special attention. Mobile homes, for example, are generally more prone to wind and water damage than standard stick-built. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed to assure homes are more resilient. For example, structures built after the late 1960s in the Northwest use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities consequently developed ordinances that required homes in the floodplain to be elevated to one foot above the floodplain to avoid future damages.

As of 2005 Oregon City had 11,664 housing units, of which 10,743 were occupied and 921 were vacant. Of these housing units 67.5%, were owner-occupied and 32.5%, were renter occupied. The median year housing structures were built is 1977, meaning much of the city's housing stock was built before stricter seismic and floodplain building codes were put in place. The median value of an owner-occupied home in 2007 was $292,791.[5] See Tables 2.5 and 2.6 below for more information regarding housing type and age.

Oregon City is unique for its role in Oregon's history and for the age and diversity of its housing. Many of the older homes and buildings in the Canemah and McLoughlin neighborhoods have historical significance and need renovations to protect them from natural hazards. Future housing plans are aimed at the development of new housing that is compatible with existing historic sites, as well as the preservation and careful redevelopment of older historic housing.

Table 2.5 Housing Type

Housing Type	Percent
Single Family	71.1%
Multi-Family	26.1%
Mobile Home	2.7%
Boat, RV, Van, etc.	0.1%

Source: US Census Bureau, 2005-2007 American Community Survey

Table 2.6 Housing Structure Age

Year Structure Built	Number of Structures	Percent of Structures
2000 or later	1,975	16.9%
1990 to 1999	2,936	25.2%
1980 to 1989	692	5.9%
1970 to 1979	2,395	20.5%
1960 to 1969	776	6.7%
1950 to 1959	286	2.5%
1940 to 1949	891	7.6%
1939 or earlier	1,713	14.7%

Source: US Census Bureau, 2005-2007 American Community Survey

2.7 Land Use and Development

Oregon City has grown in land area over the years. In 1982, Oregon City occupied 3,000 acres. In 2002, Oregon City occupied 7,295 acres and today the city limits encompass 5,943.76 acres. Urbanization at the edge of Oregon City is constrained by the Willamette River and the City of West Linn to the west, Clackamas River and the City of Gladstone to the north, and steep topography to the south and east.

2.7.1 Future Development

Future development without proper planning may result in worsening problems associated with natural hazards. Metro, the regional government for Clackamas, Multnomah, and Washington counties, determines many land use laws for the tri-county region and sets the urban growth boundary. The entire Portland Metro area is subject to tremendous growth pressures due to its desirable location and the restrictions on urban sprawl placed by urban growth boundary requirements.

In 2002, a buildable land inventory reviewed the opportunities for commercial and industrial development throughout the city and within the Urban Growth Boundary. The Economic Development Technical Report (2002) revealed 22.7 developable acres of vacant and redevelopable commercially zoned property, and 181 developable acres of land zoned for, or planned to be used for, industrial purposes. The Vacant Lands Map at the end of this section demonstrates that most of this land is in the downtown area, north of Abernethy Creek and south of Highway 213, and near Clackamas Community College along both sides of Beavercreek Road. Given the area's growth rate and development regulations, it can be expected that these sites will be developed over the next 10 - 20 years.

Oregon City was designated a Regional Center in Metro's 2040 Growth Plan. As one of seven Regional Centers for the Portland Metro Area, Oregon City is working towards becoming a hub for its surrounding satellite communities. Metro's 2040 Growth Concept contains land-use and transportation policies that allow Metro to manage growth, protect natural resources, and make improvements to facilities and infrastructure while continuing the region's quality of life. The concept includes expanding transportation options by providing alternatives to driving, revitalizing main streets, retaining the character of individual places, protecting natural resources, furthering economic growth and creating jobs, and using land more efficiently to stop sprawl. The Oregon City Regional Center, including Oregon City and surrounding communities will ultimately serve more than 150,000 people.

Potential project within Oregon City's Regional Center include Clackamette Cove, Park Place, and Beavercreek Road. The city owns Clackamette Cove, approximately 80 acres of land and water just west of I-205 and directly north of the older Oregon City Shopping Center on McLoughlin Boulevard. The city has worked with developers to create a mixed-use proposal for the site which would provide parks and public spaces to approximately 46 acres around the cove, and include public improvements such as a riverfront esplanade, small marina, water sports activities, and plaza for events. The waterfront village will feature housing, a waterside restaurant, and office space.

Two concept plans were adopted in 2008 for the Park Place and Beavercreek Road areas, which remain primarily outside of the city limits. The Park Place Concept Plan includes a new civic institution, parks and open space, and two mixed-use neighborhood-oriented commercial nodes that integrate commercial land uses, residential land uses, and public open space. The Beavercreek Road Concept Plan includes two mixed use neighborhoods, a main street, mixed employment village, an employment campus for tech flex and industrial uses, and environmentally sensitive resource areas.

2.8 Transportation

Oregon City has three state highways and one interstate. State Highway 99E (or McLoughlin Blvd.), runs along the western border of the city; Highway 213 runs north to south through the eastern part of the city; Highway 43 enters at the northwest border of the city, and Interstate 205 runs along the northern border. Oregon City public transportation is serviced by Tri-Met which provides daily local bus services to numerous community transit centers, including downtown Oregon City and the Clackamas County College Campus. The Canby Area Transit (CAT) additionally serves Oregon City with service to Canby, Aurora, Hubbard and Woodburn, while the South Clackamas Transportation District (SCTD) provides transportation between Clackamas Community College south to Molalla. Oregon City is also accessed by the Union Pacific Railroad main line and Amtrak, which travels northeast to southwest carrying both passengers and freight.

Transportation is an important consideration when planning for emergency service provisions. Growth within a city will pressure both major and minor roads, especially

if the main mode of travel is by single occupancy vehicles. The mode by which people travel to work can help predict the amount of traffic congestion and the potential for accidents. Table 2.7 shows the different methods city residents use to travel to work.

Table 2.7 Transportation used to Commute to Work

Means of Transportation	Number	Percent
Drive alone	10,861	75.4%
Carpool	1,648	11.4%
Work at home	588	4.1%
Public Transportation	558	3.9%
Walk	402	2.8%
Other	352	2.4%

Source: US Census Bureau, 2005-2007 American Community Survey

2.9 Historical and Cultural Resources

Historic and cultural resources such as historic structures and landmarks can help to define a community and may also be sources of tourism dollars. Protecting these resources from the impact of disasters is important. As the first incorporated city in the state of Oregon, Oregon City has numerous historical and cultural resources. A Cultural Assets Map showing the locations of the city's cultural assets can be found at the end of this section.

Oregon City offers an array of attractions for its citizens and visitors including:

- 7th Street Historic Fire Station
- 90 Historic Homes in Canemah, a National Registered Historic District
- 376 Individually Designated Historic Homes in McLoughlin Historic Conservation District
- 98 Individually Designated Historic Homes Outside of a Historic District
- Baker Cabin Historic Site
- Carnegie Center
- Clackamas County Courthouse
- End of the Oregon Trail Interpretive Center
- Ermatinger House
- McLoughlin House
- McLoughlin Promenade
- Museum of the Oregon Territory
- Oregon City Municipal Elevator
- Philip Foster Farm
- Rose Farm
- Stevens-Crawford House
- Willamette Falls Locks
- Oregon City/West Linn (Hwy. 43) Bridge

The city's Historic Review Board reviews new development in the McLoughlin and Canemah historic districts and the city has adopted a Historic Overlay District to

ensure that new development is compatible with existing historically designated structures.

2.10 Government Structure

The City Commission is the policy making body for Oregon City. The commission is composed of a mayor and four commissioners, all of whom are elected from the city at large. The Mayor and Commissioners in turn appoint the city manager, who serves as the administrative head of the city's government.

The following departments within the city have a role in natural hazards mitigation:[6]

The **Community Development Department** is responsible for guiding growth and development in the city. The department includes three divisions:

Building is responsible for plan review and inspections on commercial, industrial and residential developments, as well as fire life and safety plan review.

Planning is responsible for all long range and current planning for new development, as well as the city's natural resource, geologic hazard and floodplain overlay zones. It is also responsible for implementation of the Oregon City Comprehensive Plan.

Geographic Information Services (GIS) supplies mapping services to the public, city planners, engineers, public works, and other departments.

The **Public Works Department** operates and maintains existing infrastructure, plans and constructs capital improvements, and enforces the municipal code. The public works department includes six divisions:

Code Enforcement provides prompt, effective and efficient enforcement of the Oregon City Municipal Code.

Engineering Services reviews and approves development applications to ensure they are up-to-date on policies and engineering standards. It provides professional engineering services and consultation to various city departments and the general public for private development.

Water Operations distributes and maintains the potable water supply.

Wastewater Operations provides wastewater utility by maintaining and improving the wastewater collection system. They also respond to emergency system bypasses to reduce hazards to human health and the environment.

Stormwater Division provides a safe and reliable stormwater system and implements watershed protection and restoration actions that promote surface water quality and stream health.

Streets Division maintains Oregon City's transportation system.

The **Finance Department** manages the city budget, information systems, and accounting. Tasks of the department include utility billing, accounts payable and receivable, payroll, budget development and management, and internal auditing.

The **Public Safety Department** is committed to providing quality public safety services to the Oregon City community. Police services are provided by the Oregon City Police Department and fire services are provided by Clackamas Fire District #1.

The **Community Services Department** focuses on increasing, improving, and facilitating communication between the city and its residents. The department supports Oregon City Neighborhood Associations, the Citizen Involvement Committee, and numerous other citizen involvement committees. The department also manages the Library, Senior Center, and Parks and Recreation.

2.11 Existing Plans and Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth. Such existing plans and policies can include Comprehensive Plans, zoning ordinances, and technical reports or studies. Plans and policies already in existence have support from local residents, businesses and policy makers. Many land-use, comprehensive, and strategic plans get updated regularly, and can adapt easily to changing conditions and needs.

Oregon City's Natural Hazards Mitigation Plan Addendum includes a range of recommended action items that, when implemented, will reduce the city's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the city's existing plans and policies. Linking existing plans and policies to the Natural Hazards Mitigation Plan Addendum helps identify what resources already exist that can be used to implement the action items identified in the addendum. Implementing the addendum's action items through existing plans and policies increases their likelihood of being supported and implemented, and maximizes the city's resources.

The following list documents the plans and policies already in place in Oregon City:

Plan: Oregon City Municipal Code
Date of Last Revision: December, 2004
Author/Owner: City of Oregon City
Description: The purpose of the Municipal Code is to set minimum regulations on land use, development and construction and activities within the city.
Relation to Natural Hazard Mitigation:

- Title 8 Health and Safety, Chapter 8.08 Nuisances: This chapter defines and details nuisances in the city affecting health, morals, and peace & safety.
- Title 8 Health and Safety, Chapter 8.28 Weeds: This chapter requires property owners and managers to properly cut and remove all noxious vegetation, dead trees, dead brush, and dead shrubs.
- Title 12 Streets, Sidewalks and Public Places, Chapter 12.08 Community Forest and Street Trees: This chapter sets rules for tree planting and maintenance.
- Title 12 Streets, Sidewalks and Public Places, Chapter 12.12 Utility Wires and Poles: This chapter prohibits persons from erecting poles or stretch wires in, on, under, over or across any of the streets, alleys, bridges, public ways, or public grounds within the city.
- Title 13 Public Services: This title describes the public services provided by the city and all rules and regulations regarding those services.
- Title 15 Buildings and Construction: This title includes all codes for building and construction.

- Title 16 Land Divisions: This title includes general provisions and administration of land divisions.
- Title 17 Zoning: This title includes description of all zoning types, development standards and overlays within the city.
- Title 17 Zoning, Chapter 17.40 Historic Overlay District: This chapter safeguards the city's historic, aesthetic and cultural heritage through review of new development and improvements in the overlay district.
- Title 17 Zoning, Chapter 17.42 Flood Management Overlay District: This chapter establishes a flood overlay district which sets conditions and restrictions on land use in this zone.
- Title 17 Zoning, Chapter 17.44 Geologic Hazard Overlay Zone: This chapter provides safeguards in connection with development on or adjacent to steep hillside and landslide areas and other identified known or potential hazard areas.
- Title 17 Zoning, Chapter 17.49 Water Quality Resource Overlay Zone: This chapter protects and improves water quality, supports beneficial water uses, and protects the functions and values of existing and newly established water quality resource areas which provide a vegetated corridor to separate protected water features from development.

Plan: Oregon City Comprehensive Plan
Date of Last Revision: December, 2004
Author/Owner: City of Oregon City
Description: The purpose of the Comprehensive Plan is to promote sustainability and sustainable development, contain urban development, promote redevelopment, protect natural resources, foster economic vitality, provide efficient and cost-effective services, and ensure a sense of history and place.
Relation to Natural Hazard Mitigation:

- Section 2 Land Use
- Section 5 Open Spaces, Scenic and Historic Areas, and Natural Resources
- Section 7 Natural Hazards
- Section 8 Parks and Recreation
- Section 9 Economic Development
- Section 10 Housing
- Section 11 Public Facilities
- Section 12 Transportation
- Section 14 Urbanization
- Section 15 Willamette River Greenway

Plan: Oregon City Downtown Community Plan
Date of Last Revision: August, 1999
Author/Owner: City of Oregon City
Description: The plan strives to enhance the historical heart of Oregon City, while promoting a positive change for the future. The plan emphasizes the creation of pedestrian-friendly places, varied mixed use developments, new open space and civic opportunities.
Relation to Natural Hazard Mitigation: The Downtown Community Plan can be used to implement mitigation activities related to emergency situations.

Plan: Oregon City Operations Facilities Plan
Date of Last Revision: December, 2005
Author/Owner: City of Oregon City
Description: The plan analyzes and evaluates the strengths and weaknesses of the current facilities and projects their needs over the next ten years.

Relation to Natural Hazard Mitigation: The Operations Facilities Plan can be used to implement mitigation activities related to emergency situations.

Plan: Oregon City Sanitary Sewer Master Plan
Date of Last Revision: December, 2003
Author/Owner: City of Oregon City
Description: The plan evaluates the city's sanitary sewer system and recommends improvements as needed to meet the city's wastewater collection needs now and through a 20-year planning period.
Relation to Natural Hazard Mitigation: The Sanitary Sewer Master Plan can be used to implement mitigation activities related to emergency situations.

Plan: Oregon City Transportation System Plan
Date of Last Revision: April, 2001
Author/Owner: City of Oregon City
Description: The plan works as a guide to manage and develop the city's transportation facilities over a 20-year period to 2002. It incorporates the vision of the community into an integrated and efficient land use and transportation system that addresses the multi-modal desires of the community.
Relation to Natural Hazard Mitigation: The Transportation System Plan can be used to implement mitigation activities related to emergency situations.

Plan: Oregon City Water Master Plan
Date of Last Revision: October, 2004
Author/Owner: City of Oregon City
Description: The plan summarizes the components of the existing water distribution system, analyzes local water demand patterns, evaluates the performance of the water system with respect to critical service standards, identifies the improvements necessary to remedy system deficiencies and accommodate future growth. The plan also recommends specific projects for inclusion in the water distribution system Capital Improvement Program (CIP).
Relation to Natural Hazard Mitigation: The Water Master Plan can be used to implement mitigation activities related to emergency situations.

Plan: Oregon City Waterfront Master Plan
Date of Last Revision: January, 2002
Author/Owner: City of Oregon City
Description: The primary focus of the plan is to balance the interplay of the natural environment with the economic potential of public and private development within the area. The plan highlights openspace improvements and mixed use redevelopment within the waterfront district. The plan emphasizes the need to build connections within the waterfront area as well as to extend these connections to adjacent community interests including the downtown core and the End of the Oregon Trail Museum.
Relation to Natural Hazard Mitigation: The Waterfront Master Plan can be used to implement mitigation activities related to emergency situations.

2.11.1 Community Organizations and Programs

Social systems can be defined as community organizations and programs that provide social and community-based services, such as health care or housing assistance, to the public. In planning for natural hazard mitigation, it is important to know what social systems exist within the community because of their existing connections to the public. Often, actions identified by the plan involve communicating with the public

or specific subgroups within the population (e.g. elderly, children, low income). The county and its cities can use existing social systems as resources for implementing such communication-related activities because these service providers already work directly with the public on a number of issues, one of which could be natural hazard preparedness and mitigation.

The following list highlights community organizations within the city that may be potential partners for implementing action items:

- Greater Oregon City Watershed Council
- Neighborhood Associations including:
  - Canemah
  - Caufield (currently inactive)
  - Gaffney Lane
  - Hazel Grove / Westling Farm
  - Hillendale
  - McLoughlin
  - Park Place
  - Rivercrest
  - South End
  - Tower Vista (currently inactive)
- Oregon City Citizen Involvement Council
- Oregon City Chamber of Commerce
- Oregon City Kiwanis Club
- Oregon City Lions Club
- Oregon City Rotary Club
- Oregon City High School Student Clubs such as:
  - Associated Student Body
  - Green Team
  - Key Club
  - National Honor Society
  - Outdoor Club

Legend

Environmental Areas

- Parks
- Open Spaces
- Newell Creek Basin
- Title 3 Wetland Areas and Riparian Zones

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets
- Taxlots
- Rivers

The City of Oregon City makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Gladstone

Oregon City

Willamette Falls

Park Place

Dahl Park

Clackamette Park

Sunset

Henrici

N

W E

S

City of Oregon City

Title 3 Map

0 0.25 0.5 1 1.5 2 Miles

City of Oregon City
Geographic Information Systems
320 Warner Milne Rd
Oregon City, OR 97045
503-657-0891
www.ci.oregon-city.or.us

Map Date: 01/23/2009
Map File: Hazard_Environmental_Areas_11x17_portrait.mxd
Plot File: Hazard_Environmental_Areas_11x17P_20091118.pdf

Legend

Vulnerable Populations

- Elementary School
- Middle School
- High School
- Community School
- Pioneer Community Center
- Senior Living Facility
- Low Income Housing
- Willamette Falls Hospital

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets
- Taxlots
- Rivers

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Gladstone
Oregon City
Willamette Falls
Park Place ES
Holcomb ES
King ES
Mt. Pleasant ES
Gardiner MS
McLoughlin ES
Gaffney Lane ES
OC Retirement
Centerview Guest Home
Barclay
Oregon City HS
Pioneer Community Center
St John the Apostle ES
OC Manor
Eastham
Golden Age Care Center
Willamette Falls Hospital
Mt. View Convalescent
Gilman Park
OC Nursing Home
Roundtree Residence
Sierra Vista Care Center
Camlu Retirement Apts
Stillmeadow Senior Apts
N Clackamas Christian ES
N Clackamas Christian HS
Oregon City HS Freshman Campus
Henrici
Dahl Park
Clackamette Park
Willamette River
Abernethy Creek
Interstate 205
Hwy 99E
Hwy 213
82nd
Washington St
Abernethy Rd
Redland Rd
Warner Milne Rd
Beavercreek Rd
Forsythe
Thayer Rd
Maple Lane Rd
Meyers Rd
Leland Rd
Central Point Rd
Partlow Rd
South End Rd
Linn Ave
Front Ave
Swan Ave
Holly Ln
Fir Ave
Main St
Molalla Ave
Beaver Creek

City of Oregon City
Vulnerable Populations Map

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W E
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0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Vulnerable_Populations_11x17_portrait.mxd
Plot File: Hazard_Vulnerable_Populations_11x17P_20090123.pdf

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Legend

Economic & Population Centers

- Shopping Center
- Government Building
- School
- Paper Mill
- Regional Center

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets
- Taxlots
- Rivers

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Gladstone
Oregon City
Shopping Center
Barclay School
Oregon City School District Admin
Blue Heron Paper Mill
Old Oregon City HS
St John the Apostle ES
Eastham
Willamette Falls Hospital
Park Place ES
Holcomb ES
Dahl Park
Clackamette Park
Willamette Falls
King ES
Mt Pleasant ES
Gardiner MS
City of Oregon City
Oregon City
Clackamas County
Danielson's Shopping Center
South Ridge Shopping Center
McLoughlin ES
Berry Hill Shopping Center
Gaffney Lane ES
Clackamas Community College
N Clackamas Christian ES
N Clackamas Christian HS
New Oregon City HS
Trails End Marketplace
Henrici
Abernethy Creek
Willamette River
Interstate 205
Hwy 99E
Hwy 213
82nd
Forsythe
Redland
Beavercreek
Molalla
Washington St
Abernethy Rd
Park Place
Front Ave
Swan
Linn
Leland Rd
Central Point Rd
Warner Milne Rd
Maple Lane Rd
Thayer Rd
Meyers Rd
Gaffney Ln
Holly Ln
Broadway Ave
Division St
McLoughlin Blvd
Portland Ave
Harvard Ave
Main St
Jackson St
Center St
Hilltop
Mountain View Dr
Donovan Rd
Gerkman Rd
Lodge
Loder Rd
Henrici Rd
Beaver Creek Rd
Cemetery Rd
Geer Rd
Warnock
Cripsen
Tioga
Oak Grove
Clairmont Dr
Shadow Ridge Dr
Shady Glen St
Quail Crest Ln
Old Acres Ln
Saddle Ln
Hillcrest Rd
Fern Bluff Dr
Fern Berry Ln
Kelly Scott Ln
Bronco Ln
Hill Valley Ln
Mason Heights Dr
Meadow Ridge Rd
Sunset Ridge Ct
Sunset Dr
Sunset Ave
Sunset Terrace
Sunset Ct
Sunset Cir
Sunset Pl
Sunset Ln
Sunset Way
Sunset Loop
Sunset Blvd
Sunset Park Rd
Sunset Park Dr
Sunset Park Ln
Sunset Park Way
Sunset Park Loop
Sunset Park Blvd
Sunset Park Ct
Sunset Park Cir
Sunset Park Pl
Sunset Park Terrace
Sunset Park Ave
Sunset Park St

Legend

Vacant Lands

- Constrained
- Unconstrained

- Taxlots
- Parks / Cemeteries (Constrained)
- Rivers

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets

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Gladstone
Oregon City
Willamette Falls
Park Place
Dahl Park
Clackamette Park
Jon Storm
Abernethy Bridge at the Trail Interpretive Landing
Atkinson
Barclay
McLoughlin Promenade
Pioneer Community Center
Senior Center
Waterboard
Old Canemah
Canemah
Rivercrest
Singer Creek
Barclay Hills
Stafford
Mountaiview Cemetery
St. John's Catholic Cemetery
Canemah Cemetery
Hazelwood
Chapin
Shenandoah
Open Space
Hillendale
Wesley Lynn Park
Henrici
FORSYTHE
Bar
RIVER RD
ABERNETHY
PORTLAND AV
82ND
S
HOLCOMB BLVD
FRONT AV
SWAN
WASHINGTON ST
INTERSTATE 205
ABERNETHY RD
HWY99E
1ST
ANCHOR WAY
REDLAND
HWY 213
DIVISION ST
BLVD
HIGH
McLOUGHLIN
LINN AV
HOLLY LN
HOLLY
Arliss Creek
Creek
CEMETERY RD
END RD
WARNER PARROT RD
WARNER MILNE RD
LANE
MAPLE
MOLALLA
BEAVERCREEK RD
BEAVERCREEK
THAYER RD
PARTLOW RD
POINT
CENTRAL
LELAND RD
MEYERS RD
GAFFNEY LN
GAFFNEY AV
FIR ST
MAIN ST
RIVER
Willamette
Willamette River
S GERKMAN RD
S LINDSAY
S MOLALLA AV
S MAPLE LN
S THAYER RD
S MEYERS RD
S LELAND RD
S MCCORD RD
S POINT RD
S CENTRAL RD
S GAFFNEY LN
S GAFFNEY AV
S FIR ST
S MAIN ST
S DIVISION ST
S HOLLY LN
S HOLLY
S LINN AV
S FRONT AV
S SWAN
S WASHINGTON ST
S ANCHOR WAY
S REDLAND RD
S 82ND
S BEAVERCREEK RD
S HENRICI RD
S BEAVERCREEK RD
S HOLCOMB BLVD
S ABERNETHY RD
S PORTLAND AV
S RIVER RD
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S 97TH
S 98TH
S 99TH
S 100TH

City of Oregon City
Vacant Lands Map

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W E
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0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Vacant_Lands_11x17_portrait.mxd
Plot File: Hazard_Vacant_Lands_11x17P_20090123.pdf

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Legend

Cultural Assets

- Clackamas County Courthouse
- Cultural/Historic Site
- Canemah Historic District
- McLoughlin Conservation District

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets
- Taxlots
- Rivers

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Gladstone
Oregon City
Straight Pioneer Cemetery
End of the Oregon Trail Interpretive Center
Clackamas County Courthouse
Municipal Elevator
McLoughlin House
Stevens Crawford Museum
7th Street Fire Station
Ermatinger House
Carnegie Center
Museum of the Oregon Territory
Pioneer Cemetery
Dahl Park
Clackamette Park
Willamette Falls
Sunset
Henrici
INTERSTATE 205
ABERNETHY RD
82ND
FORSYTHE
WASHINGTON ST
HOLCOMB BLVD
REDLAND RD
HWY 213
MOLALLA AV
BEAVERCREEK RD
WARNER MILNE RD
PARRISH RD
LELAND RD
CENTRAL POINT RD
Willamette River
Abernethy Creek

City of Oregon City
Cultural Assets Map

N W E S

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Cultural_Assets_11x17_portrait.mxd
Plot File: Hazard_Cultural_Assets_11x17P_20090123.pdf

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Section 3: Hazard Assessment

3.1 What is a Hazard Assessment?

Conducting a hazard assessment can provide information on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment that may result from natural hazard events. Hazard assessments are subject to the availability of hazard-specific data. Oregon City conducted a hazard assessment for all of the hazards for which data was available. The three levels of a risk assessment are as follows:

1) ***Hazard Identification*** identifies the geographic extent and intensity of the hazard and the probability of its occurrence. Maps are frequently used to display hazard identification data. Oregon City identified seven major hazards that consistently affect this geographic area. These hazards – floods, landslides, wildfires, earthquakes, severe winter storms, windstorms, and volcanoes – were identified through an extensive process that utilized input from the Hazard Mitigation Advisory Committee. The geographic extent of each of the identified hazards has been identified by the Oregon City GIS Department using the best available data, and is illustrated by the maps listed in Table 3.1.

2) ***Vulnerability Assessment/Inventorying Assets*** combine hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard. A complete listing of community assets is located later in this section and a detailed description of the vulnerability of these assets can be found in the specific hazard sections.

3) ***Risk Analysis/Estimating Potential Losses*** involves estimating the damages, injuries, and financial losses likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. Unfortunately, there is insufficient data and resources for conducting a risk analysis for the natural hazards affecting Oregon City. However, this need is identified in the action plan, and a complete risk assessment will be conducted should resources are available.

Table 3.1 List of Hazard Mitigation Plan Maps

Type of Map	Section of the Plan
Environmental Assets	2: Community Profile
Vulnerable Populations	2: Community Profile
Economic Population Centers	2: Community Profile
Vacant Lands	2: Community Profile
Cultural Assets	2: Community Profile
Critical Facilities	3: Hazard Assessment
Essential Facilities	3: Hazard Assessment
Critical Roads	3: Hazard Assessment
100 Year Floodplain	4: Natural Hazards
Landslide Hazard	4: Natural Hazards
Wildfire Hazard	4: Natural Hazards
Snowplow Routes/Sanding Priority	4: Natural Hazards
Earthquake Hazard	4: Natural Hazards

3.2 Mapping Methodology

Areas of hazard zones were calculated by overlaying the hazard coverage on the tax lot base. Those tax lots that intersected with the hazard areas were included in the area totals. Similarly, critical and essential facilities affected by each hazard were determined by overlaying each hazard zone map on top of the critical and essential facilities maps. The datasets used are from the Oregon City digital database and have the following sources:

1) Title 3 data:
   The riparian zones, water quality resource areas, wetlands, and vegetated corridors were generated from Oregon City's Title 3 datasets.

2) Floodplains:
   Taken from the FEMA 100 year floodplain maps
   1996 Flood Overlay

3) Slope and Landslides:
   Point landslide data from study by Scott Burns of Portland State University.
   Slope polygons generated by Clackamas County from 2-foot contours.

4) Wildfires:
   Taken from the Clackamas County wildfire hazard maps

5) Earthquakes:
   Relative earthquake hazard data provided by Metro and the Department of Geology and Mineral Industries (DOGAMI)

3.3 Community Assets: Vulnerability Assessment

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and the environmental integrity of Oregon City. Critical Facilities (C) are facilities and infrastructural

elements that are necessary for emergency response efforts. Essential facilities (E) are facilities and infrastructural elements that supplement emergency response efforts. The exposure of community assets to natural hazards is described in Table 3.2 below. The community assets were defined as follows:

City Facilities

1. Oregon City Main Fire Station/Emergency Operations Center (C)
2. Holcomb Fire Station (C)
3. South End Fire Station (C)
4. Oregon City Police Department (C)
5. Willamette Falls Hospital (C)
6. Operations Center (C)
7. Oregon City Carnegie Center
8. City Hall (E)
9. Pioneer Community Center (E)
10. Abernethy Center (E)
11. City Office Buildings (E)

County Facilities

1. Beavercreek Fire Station (C)
2. C-COM (C)
3. Clackamas County Emergency Operations Center (C)
4. Clackamas County Jail (E)

Federal Facilities

1. National Guard Armory (E)

Schools (Potential Shelter Sites)

1. John McLoughlin Elementary
2. Gaffney Lane Elementary
3. Holcomb Elementary
4. King Elementary
5. Mt. Pleasant Elementary
6. Park Place Elementary
7. Gardiner Middle School
8. Ogden Middle School
9. Oregon City High School
10. Oregon City High School – Jackson Campus
11. Clackamas Community College
12. Eastham Community School
13. North Clackamas Christian
14. St. John the Apostle

Churches (Potential Shelter Sites)

1. Christ Church Apostolic
2. Great Day Fellowship Church
3. Light on the Hill Fellowship

4. Logan Community Church
5. Maranatha Baptist Church
6. Mountain View Community Church
7. St. John the Apostle Catholic Church
8. St. Paul's Episcopal Church
9. St. Philip Benizi Church
10. Stone Creek Christian Church
11. Trinity Lutheran Church – LCMS
12. Victorious Faith Family Church
13. Oregon City Christian
14. Oregon City Evangelical
15. First United Methodist Church
16. First Presbyterian
17. Oregon City Church of the Nazarene

Infrastructure

1. **Private Utilities**
    - Natural Gas System (C)
    - Electrical Power System (C)
    - Cellular Tower System (E)
    - Telephone System (E)
2. **Wastewater**
    - Tri City Wastewater Treatment Plant (C)
    - Wastewater Collection System (C)
    - Settler's Point Lift Station (E)
    - Amanda Lift Station (E)
    - Barclay Hills Lift Station (E)
    - Brendon Estates Lift Station (E)
    - Canemah Lift Station (E)
    - Cook Street Lift Station (E)
    - Elevator Lift Station (E)
    - Hilltop Acres Lift Station (E)
    - Parrish Road Lift Station (E)
    - Pease Road Lift Station (E)
    - Hidden Creek Lift Station (E)
    - Nobel Ridge Lift Station (E)
    - Newell Crest Lift Station (E)
3. **Water**
    - Hunter Pump Station (C)
    - Mountain View Pump Station (C)
    - Barlow Crest Reservoir (C)
    - Boynton Lift Station (E)
    - Boynton Standpipe Reservoir (C)
    - Henrici Reservoir (C)
    - Mountainview Reservoir #1 (2 MG) (C)
    - Mountainview Reservoir #2 (10.5 MG) (C)
    - South Fork Water Filter Plant (C)

- South Fork Water Intake (C)
- South Fork/Division Street Pump Station (C)
- Clackamas River Water/South Fork Water Intertie (C)
- South Fork Water Transmission Line (C)
- Water Distribution System (C)
- Fairway Downs Pump Station (E)
- Livesay Pump Station (E)

4. **Stormwater**
   - Stormwater Management System (E)
5. **Bridges, Overpasses and Main Culverts (C)**
   - Willamette River Bridge
   - I-205 at Clackamas River
   - McLoughlin Blvd at Willamette River
   - I-205 at Main Street
   - Washington Street at Abernethy Creek
   - Holcomb Blvd at Oregon 213
   - McLoughlin Tunnel at UPRR
   - Anchor Way at Abernethy
   - George Abernethy Bridge/I-205 over Willamette
   - Hwy 213/Redland Road overpass
   - McLoughlin Blvd. at Clackamas Road
   - McLoughlin at Abernethy Culvert
   - S.E. 82nd Pedestrian Bridge
6. **Arterials (C)**
   - Meyers Road
   - Central Point Road
   - South End Road
   - Leland Road
   - Molalla Ave
   - Beavercreek Road
   - Warner Milne Road
   - Warner Parrott Road
   - Linn Avenue
   - Division Street
   - McLoughlin Blvd/Highway 99E
   - High Street
   - 5th Street
   - 7th Street
   - Anchor Way
   - Redland Road
   - Abernethy Road
   - Washington Street
   - Holcomb Boulevard
   - Main Street (7th to McLoughlin Blvd)
   - Glen Oak Road
   - Maple Lane Road
   - Highway 213

- Interstate 205

Table 3.2 identifies the number of facilities and infrastructure exposed to each of the natural hazards that could affect Oregon City. The implications of exposure to the various hazards are outlined in each of the hazard sections (Section 4).

Table 3.2. Oregon City Vulnerability Assessment

Hazard	Land Area Exposed (Acres)	% Land Area Exposed	# Vul. Pop. Centers	Critical Facilities Exposed	Essential Facilities Exposed	Econ. & Pop. Centers Exposed	Cultural/ Historical Assets Exposed
Flood	606.91	9.66%	0	1	0	0	1
Landslide	536 acres (22 from points, 514 from steep slopes)	8.53%	0	1	0	0	0
Earthquake	6282	100%	28	25	32	9	10
Windstorm	6282	100%	28	25	32	9	10
Severe Winter Storm	6282	100%	28	25	32	9	10
Wildfire	6282	100%	28	25	32	9	10
Volcano	6282	100%	28	25	32	9	10

Legend

Critical Facilities

- Hospital
- Fire Station
- Public Building
- Power Sub-Station
- Reservoir
- Water Utilities
- Communication Tower
- Major Arterial Roads

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets

- Taxlots
- Rivers

The City of Oregon City makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Gladstone
Oregon City
Sunset
Willamette Falls
Dahl Park
Clackamette Park
Park Place
Power Substation
South Fork Water Intake
South Fork Water Filter Plant
Barlow Crest Reservoir
Fire Station
Hunter Pump Station
Livesay Pump Station
Willamette Falls Hospital
Public Works
Armory
Mountain View Pump Station
Power Communication Tower
City Hall/ Police Station
Boynton Pump Station & Standpipe
Clackamas County Emergency Operations
Fairway Downs Pump Station
Henrici
Henrici Reservoir
Abernethy Creek
Willamette River
Clackamas River
INTERSTATE 205
82ND
FORSYTHE RD
ABERNETHY RD
WASHINGTON ST
MOLALLA
BEAVERCREEK RD
REDLAND RD
HWY 213
HWY 99E

City of Oregon City
Critical Facilities Map

N W E S

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Critical_Facilities_11x17_portrait.mxd
Plot File: Hazard_Critical_Facilities_11x17P_20090123.pdf

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Legend

Essential Facilities

- Elementary School
- Middle School
- High School
- Clackamas Community College
- Community School
- Pioneer Community Center

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets
- Taxlots
- Rivers

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Gladstone
Oregon City
Willamette Falls
Willamette River
Clackamette Park
Dahl Park
Abernethy Center
Municipal Elevator Lift Station
Barclay
Old Oregon City HS
Carnegie Center
Pioneer Community Center
St John the Apostle ES
Eastham
National Guard Armory
City- Community Development
Canemah Lift Station
Barclay Hills Lift Station
Communication Cell Tower
Newell Crest Lift Station
King ES
Amanda Ct./ Arista Lift Station
Mt Pleasant ES
Gardiner MS
Hilltop Acres Lift Station
Cook Street Pump Station
Boynton Lift Station
City Hall
City Office Buildings
Clackamas County Jail
McLoughlin ES
Pease Rd. Lift Station
Settlers Point Lift Station
Gaffney Lane ES
Clackamas Community College
Parrish Rd. Lift Station
N Clackamas Christian ES
N Clackamas Christian HS
New Oregon City HS
Hidden Creek/Meyers Rd. Pump Station
Nobel Ridge Lift Station
Fairway Downs Pump
Brendon Estates Lift Station
Henrici
Park Place ES
Holcomb ES
INTERSTATE 205
HWY 99E
ABERNETHY RD
WASHINGTON ST
82ND
FORSYTHE
REDLAND
HWY 213
BEAVERCREEK
MOLALLA
LINN
FRONT AV
SWAN
DIVISION
MCLOUGHLIN BLVD
PARRISH RD
LELAND RD
CENTRAL POINT RD
MEYERS RD
GAFFNEY LN
ANCHOR WY
Abernethy Creek
Clackamas River

City of Oregon City
Essential Facilities Map

N
W E
S

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Essential_Facilities_11x17_portrait.mxd
Plot File: Hazard_Essential_Facilities_11x17P_20090123.pdf

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Legend

- Critical Culverts / Overpass
- Critical Arterial Roads
- Other Arterials
- Minor Streets
- City Limits
- UGB
- Taxlots
- Rivers

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City of Oregon City

Critical Roads Map

N W E S

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Critical_Roads_11x17_portrait.mxd
Plot File: Hazard_Critical_Roads_11x17P_20090123.pdf

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4.1 Flooding

Flooding results when there is an excess amount of rain or snowmelt and river channels, ditches and other watercourses are filled with more water than they can hold. When precipitation brings more water (or when there is a blockage in the watercourse), the surrounding land is flooded.

In this part of the country, flooding is most common from October through April when storms from the Pacific Ocean bring intense rainfall. Flooding can be aggravated when the rain is accompanied by snowmelt, frozen ground, and high tides. It was a combination of these factors that produced the most recent disastrous floods in February and November 1996.

There are four main types of flooding that impact Oregon City:

Riverine Flooding

These floods have a long duration. Often, the conditions that precede this type of flooding can be observed 10 to 20 days in advance of the flood crest. Very heavy rains over a period of five to ten days can bring the waterways in Oregon City to flood stage, but the worst flooding requires several other conditions. Riverine flooding occurs along three major waterways:

- Willamette River (drainage area of 10,100 square miles);
- Clackamas River (drainage area of 937 square miles); and
- Abernethy Creek (drainage area of 30 square miles).

Local Drainage

Local drainage flooding occurs along the smaller creeks and drainage ways. Local drainage flooding is more likely to result from heavy local storms. Local drainage problems occur throughout the city. There are three general types of problems:

- High water tables, especially in the southern part of the city, mean wet crawl spaces, yards and, sometimes basements after local storms.
- In some areas, the “lay of the land” means surface water doesn’t drain quickly to a receiving stream or storm sewer.
- Storm sewers and culverts may be too small to carry heavier flows.

Local drainage problems have been aggravated by property owners who do not realize the repercussions of their actions. Roadside ditches and swales between buildings may be filled by owners who want a more level yard that is easier to mow. Some residents dump their yard clippings and other waste into the nearest ditch, adding to the debris that dams or plugs channels.

Local drainage flooding may occur with little warning, but the depths and velocities are usually not life threatening.

Flash Flooding

These floods are of short duration and often occur after intense local rainstorms that are frequently associated with late-summer (August–September) thunderstorms. Flash flooding events generally last less than two hours and can damage properties and structures located very close to small waterways, such as Abernethy Creek, or can even be generated by run-offs from steep street sections. Flash floods can also occur on any of the waterways following failure of an upstream dam. The speed of water onset, lack of advance warning, and depth of flooding make dam failures a potentially catastrophic event.

Dam Flooding

There are four major dams upstream of Oregon City on the Clackamas River: North Fork, Faraday, River Mill and Timothy. These are operated by Portland General Electric and are subject to the dam safety and warning requirements of the Federal Energy Regulatory Commission.

According to the Clackamas County Emergency Operations Plan, should the North Fork Dam fail under a "probable maximum flood" (a worst case scenario where all four dams fail), parts of Oregon City would be inundated by a wall of water 60 - 80 feet high in approximately an hour and a half. This would be a severe threat to public health and safety. There are no major dams on Abernethy Creek and the Willamette River dams are far enough upstream and dispersed so that failures on these two waterways would not be much worse than a regular flood.

4.1.1 Flooding History

The main streets of Oregon City were flooded as early as 1861 when the Willamette River spilled over four feet of water on them. Since then, severe riverine flooding on the Willamette occurred in 1890, 1924, 1943, 1948, 1956, 1964 and 1996. Major floods on the Clackamas were in 1923, 1931, 1960, 1964 and 1996. While 1996 is fresh in many memories, the floods of 1861, 1890 and 1964 rose even higher. The Willamette and Clackamas Rivers both flooded in January 1997 and from December 28th, 2005 to January 1st, 2006 following severe winter storms. The high water caused bank erosion and cleanup was required at Clackamette Park, for which FEMA provided some funding.

From January 1st to 2nd, 2009 a severe winter storm dropped over 3.5 inches of rain over a 24-hour period. The event led to localized flooding, land movement, traffic delays, and sewer line back-ups. Sections of Meyers Road, Beavercreek Road, Linn Avenue, Abernethy Road, and Van Buren Street were closed due to the effects of the storm.

4.1.2 Flooding Damage

The types of damage caused by a flood depend on the depth and velocity of the flood waters. Faster moving waters can wash buildings off their foundations and sweep cars downstream. However, most flood damage in Oregon City is caused by water saturating materials susceptible to damage such as wood, insulation, wallboard, and fabric. This was the case for most of the areas flooded in 1996. In addition to direct

property damage, deep flooding can close roads and railroads. Floodwaters also erode soil, undercut bridges and soak landslide-prone hills, causing secondary disasters.

Not all flood prone areas are subject to damage. Several valleys, such as the upper reaches of Abernethy Creek, are still in or near their natural state. Flooding of such areas causes no damage to human development and may help the riparian habitat.

The area affected by the February 1996 flood was roughly the same as FEMA's 100-year floodplain shown in the 100 Year Floodplain Map. Federal disaster assistance figures in terms of FEMA's Individual Assistance programs show the extent of the problem in Oregon City.

Table 4.1 1996 Federal Individual Assistance Figures for Oregon City

Federal Cost	Oregon City Households	Program
N/A	300	Applied for assistance
$369,000	125	Were provided with temporary housing support while they repaired and rebuilt. Many others stayed at friends' and relatives' places and did not need temporary housing aid.
$134,500	36	Lower income or fixed income residents given Individual and Family Grants.
$833,000	45	Families received low interest reconstruction loans.

Source: City of Oregon City

In contrast to these disaster assistance figures, few flood insurance policies were in effect before the flood of 1996. Only 12 flood insurance claim payments were made, but the figures in Table 4.2 show that the few who were insured received much higher payments than those who received disaster assistance. Two of the residential properties are located outside of the mapped floodplain and are subject to a local drainage problem.

Table 4.2 1996 NFIP Claim Payments

Federal Cost	Households	Property Type
$123,000	5	Residential properties
$397,000	4	Commercial properties
$449,000	3	Publicly owned properties (including County public works)

Source: City of Oregon City

The state's Interagency Hazard Mitigation Team Report on the 1996 flood noted that 65% of the total damage in the state was incurred by state and local governments. The direct cost to Oregon City from the February 1996 flood is estimated at:

75,000	in flood fighting expenses
125,000	for debris removal, cleanup, and soil testing (near the landfill)
167,000	for repairs to city property
$367,000	indirect costs to the city (including the February landslides costs)

Much of this was funded through federal disaster aid under FEMA's Public Assistance program, but that simply transfers a local public expense to more taxpayers. In addition to these quantitative measures of the effects of flooding on Oregon City, there were other types of damage to the community and its economy:

- Businesses, roads and railroads were closed for days and weeks from flooding, which had a regional as well as local economic impact.
- Several businesses closed permanently.
- Clackamas County's Department of Transportation and Development Facility was flooded with water more than eight feet deep. County crews spent their time rescuing county equipment and were not free to assist residents elsewhere.

4.1.3 Flooding Hazard Assessment

Hazard Identification

Hazard identification is the first step of flood hazard assessment. Identification is the process of estimating: (1) the geographic extent of the floodplain; (2) the intensity of the flooding that can be expected in specific areas of the floodplain; and (3) the probability of occurrence of flood events. This process usually results in the creation of a floodplain map.

Oregon City is a regular participant in the National Flood Insurance Program (NFIP) with 54 policies in force at a value of $21,655,700.[7] The city's most current effective Flood Insurance Rate Map (FIRM) date is June 17th, 2008 (Initial FHBM 12/28/1973)[8]. The city is also a participant in FEMA's Community Rating System (CRS) and the city's current 'class' is 7. Oregon City has had a total of 24 losses, 18 of which are closed. Total payments have amounted to $1,464,739.55.[9]

Oregon City has had a total of 2 repetitive losses, neither of which occurred in B, C or X zones. Additionally, the city has had 9 Letters of Map Change (LOMC), and the city's last Community Assisted Visit occurred on February 28th, 2002.[10]

The geographic extent of the flooding hazard was determined using the designated FEMA NFIP 100-year floodplain data, as well as the inundation line for the 1996 flood. The floodplain map illustrates the flood hazard area for Oregon City. The floodplain map shows there are 560 acres identified in the FEMA 100 year floodplain, and 46 additional acres included in the 1996 flood inundation, which is 9.66% of the city's 6,282 acres.

Vulnerability Assessment

Vulnerability assessment is the second step of a flood hazard assessment. It combines the floodplain boundary, generated through hazard identification, with an inventory of

the property within the floodplain. Understanding the population and property exposed to natural hazards will assist in reducing risk and preventing loss from future events.

Oregon City works to mitigate problems regarding flood issues when they arise. Some areas in the city are more susceptible to flooding issues and have incurred repetitive losses, meaning they have had two or more NFIP claims in the past ten years. According the most current data from the Oregon Department of Land Conservation and Development, one property in Oregon City limits is identified as a 'repetitive loss property.' Loss payments for this property total $51,162.

Calculating the actual damage caused by a flooding event is very difficult to compute due to the number of unknown variables. However, the amount of property in the floodplain, as well as the value of those properties can be calculated to provide a working estimate for potential flood losses. The 100-year FEMA floodplain combined with the 1996 inundation line, encompasses 654.62 acres of Oregon City land, which includes 259 tax lots with an assessed land value of $89,652,796 and an assessed building value of $138,668,900.

The majority of the buildings affected by flooding are located in the lowest part of the city, where the three waterways converge. The Floodplain Map shows 12.7 miles of the transportation network could be affected in a flood. Listed below are the 3 critical, 1 essential, and 1 additional infrastructure features impacted in the floodplain:

- 18th Street PGE Substation (Critical)
- South Fork Water Board water Intake (Critical)
- Tri-City Wastewater Treatment Plant (Critical)
- Abernethy Center (Essential)
- Metro South Transfer Station (Infrastructure)

Risk Analysis

Risk analysis is the third and most advanced phase of a hazard assessment. It builds upon the hazard identification and vulnerability assessment.

A flood risk analysis for Oregon City should include two components: (1) the life and value of property that may incur losses from a flood event (defined in the vulnerability assessment); and (2) the number and type of flood events expected to occur over time.

Flow velocity models can assist in predicting the amount of damage expected from different magnitudes of flood events. The data used to develop these models is based on hydrological analysis of landscape features. Changes in the landscape, often associated with human development, can alter the flow velocity and the severity of damage that can be expected from a flood event. Using GIS technology and flow velocity models such as multi-hazard HAZUS, it is possible to map the damage that can be expected from flood events over time. It is also possible to pinpoint the effects of certain flood events on individual properties.

At the addendum's time of publication, data was insufficient to conduct a risk analysis for flood events in Oregon City. The city has addressed this issue in action item ST-MH #2, and will complete a risk assessment as data and resources become available.

Hazard Scores

The HMPC determined the probably of a flood to be high, meaning one or more flooding events are likely within a 10-year period. This is in agreement with the county's high rating. Vulnerability is moderate; meaning 1-10% of the population is likely to be affected by a flood. This score is also in agreement with the county's moderate rating. History of flooding hazard events was determined to be high, meaning four or more flooding events have occurred in a 100 year period. Finally, the HMPC determined maximum threat to be moderate; meaning a maximum of 5-25% of the population could be affected by a flood in a worse case scenario. These scores will be used and discussed in more detail in Section 5 of the addendum.

4.1.5 Existing Flood Mitigation Activities

Flood mitigation activities listed here include current mitigation programs and activities that are being implemented by Oregon City agencies or organizations.

Oregon City Codes Pertaining to Flooding

Oregon City Municipal Code Title 17 Zoning, Chapter 17.42 Flood Management Overlay District

A. The city has established a flood management overlay district. The flood management overlay district is an overlay zone classification defining areas subject to periodic flooding or inundation which can result in property harm or loss, disruption of public services, hazards for public health, or added expense for public services. All conditions and restrictions of land use established by this chapter of the city's zoning ordinance shall be in addition to such restrictions and conditions as may be imposed and established in underlying zoning districts.

B. It is the purpose of this chapter to promote the public health, safety and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

1. To protect human life and health;
2. To minimize expenditure of public money and costly flood control projects;
3. To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
4. To minimize prolonged business interruptions;
5. To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazard;
6. To help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;
7. To ensure that potential buyers are notified that property is in an area of special flood hazard;

8. To ensure that those who occupy the areas of special flood hazard assume responsibility for their actions; and
9. To protect flood management areas, which provide the following functions:
   a. Protect life and property from dangers associated with flooding;
   b. Flood storage, reduction of flood velocities, reduction of flood peak;
   c. Flows and reduction of wind and wave impacts;
   d. Maintain water quality by reducing and sorting sediment loads;
   e. Processing chemical and organic wastes and reducing nutrients, recharge, store and discharge groundwater; and
   f. Provide plant and animal habitat, and support riparian ecosystems. (Ord. 08-1008 § 1(part), 2008: Ord. 99-1013 § 8(part), 1999)

Comprehensive Plan Section 7: Natural Hazards
Policy 7.1.5
Minimize the risk of loss of life and damage to property from flooding by limiting development in the 100-year floodplain and by ensuring that accepted methods of flood proofing are used.

Policy 7.1.6
Encourage the use of land and design of structures that are relatively unaffected by the periodic effects of flooding, such as parking and other uses not normally occupied by humans.

Policy 7.1.7
Prohibit uses in areas subject to flooding that would exacerbate or contribute to hazards posed by flooding by introducing hazardous materials, filling or obstructing floodways, modifying drainage channels, and other detrimental actions.

Flood Mitigation Projects

The Greater Oregon Watershed Council did plantings along Abernethy Creek. Sediment is regularly removed from culverts around the city to allow for better water flow. River bank stabilization and restoration work was done along the Willamette River at Jon Storm Park. Oregon City has amended their flood ordinance maintain consistency with FEMA ordinance requirements, and adopted a new set of FEMA floodplain maps. The city has also increased public information online. As a result, Oregon City's FEMA rating went down from a 9 to a 7.

4.1.6 Flood Mitigation Action Items

The flood mitigation action items provide direction on specific activities that organizations and residents in Oregon City can take to reduce risk and prevent loss from flood events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

ST-FL#1: Promote the use of naturally flood prone open space or wetlands as flood storage areas.
Ideas for Implementation:

- Develop and implement flood protection alternatives for properties within and adjacent to the 100-year floodplain by taking into account city codes related to the floodplain.

Coordinating Organization: Public Works Department, Community Development Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

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ST-FL#2: Continue to implement and enhance the flood public education program designed to inform local residents about:

- The causes of local drainage problems, flooding and landslides;
- Why channels, ditches and swales should be maintained;
- What owners can do to protect their properties;
- The penalties for dumping in or altering watercourses;
- Information regarding health and safety issues resulting from the flooding hazard (such as sewerage leakages); and
- Educating about types of flooding and benefits of flooding as a natural process.

Ideas for Implementation:

- Community-wide dissemination of information through the city's newsletter, Trail News, and city's website;
- Promote purchase of floodplain insurance;
- Use GIS database to identify property owners in flood prone areas, and target these people for a group mailing.
- Distribute flood preparedness information

Coordinating Organization: Public Works Department, Community Development Department, Clackamas Fire District #1
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

---

ST-FL#3: Continue participating in the National Flood Insurance Program and develop strategies to reduce property damage and related financial impacts due to flooding.

Ideas for Implementation:

- Continue to develop strategies to improve the city's current rating in the National Flood Insurance Program's Community Rating System;

- Continue to analyze each property in the floodplain;
- Identify appropriate mitigation activities for repetitive flood properties;
- Explore options for incentives to encourage property owners to engage in mitigation.

Coordinating Organization: Public Works Department and Community Development Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Natural Systems, Partnerships and Implementation

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LT-FL#1: Complete periodic updates of the Surface Water Management Master Plan.

Coordinating Organization: Public Works Department
Timeline: 5 years
Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

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Legend

- FEMA 100 Year Floodplain
  Data effective June 17, 2008
- 1996 Flood Inundation
- Taxlots
- Rivers
- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets

The City of Oregon City makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Gladstone
Oregon City
West Linn
Willamette Falls
Park Place
Henrici
Sunset
Barclay Hills
Oak Park
Dunaway Park

N
W E
S

City of Oregon City
100 Year Floodplain Map

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_100_Year_Floodplain_11x17_portrait.mxd
Plot File: Hazard_100_Year_Floodplain_11x17P-with1996flood_20090123.pdf

City of Oregon City
Geographic Information Systems
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4.2 Landslide

In this plan, the term "landslide" includes rockslides, debris flows, and slumps, all of which are defined in the Clackamas County Natural Hazards Mitigation Plan. Most landslides occur when too much water saturates the soil, and loose soil on a steep hillside is especially susceptible to landslides.

Slides can be caused by activities that steepen slopes or add weight or water to the slope. Erosion and grading for road construction are examples of how slopes can be steepened. Weight can be added to a slope by adding fill material, increasing the saturation by removing vegetation, altering drainage, and altering runoff flow patterns. Water also can weaken the material's ability to resist sliding.

Generally, a combination of factors work together, cumulatively decreasing the stability of a slope until one triggering event initiates the landslide. Triggering events include heavy rains, earthquakes or heavy traffic that shake a saturated area, or when the lower edge of a hillside is removed or washed out.

Landslides tend to occur where older landslides have occurred before. In fact, sliding commonly involves reactivated landslides. Although landslides are due primarily to the forces of gravity and can occur at any time without warning, they often are seasonal since they are frequently triggered by heavy rainfall.

The cause and effect relationships are not necessarily confined to an immediate area; conditions or actions on one parcel of land can cause slides on other parcels. Although the total area of land with a high potential for landslides is small, the consequences are serious when structures, roads, and utility system components are in the landslide's path.

4.2.1 Landslide History

The flooding of 1996 caused numerous landslide events in Oregon City. One of these events caused a sanitary sewer pump to begin sliding downhill. A report by Portland State University found that half of the 48 landslides that occurred in the region in 1996 were considered "natural," while the others were triggered by human activity. Those triggered by human activity included:

- 5 where the slope had been cut and steepened;
- 9 where fill had been placed on top of the natural ground;
- 10 where human activity diverted water, such as driveway runoff or clogged gutters

Oregon City experienced another series of landslides as a result of the December 28th, 2005 to January 1st, 2006 storm and flood:

- On Trillium Drive a storm sewer manhole that was supposed to spread water failed, resulting in water flowing down the side of a slope and eroding the slope significantly.
- Morton Road had a landslide that affected an apartment building. This landslide was the result of poor surface water management.

- A portion of a slope slid near the football field at Oregon City High School Jackson Campus. This slide caused no structural damage. The cause of the slide was not confirmed.
- A landslide at Newell Crest Drive impacted three homes and required one home to be permanently vacated.
- Newell Creek Village Apartments experienced impact due to landslides, as water and storm sewer lines were severed and two buildings needed to be evacuated and were ultimately demolished. Causes were related to a poorly managed private storm sewer system and reactivation of ancient landslides.

4.2.2 Landslide Damage

Where landslides damage infrastructure, such as streets, water pipes and power lines, the health and safety impact can be far reaching. The threatened North Fork water transmission pipe is an example that could have serious public health repercussions. The South Fork Water Board is investigating alternative ways to protect this key lifeline.

Landslides destroy or damage anything on the sliding hillside or in the path of the slide. This includes buildings, houses and streets. Sometimes, a small amount of settlement occurs, giving the owner time to shore up or retrofit the building to prevent further damage. Many property owners in Oregon City have built retaining walls and replaced slide prone soils with rock to help prevent landslides. However, if an entire hillside fails, the buildings may be destroyed and the streets washed out or covered in debris.

4.2.3 Landslide Hazard Assessment

Hazard Identification

An essential step towards mitigation of landslide hazards is to identify the hazardous locations. Mapping landslide and debris flow allows the city to estimate damage due to a given event location and to help prevent future losses in landslide prone areas. The geographic extent of the landslide hazard was delineated using 25% or greater slope, and historic point slides with width, length of slide. The landslide hazard is depicted on the Landslide Hazard Map at the end of Section 4.2, and shows that landslides could affect 8.53% of the city's land area.

Vulnerability Assessment and Risk Analysis

Landslides can impact major transportation system components, blocking residents from essential services and businesses. Continuing to map landslide and debris flow areas will help in preventing future loss.

Vulnerability assessments for landslides will assist in predicting how different types of property and population groups will be affected by a hazard. Data that includes specific landslide-prone and debris flow locations can be used to assess the population and total value of property at risk from future landslide occurrences. The City of Oregon City uses percent slope as an indicator of hill slope stability. The city uses a 25% or greater threshold to identify potentially unstable hill slopes. 518 acres

in the city exceeds this 25% slope threshold, indicating that 8.25% of the land in Oregon City has potentially unstable soil.

Factors included in assessing landslide risk include population and property distribution in the hazard area, the frequency of landslide or debris flow occurrences, slope steepness, soil characteristics, and precipitation intensity. This type of analysis could generate estimates of the damages to the Oregon City due to a specific landslide or debris flow event. At the time of publication of this addendum, Oregon City was unable to perform a quantitative risk assessment due to insufficient data and lack of software needed to conduct this type of analysis. The city has addressed this issue in action item ST-MH #2, and will be completing a risk assessment as data and resources become available.

Hazard Scores

The HMPC determined the probably of landslide hazards to be high, meaning one or more landslide events are likely within a 10-year period. This is in agreement with the county's high rating. Vulnerability is low; meaning less than 1% of the population is likely to be affected by a landslide. The low vulnerability score is also in agreement with the county's low rating. History of landslide hazard events was determined to be high, meaning four or more landslide events have occurred in a 100 year period. Finally, the HMPC determined maximum threat to be low; meaning a maximum of 5% of the population could be affected by a landslide in a worse case scenario. These scores will be used and discussed in more detail in Section 5 of the addendum.

4.2.4 Existing Landslide Mitigation Activities

Landslide mitigation activities listed here include current mitigation programs and activities that are being implemented by the City of Oregon City agencies or organizations.

City of Oregon City Codes Pertaining to Landslides

Municipal Code Title 15 Building and Construction, Chapter 15.48 Grading, Filling and Excavating

The purpose of this chapter is to mitigate, minimize or eliminate the adverse impacts caused by grading, fill and excavation activities on public or private property. It establishes policies, procedures and minimum requirements for grading and earthwork construction. It is intended to promote the general health, safety and welfare of the public and requires the applicant to follow sound land development practices. (Ord. 99-1029 §3, 1999)

Municipal Code Title 17 Zoning, Chapter 17.44 US Geologic Hazard

The purpose of this chapter is to provide safeguards in connection with development on or adjacent to steep hillside and landslide areas and other identified known or potential hazard areas, thereby preventing undue hazards to public health, welfare and safety. Such hazards include landslides, mud flows, high ground water tables, soil slump and erosion, which, in turn, may cause siltation or other degradation of water quality and damage to property and public facilities. The direct and indirect costs of

these effects, in economic and noneconomic terms, can be high and warrant a conservative approach both in the review of land use applications for development of sites with steep and unstable soils and in the imposition of development conditions and restrictions. (Ord. 94-1001 §2 (part), 1994)

Municipal Code Title 17 Zoning, Chapter 17.47 Erosion and Sediment Control
A. The purpose of this chapter is to require erosion prevention measures and sediment control practices for all development during construction to prevent and restrict the discharge of sediments, and to require final permanent erosion prevention measures, which may include landscaping, after development is completed. Erosion prevention techniques shall be designed to protect soil particles from the force of water and wind and other mechanical means so that they will not be transported from the site. Sediment control measures shall be designed to capture soil particles after they have become dislodged by erosion and attempt to retain the soil particles on site.
B. The objective of these measures is to control, at the source, waterborne and airborne erosion and the air and water pollution that results from such erosion mechanisms. This chapter recognizes that all non-point discharges eventually end up in surface water bodies. This chapter is intended to control water quality degradation from construction and development activities and it applies in addition to any other applicable provision of this code, state or federal law. This chapter is not intended to serve as a guideline for stormwater management control measures for already constructed developments. (Ord. 99-1013 §9 (part), 1999)

Comprehensive Plan Section 7: Natural Hazards Policy 7.1.8
Provide standards in city codes for planning, reviewing, and approving development in areas of potential landslides that will prevent or minimize potential landslides while allowing appropriate development.

Landslide Mitigation Projects

After the 1996 landslide events, 20 of the 48 landslides were repaired by the city, meaning reconstruction or mitigation took place. These fixes varied and included constructing retaining walls, installing rockfill, and moving structures. The sanitary sewer pump station that began sliding downhill had seismic isolation piles installed under the foundation of the building to mitigate future slides.

Repairs and mitigation after the December 28th, 2005 to January 1st, 2006 landslides included:

- The storm sewer manhole that failed on Trillium Drive was repaired. The city installed monitoring wells with inclinometers to allow the city to continue to monitor the slope.
- The owner of the Morton Road apartment building installed a crib wall.
- A homeowner on Newell Crest Drive constructed a retaining wall, costing approximately $100,000.
- Newell Creek Apartments had the most mitigation work done. The city temporarily repaired one of the water lines and permanently abandoned the waterline on the slope and reconfigured the second water line. The repaired line that remained at risk was later replaced with a new water

line with flexible couplings at the joints. The city required relocation and reconstruction of the apartment complex's private sanitary sewer pump station.

The city additionally has many ongoing mitigation actions including a water pipe line leak detection system and annual assessments of slide hazard areas.

4.2.5 Landslide Mitigation Action Items

The landslide mitigation action items provide direction on specific activities that organizations and residents in Oregon City can take to reduce risk and prevent loss from landslide events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

ST-LS#1: Continue to implement municipal codes and policies mitigating future landslide damage.

Ideas for Implementation:

- Projects should be carefully engineered so:
  - ✓ The most appropriate measures are used;
  - ✓ Environmental impacts are avoided;
  - ✓ There are no adverse impacts on other properties.
- Obtain funding to be engaged in more pro-active bank stabilization projects;
- Limit construction in known landslide areas;
- Regular water distribution system leak detection in geologic hazard areas.

Coordinating Organization: Public Works Department and Community Development Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

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ST-LS# 2: Maintain an inventory of streets and properties threatened by landslides.

Ideas for Implementation:

- Utilize technology, geologic resources, and other available data to identify areas of slope risk;
- Identify areas where strategic planting could assist in soil stabilization.

Coordinating Organization: Oregon City Geographic Information Systems, Public Works Department, Community Development Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

ST-LS#3: Educate the community about landslides, their associated risks and ways of reducing vulnerability.

Ideas for Implementation:

- Disseminate information in a quarterly newsletter and city website;
- Prepare and distribute an informational brochure on unstable slopes, historical landslide areas, and mitigation action items.

Coordinating Organization: Oregon City Geographic Information Systems, Public Works Department, Community Development Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Partnerships and Implementation

Legend

- Historic Landslides
- Slopes 25% and Greater
- Taxlots
- Rivers
- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets

SOURCE: Historic Land Slide Data from Portland State University study by Scott Burns. Slope data derived by Oregon City.

The City of Oregon City makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Gladstone

Oregon City

Willamette Falls

Dahl Park

Clackamette Park

Park Place

Sunset

Henrici

INTERSTATE 205

City of Oregon City

Landslide Hazard Map

N W E S

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Landslide_Hazard_11x17_portrait.mxd
Plot File: Hazard_Landslide_Hazard_11x17P_20090123.pdf

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4.3 Wildfire

Wildland urban interface fires occur where development extends into forested areas, or where vegetation surrounds a building. Fire fighting efforts become complicated when buildings are placed in areas with steep terrain, poor access, and limited water supply. Use of highly flammable materials on structure exteriors, such as wooden shake or shingle roofs, increase fire risk.

4.3.1 Wildfire History

After a long dry spell, a major fire broke out near Rosemont Ridge in September 1967. The fire burned 300 acres and cut telephone and electrical service, but fire fighters were able to save all threatened homes. Less than two weeks later another fire destroyed 500 acres. This fire took the efforts of over 150 firefighters to save the homes.

One area that's particularly susceptible to fires is the Canemah Bluffs area. This wildland urban interface has heavy tree coverage and a dense neighborhood sits atop a steep wooded area, increasing the threat of wildfire. In August 2005, a wildfire on the Canemah Bluffs burned down a non-occupied historic structure. Another fire began in this same area in 2007. The 2007 fire began at Highway 99E and spread up the rock cliff face.

The Hazard Mitigation Plan Committee identified two additional areas that are particularly susceptible to wildfires: Newell Creek Canyon and the Waterboard Park. Newell Creek Canyon is open space located outside the Metro UGB and is not part of a master plan. This area is a major wildland urban interface and has the potential for a catastrophic fire. Transients often have campfires in this area, creating a potential for fire to start. Highway 213 runs through this area and a cigarette thrown from a car is another potential source of ignition. If a fire were to break out along the highway, firefighters would have to fight it from the highway as there is limited access to the canyon. The Barclay Hills residential development on the west side of the canyon has very poor access, with only one way in and one way out.

Waterboard Park is located along the bluff below Promontory Avenue. This area is considered a charter park, meaning trees and brush cannot be cut to reduce fuel load. Like Newell Creek Canyon, Waterboard Park is home to many transients and campfires pose a threat to igniting a fire.

4.3.2 Wildfire Damage

Several factors combine to make wildland urban interface fires extremely dangerous: 1) the compounding effects of a fast moving fire, especially if wind driven; 2) limited avenues for evacuation and mobility for fire suppression forces; 3) poor visibility; 4) extreme heat; and 5) limited mobility of some residents, etc.

Buildings caught in a wildland urban interface fire area are nearly always destroyed. Usually, full reconstruction or replacement of the structures is necessary. Some structures can be saved, and others survive because of adherence to fire-safe measures and defensive actions taken by property owners and responding fire protection

agencies. It is important to note that the nature of the development that has increased this risk is a relatively recent phenomenon.

4.3.3 Wildfire Hazard Assessment

Hazard Identification

Wildfire hazard identification data is based upon fuels, weather, and topography, and was generated by Clackamas County GIS data. The wildfire hazard in Oregon City is shown on the Wildfire Areas Map at the end of Section 4.3.

Vulnerability Assessment

The history of wildland urban interface fires in the community and surrounding area have shown that property can be damaged or destroyed as structures, vegetation and other flammables easily merge in unpredictable and unmanageable ways. Other factors that might affect the outcome of a wildfire are: access to the location and water; response time from the fire station; and the availability of personnel and equipment. Weather, such as hot dry winds and drought, can also play a part in wildfires. About 8.16 miles of critical streets are exposed to the high and moderate wildfire zones. Table 4.3 provides the number of acres and assets at high and moderate risk to wildfire:

Table 4.3 Wildfire Exposure and Vulnerable Assets

Fire Class	Acres	Number of Critical Facilities	Number of Essential Facilities
High	962	1	1
Moderate	1,881	2	9
Non-Fuel	3,429	17	7

Source: Oregon City Geographic Information Systems

Risk Analysis

Key factors included in assessing wildfire risk include ignition sources, building materials and design, community design, structural density, slope, vegetative fuel, fire occurrence, and weather, as well as occurrences of drought. At the time of publication of this plan, data and modeling software were insufficient to conduct a risk analysis. The city has addressed this issue in action item ST-MH #2, and will be completing a risk assessment as data and resources become available.

Hazard Scores

The HMPC determined the probably of a wildfire to be moderate, meaning one or more wildfire events are likely within a 50-year period. This is in agreement with the county's moderate rating. Vulnerability is moderate; meaning 1-10% of the population is likely to be affected by a wildfire. This score is also in agreement with the county's moderate rating. History of wildfire events was determined to be moderate, meaning 2-3 wildfire events have occurred in a 100 year period. Finally, the HMPC determined maximum threat to be moderate; meaning a maximum of 5-25% of the population could be affected by a wildfire in a worse case scenario. These scores will be used and discussed in more detail in Section 5.

4.3.4 Existing Wildfire Mitigation Activities

Oregon City Codes Pertaining to Wildfires

Title 15 Buildings and Construction, Chapter 15.40 Fire Code

The 2007 Edition of the Uniform Fire Code, as amended and adopted by the state of Oregon pursuant to OAR 837-040-0001 to -0010, is adopted in its entirety, and all provisions, rules, regulations, penalties and statements therein are made with exceptions and modifications of this chapter. (Ord. 99-1002 §1 (part), 1999)

Comprehensive Plan Section 7: Natural Hazards Policy 7.1.13

Minimize the risk of loss of life and damage to property from wildfires within the city and the Urban Growth Boundary.

Clackamas County Community Wildfire Protection Plan

This plan provides a consolidated reference documenting wildfire hazards, prevention and response efforts, and resource-sharing information for all participating local, state, and federal fire agencies.

Wildfire Mitigation Projects

Oregon City's Fire Department, Clackamas County Fire District #1, has a Fire Prevention Division dedicated to protecting and preserving life and property through education, engineering, and enforcement. The Fire Prevention Division offers numerous education opportunities including school programs, public presentations, media events, and safety fairs. They review pre-construction plans and develop fire codes. Additionally this division inspects buildings for fire code compliance, enforces open burning regulations, and offers juvenile fire setter counseling and follow-up.

4.3.5 Wildfire Mitigation Action Items

The wildfire mitigation action items provide direction on specific activities that organizations and residents in Oregon City can undertake to reduce risk and prevent loss from wildfire events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation. Plan goals and county action items addressed are also noted for each action item.

ST-WF#1: Enhance outreach and education programs aimed at mitigating wildfire hazards and reducing or preventing public exposure to hazards.

Ideas for Implementation:

- Utilize new wildland urban interface mapping data to identify property owners in vulnerable areas; and
- Educate the community on ways of reducing wildfire risk.

Coordinating Organization: Clackamas Fire District #1 and Oregon City Geographic Information Systems
Timeline: Ongoing

Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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LT-WF#1: Complete periodic updates of the Water Master Plan

Ideas for Implementation:

- Maintain inventory of water lines and fire hydrants and continue to prioritize improvements based on criticality of need for fire protection;
- Implement standards to ensure appropriate sizing of water lines for efficient and effective use of fire hydrants; and
- Complete periodic rate studies and implement rate increases as necessary.

Coordinating Organization: Public Works Department
Timeline: 5 years
Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

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LT-WF#2: Promote fire-resistant strategies for new developments.

Ideas for Implementation:

- Require fuel breaks in site plans, describe the procedures for ongoing maintenance, and place information on the Oregon City website for public view;
- Review street designs that facilitate the movement of fire fighting equipment; and
- Review roofing standards and develop recommendations for promoting non-combustible roofing.

Coordinating Organization: Community Development Department and Clackamas Fire District #1
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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Legend

Wildfire Hazard rating

- High
- Moderate
- Non-Fuel
- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets

Facilities

- Essential
- Critical

- Taxlots
- Rivers

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Gladstone
Straight Pioneer Cemetery
End of the Oregon Trail Interpretive Center
Clackamas County Courthouse
McLoughlin House
Municipal Elevator
Stevens Crawford Museum
7th Street Fire Station
Ermatinger House
Carnegie Center
Museum of the Oregon Territory
Pioneer Cemetery
Oregon City
Willamette Falls
Dahl Park
Clackamette Park
Sunset
Henrici
INTERSTATE 205
HWY 99E
HWY 213
82ND
FORSYTHE
WASHINGTON ST
ABERNETHY RD
14TH ST
7TH ST
DIVISION
HOLCOMB BLVD
REDLAND RD
BEAVERCREEK RD
MOLALLA AV
LEILAND RD
WARNER MILNE RD
PARRISH RD
PARTLOW RD
MAPLE LANE RD
THAYER RD
MEYERS RD
CENTRAL POINT RD
Willamette River
Kenneth Creek

City of Oregon City
Wildfire Areas Map

N W E S

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/28/2009
Map File: Hazard_Wildfire_Acres_11x17_portrait.mxd
Plot File: Hazard_Wildfire_Areas_11x17P_20090128.pdf

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4.4 Severe Storm: Wind and Winter

Wind and winter storms are caused by severe weather conditions. Wind storms can occur at any time of the year while severe winter storms are limited to the winter months. Wind storms are usually "straight line" storms with winds that do not exceed 90 miles per hour, although wind speeds as high as 119 mph were recorded in Portland in 1962.

A severe winter storm can be accompanied by high winds. Wind and severe winter storms are addressed together because they also have similar impacts, particularly in the form of damage to trees and power lines.

4.4.1 Severe Storm History

Severe wind and winter storms have occurred on numerous occasions in Oregon City. The historical severe wind and winter storm events have been described in Sections 9 and 10 of the Clackamas County Natural Hazards Mitigation Plan, and are applicable to Oregon City. A few events require more description.

On December 11th, 1995, a windstorm hit Oregon. Oregon City was one of the most severely damaged cities in Clackamas County. Winds tore off roofs from buildings, uprooted or damaged trees, and knocked out electrical and telephone service.

From January 9th to 12th, 1998, a severe winter storm included freezing rain and snow and was accompanied by high winds for two days. Most of the city lost power due to downed electrical lines and malfunctioning transformers. One emergency shelter was opened for those who could not stay in their homes. Off-duty firefighters were called in to help respond to the increased number of calls.

From January 1st to 2nd, 2009, a severe winter storm dropped over 3.5 inches of rain in a 24-hour period. The snow and rain led to localized flooding, land movement, traffic delays, and sewer line back-ups. Sections of Meyers Road, Beavercreek Road, Linn Avenue, Abernethy Road, and Van Buren Street were closed due to the effects of the storm.

4.4.2 Severe Wind and Winter Storm Damage

Wind and winter storms pose a relatively low threat to life and safety because people usually have time to seek shelter from the storm. Schools and businesses are often shut down during major storm events, allowing people to stay in their homes. Buildings are constructed to offer protection from most storms likely to threaten Oregon City.

While threats to life and safety can be relatively low, hazards and damages can be extensive. Icy streets may pose the most serious threat during a winter storm. Ice is a hazard for drivers. Emergency equipment can have trouble traveling on icy streets, meaning police, fire, and ambulance vehicles may have more trouble responding to calls in icy conditions.

Trees and tree limbs can fall on buildings, utilities and power lines, causing power outages. Debris created from trees can block roads and reduce accessibility. Wind and ice can damage antennas and telephone lines, hampering emergency services and radio and television broadcasts.

4.4.3 Severe Storm Hazard Assessment

Hazard Identification

The severe storm hazard is difficult to illustrate cartographically. However, Oregon City has developed a map identifying sanding and plowing routes and priorities of maintenance to reduce the effect of the severe storm event. However, the snowplow and sanding priorities map does not accurately portray the geographic extent of the severe storms in Oregon City, as the entire city would be affected by large-scale storm events.

Vulnerability Assessment

Oregon City has prioritized streets and roadways for sanding, plowing, or other clearing methods during severe weather. The city has not done a study on actual number of individuals or property that can be affected during a severe winter storm. Severe storms can bring power outages and cause transportation and economic disruptions. Specific problems for residences in the city include electrical wires, and trees and tree limbs that come down during severe storms that cause both major and minor property damage as well as create a threat to life. Downed wires and trees can make accessibility to residences by police and fire difficult.

Risk Analysis

Factors that should be included in a storm risk analysis include population and property distribution in the hazard area, the frequency of storm events, and information on trees, utilities, and infrastructure that may be impacted by severe storm events. Modeling software is required to predict potential losses from a particular storm event. At this time, Oregon City is unable to perform a quantitative risk assessment due to insufficient data. The city has addressed this issue in action item ST-MH #2 and will be completing a risk assessment as data and resources become available.

Hazard Scores

The HMPC determined the probably of severe storm events to be high; meaning one or more severe storms are likely within a 10-year period. Vulnerability is high; meaning more than 10% of the population is likely to be affected by a severe storm. The county chose to rank wind storms separately from winter storms, so it is not completely viable to compare the city's ratings to the county's ratings. The county found the probability of wind storms is moderate, and probability for winter storms is high. The county determined the vulnerability of wind and winter storms to be low and moderate, respectively. Both of these vulnerability ratings are lower than the city's high rating because past events have shown that most of Oregon City's population and assets are affected in severe storm events. History of severe storm events was determined to be high, meaning four or more storm events have occurred

in a 100 year period. Finally, the HMPC determined maximum threat to be high, meaning more than 25% of the population could be affected by a severe storm in a worse case scenario. These scores will be used and discussed in more detail in Section 5 of the addendum.

4.4.4 Existing Severe Storm Mitigation Activities

Severe Storm Mitigation Projects

As a result of the December 26, 2003 to January 14, 2004 winter storm, Oregon City developed a snow route priorities map. This map informs Public Works which roads should be cleared first and what roads require closure. The plan even includes sign placement procedures.

The city has now changed from exclusively using sand to a combination of sand and a de-icing compound for use on its streets.

The city is installing emergency generators for sanitary sewer pump stations in susceptible hazard areas. In winter storms, it is difficult for the city to bring portable generators to those sites.

4.4.5 Severe Storm Mitigation Action Items

The severe storm mitigation action items provide direction on specific activities that organizations and residents in Oregon City can take to reduce risk and prevent loss from severe storm events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation. Plan goals are also noted for each action item.

LT-SS: Reduce power outages from windstorm and severe winter storm hazard.

Ideas for Implementation:

- Partner with PGE to obtain funding to bury power lines subject to frequent failures;
- Encourage burial of power lines for existing development; and
- Proactively maintain trees.

Coordinating Organization: Public Works Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

Snowplow Routes and Sanding Priorities

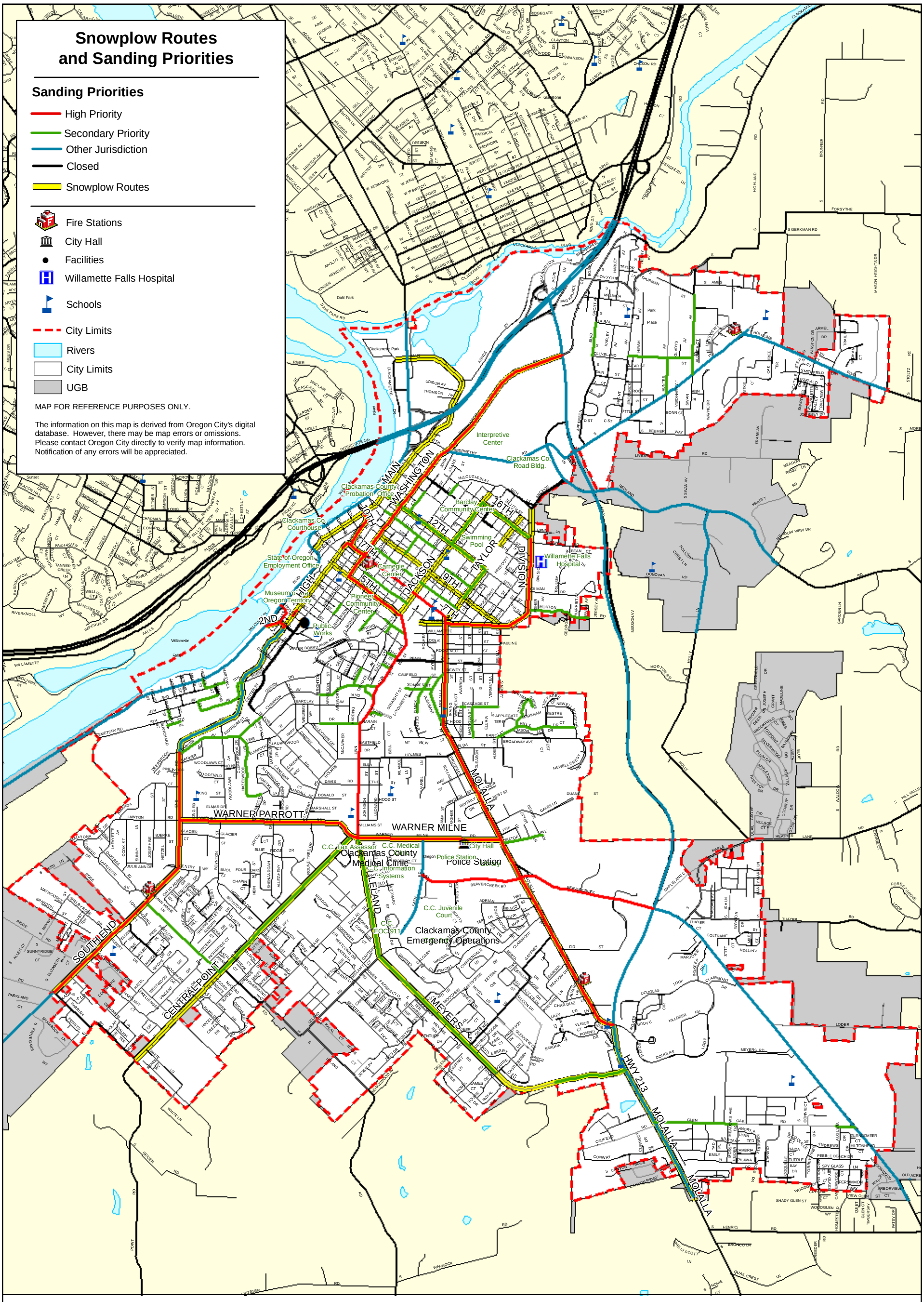
Sanding Priorities

- High Priority
- Secondary Priority
- Other Jurisdiction
- Closed
- Snowplow Routes

- Fire Stations
- City Hall
- Facilities
- Willamette Falls Hospital
- Schools
- City Limits
- Rivers
- City Limits
- UGB

MAP FOR REFERENCE PURPOSES ONLY.

The information on this map is derived from Oregon City's digital database. However, there may be map errors or omissions. Please contact Oregon City directly to verify map information. Notification of any errors will be appreciated.



City of Oregon City

Snowplow Routes / Sanding Priorities Map

N W E S

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: City_Snow_Routes_Map_11x17.mxd
Plot File: City_Sanding_Routes_and_Priorities_11x17_20090123.pdf

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4.5 Earthquake

Most large earthquakes in the Pacific Northwest are shallow crustal, deep intraplate, or subduction zone earthquakes. These earthquakes can have great impact on Oregon communities. Earthquakes can trigger other types of ground failures which could contribute to the damage. These include landslides, dam failures, and liquefaction induced spreading and slumping. Where these hazards exist in Oregon City, it is prudent to assume that moderate to strong ground shaking will result in ground failures.

Ground shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a special problem in low lying areas adjacent to rivers where the water table is shallow and the soils are subject to liquefaction. For example, the fine-grained alluvial soils along the banks of the Willamette and Clackamas Rivers and Abernethy Creek are likely subject to this hazard.

It should be noted that the most hazardous area, the red zone on the Earthquake Map at the end of this section, coincides with the most severe flood prone area north of Abernethy Creek. This is primarily due to the alluvial soil type and high water table found in many floodplains that are most subject to liquefaction during an earthquake.

4.5.1 Earthquake History

Historical records count over 56 earthquakes in the Portland metro area. The more severe earthquakes occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8. Rocks in Waterboard Park loosened and fell as a result of the quake; however, no one was injured and reported damages were limited.

For a complete listing of all earthquakes affecting Oregon City and surrounding areas refer to Section 11 of the Clackamas County Natural Hazards Mitigation Plan.

4.5.2 Earthquake Damage

Within each earthquake zone, buildings, utilities and transportation systems are affected differently. Unreinforced masonry buildings, such as those in the downtown area, perform very poorly even in moderate earthquakes. Other types of construction, such as older concrete frame and tilt-up concrete wall buildings also perform poorly. Single family dwellings, if not properly bolted to their foundations or having inadequate foundation systems to resist earthquakes (e.g., post and pier, cripple wall, stone, etc.) can also suffer major damage.

Vulnerable buildings, roads, bridges and utility lines and the unpredictability and instantaneous nature of earthquakes can result in enormous loss of lives. Because the greatest potential for loss of life is to people within a collapsing building, the true extent of the risk is dependent on a review of each building.

The threat can be reduced by properly locating structures and designing and constructing them to the latest codes and standards containing seismic design requirements. When proper codes and other measures are followed, seismic safety improves over time as older, more vulnerable buildings, utilities and transportation systems are replaced. However, the existing inventory of buildings built to earlier standards (or no standard) can pose major threats to life safety or the functioning of key community services.

A few buildings, bridges, and other structures are likely to collapse or dislodge heavy elements (e.g., parapets), causing casualties. Other types of property damage will be more widespread. Examples of other types of property damage include:

- Failures of older dwellings, especially if not bolted to their foundations;
- Fallen ceiling tiles and light fixtures;
- Broken water pipes and other utility services in buildings;
- Loss of inventories;
- Business interruption;
- Potential loss by fires due to broken gas lines;
- Interruption of service due to broken water and sewer lines; and
- Loss of utility services due to damage to wastewater treatment facilities, bridges and overpasses, natural gas pipes, and electrical power facilities and lines.

4.5.3 Earthquake Hazard Assessment

Hazard Identification

The geographic extent of the earthquake hazard in Oregon City was illustrated by DOGAMI using LIDAR data, and combined with soil and slope data from the Soil Survey Geographic (SSURGO) Database. The Earthquake Hazard Map at the end of this section shows the relative earthquake hazard in four categories: high, moderate, moderate/low, and low.

Three potential source zones capable of generating damaging earthquakes are thought to exist in the region. These include the Portland Hills Fault Zone, Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment.[11] The fault zone extends along the eastern margin of the Portland Hills for a distance of 25 miles, and lies about 2 miles northeast of Oregon City.

Gales Creek-Newberg-Mt. Angel Structural Zone

The Gales Creek-Newberg-Mt. Angel Structural Zone is a 50-mile-long zone of discontinuous, NW trending faults that lies about 17 miles southwest of Oregon City. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment.[12]

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year.[13] Scientists have recently found evidence that11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D. [14]

Vulnerability Assessment

The city identified vulnerable populations that could be negatively affected by a hazard event. These populations include schools, elderly communities, low income housing developments, and hospitals.

In 2007 DOGAMI released the results of the Statewide Seismic Needs Assessment, which evaluated the collapse potential of education and emergency services buildings. The report found that buildings on seven school campuses had a collapse potential of 'high' or 'very high' in the event of a high magnitude earthquake. School campuses with buildings at 'high' risk of collapse include Gaffney Lane Elementary, Gardiner Middle School, John McLoughlin Elementary, King Elementary, Mt. Pleasant Elementary, Park Place Elementary, and Clackamas Community College. School campuses with buildings at 'very high' risk of collapse include Mt. Pleasant Elementary and Clackamas Community College. Willamette Falls Hospital had a 'high' risk of collapse. Additional information and findings from this report can be found at http://www.oregongeology.org/sub/projects/rvs/OFR-O-07-02-SNAA-onscreen.pdf.

The area vulnerable to earthquake is larger than from any other hazard identified and potentially would produce more damage to property and life although degree of damage is clearly related to degree an earthquake is felt. Older buildings and the sewer system in the city are most vulnerable to damage. Earthquakes shift soil that could cause landslides. Transportation routes and economics within the city can also be affected. Demand on resources such as Police, Fire and Public Works would also increase.

Risk Analysis

The county's plan provides a quantitative analysis of nine potential earthquake scenarios for Clackamas County. This analysis includes an estimation of fatalities, direct damage losses, number of buildings in complete damage state, and number of people requiring shelter. Oregon City does not have the resources to conduct a local risk assessment for the earthquake analysis, so the data reported in the county's plan is the best quantitative assessment for the earthquake hazard in Oregon City.

Hazard Scores

The HMPC determined the probably of an earthquake to be moderate; meaning one or more earthquakes are likely within a 50-year period. This is lower than the county's high rating because based on history the HMPC did not believe they would have one or more large-scale earthquakes within a 10 year period. Vulnerability is moderate, meaning 1-10% of the population is likely to be affected by an earthquake. This score is lower than the county's high rating because the majority of the city's population and assets are located in areas of low earthquake risk, as identified in the Earthquake Hazard Map below. The HMPC found the history of earthquake events to be low, meaning 0-1 major earthquakes have occurred in a 100 year period. Finally, the HMPC determined maximum threat is moderate; meaning a maximum of 5% to 25% of the population would be affected by an earthquake in a worse case scenario. These scores will be used and discussed in more detail in Section 5 of the addendum.

4.5.4 Existing Earthquake Mitigation Activities

Oregon City Codes Pertaining to Earthquakes

Comprehensive Plan Section 7: Natural Hazards

Policy 7.1.9

Locate, design, and construct structures in conformance with current building codes and standards for seismic-resistant design.

Policy 7.1.10

Evaluate the need to retrofit existing public facilities such as water reservoirs, bridges, pipelines, and hospitals to better withstand earthquakes.

Earthquake Mitigation Projects

Many buildings in Oregon City have been seismically upgraded including the Carnegie Center, fire station #15, the 10.5 million gallon Mountainview drinking water reservoir, and numerous buildings at Clackamas Community College. New public buildings built for seismic activity include Oregon City High School and all water pump stations. Additionally, new water lines with flexible couplings at the joints were installed near the Newell Creek Apartments.

4.5.5 Earthquake Mitigation Action Items

The earthquake mitigation action items provide direction on specific activities that organizations and residents in Oregon City can undertake to reduce risk and prevent loss from landslide events. Each action item is followed by ideas for implementation, which can be used by the steering committee and local decision makers in pursuing strategies for implementation.

LT-EQ#1: Conduct seismic evaluations on identified community assets and 'high risk' school and emergency service buildings for implementing appropriate structural and non-structural mitigation strategies.

Ideas for Implementation:

- Obtain funding to perform evaluations;

- Prioritize seismic upgrades based on criticality of need and population served; and
- Partner with appropriate organizations to implement seismic upgrades.

Coordinating Organization: Community Development Department, Public Works Department, Clackamas Fire District #1
Timeline: 5 years
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Partnerships and Implementation

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Legend

Relative Earthquake Hazard

- High
- Moderate
- Moderate / Low
- Low

Relative earthquake hazard is based on the factors of ground motion amplification, liquefaction, and slope instability.

- City Limits
- UGB
- Freeways
- Arterials
- Minor Streets
- Taxlots
- Rivers

SOURCE

Relative earthquake hazard data provided by Metro and the Department of Geology and Mineral Industries.

DISCLAIMER

The information on this map is based on data from scattered borehole, best-available geologic mapping, and state-of-practice geologic and geotechnical analysis. As a result it is general and subject to errors resulting from data gaps and interpretation. This map cannot be substituted for site-specific geotechnical investigation. Qualified practitioners working on a site-specific basis should assess the site-specific potential for and consequent damage from soil liquefaction, amplified ground shaking, landsliding, or any other earthquake hazard.

The City of Oregon City makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Gladstone

Oregon City

Willamette Falls

Clackamette Park

Dahl Park

Park Place

Henrici

N

W E

S

City of Oregon City
Earthquake Hazard Map

0 0.25 0.5 1 1.5 2 Miles

Map Date: 01/23/2009
Map File: Hazard_Earthquake_Hazard_11x17_portrait.mxd
Plot File: Hazard_Earthquake_Hazard_11x17P_20090123.pdf

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4.6 Volcanic Eruption

Volcanic eruptions can be devastating and long lasting. In addition to their flows of lava and debris, emissions of toxic gasses, and extensive deposits of airborne particles and ash, eruptions can also be accompanied by earthquakes, landslides, floods (due to snowmelt or dam breach), and other hazards, including altering weather worldwide.

Debris flows and lahars (flows with water, ice or snow) can wipe out everything in their path. Sometimes debris flows can dam streams and rivers, resulting in impoundment of water and debris build up behind very unsafe structures. This creates damage along the streams.

The Cascades, shaped largely by volcanic activity, account for much of the area's topography. Many of the volcanoes running from the State of Washington through Oregon to northern California are active or dormant. Few are judged by scientists to be extinct.

The 1980 eruption of Mt. St. Helens 60 miles to the north of Oregon City served as a strong reminder of the hazard to Portland Metro area residents. Because of wind patterns, the Metro area received a relatively minor ash fall when Mt. St. Helens erupted.

4.6.1 Volcanic Eruption History

Mt. St. Helens's famous 1980 eruption is well known. Mt. Hood, while not as active in recent years, has experienced four major eruptions during the last 15,000 years. The most recent occurred 200-300 years ago. Emissions also occurred in 1859, twice in 1865, and in 1903 when steam and fragments of rock and lava were ejected. During the past 2,000 years, lava domes at Mt. Hood have grown and collapsed creating hundreds of pyroclastic flows extending 11 kilometers down the mountain's southwest flank. This volcano remains in an active state.

4.6.2 Volcano Damage

Severe disruption of Oregon City is not expected from most of the effects of an eruption of Mt. Hood or Mt. St. Helens. The most likely problem would be ashfall, but the prevailing westerly winds most likely will carry most of the ash eastward. However, there is concern about nearby watersheds and associated facilities that store, transmit, and treat water for communities in the area. Prolonged water outages could have severe social and economic impacts.

4.6.3 Volcanic Eruption Hazard Assessment

The hazard assessment in the Clackamas County Natural Hazards Mitigation Plan best describes the volcano hazards for the Oregon City area. As such, the information will not be repeated here.

Hazard Scores

The HMPC determined the probability of a volcanic eruption to be low; meaning fewer than one volcanic eruptions are likely within a 100-year period. This is in agreement with the county's low rating. Vulnerability is low; meaning less than 1%

of the population is likely to be affected. This score is lower than the county's high rating because Oregon City is located very far from any active volcanoes, whereas parts of the county border Mt. Hood. History of volcanic eruptions was determined to be low, meaning 0-1 volcanic eruptions have occurred in a 100 year period. Finally, the HMPC determined maximum threat to be high; meaning more than 25% of the population could be affected by a volcanic eruption in a worse case scenario. These scores will be used and discussed in more detail in Section 5 of the addendum.

4.6.4 Existing Volcanic Eruption Mitigation Activities

The existing volcanic hazard mitigation activities are conducted at the county, regional, state, and federal levels and are described in the Clackamas County Natural Hazards Mitigation Plan. As such, the information will not be repeated here.

4.6.5 Volcanic Eruption Hazard Mitigation Action Items

Oregon City will not be undertaking any local volcanic eruption mitigation activities, but will partner with the county in the implementation of identified mitigation action items.

4.7 Multi-Hazard

4.7.1 Multi-Hazard Action Items (MH)

Multi-hazard action items are those activities that pertain to all seven hazards in the mitigation plan: flood, landslide, wildfire, severe winter storm, windstorm, earthquake, and volcanic eruption. The multi-hazard mitigation action items provide direction on specific activities that organizations and residents in Oregon City can undertake to reduce risk and prevent loss from landslide events. Each action item is followed by ideas for implementation, which can be used by the HMPC and local decision makers in pursuing strategies for implementation. Plan goals and county action items addressed are also noted for each action item.

ST- MH#1: Participate with Clackamas County and regional partners to identify and coordinate building officials that are qualified to conduct damage assessments.

Coordinating Organization: Oregon City Emergency Management and Clackamas Fire District #1
Timeline: 1 year
Plan Goals Addressed: Protect Life and Property, Emergency Services, Partnerships and Implementation

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ST- MH#2: Continue to update and improve hazard assessments in the Oregon City Natural Hazards Mitigation Plan Addendum.

Ideas for Implementation:

- Continue to update vulnerability assessment as new development occurs;
- Cooperate with participating agencies or secure funding needed to obtain data to perform a risk analysis for Oregon City; and
- Incorporate data and maps from the DOGAMI landslide LIDAR study into the addendum. LIDAR data can be used to identify earthquake faults and landslides in urban areas.

Coordinating Organization: Oregon City Geographic Information Systems, Hazard Mitigation Plan Committee
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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ST-MH#3: Integrate the goals and action items from the Oregon City Natural Hazards Mitigation Plan Addendum into existing regulatory documents and programs, where appropriate.

Ideas for Implementation:

- Use the Natural Hazards Mitigation Plan for compliance with State Land Use Planning Goal 7 and the city's Comprehensive Plan;
- Partner with other organizations and agencies with similar goals to promote building codes at the state level that are more disaster resistant; and
- Use the NHMP as a reference when updating master plans, capital improvement plans, the Comprehensive Plan and the Municipal Code.

Coordinating Organization: Community Development Department, Public Works Department, City Commission
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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ST-MH#4: Identify and pursue funding opportunities to develop and implement hazard mitigation activities.

Ideas for Implementation:

- Develop incentives for citizens and businesses to pursue hazard mitigation projects;
- Allocate city resources and assistance to mitigation projects when possible; and
- Partner with other organizations and agencies to identify grant programs and foundations that may support mitigation activities.

Coordinating Organization: Community Development Department and Public Works Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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ST-MH#5: Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing risk.

Ideas for Implementation:

- Maintain hazard related information and public information materials and disseminate to public through existing resources;
- Conduct public education as hazard seasons approach;
- Target neighborhood associations to sponsor CERT teams;
- Add emergency preparedness and response curriculum to school programs;
- Partner with Clackamas County and other jurisdictions to develop public education flyers for all hazards;
- Utilize Community Rating System publications for guidance on preparing effective public information;
- Include hazard information on the city website; and

- Include insurance information in public outreach and education materials.

Coordinating Organization: Hazard Mitigation Plan Committee
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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LT- MH#1: Update the Oregon City Emergency Operations Plan to provide a comprehensive multi-hazard emergency response program.

Ideas for Implementation:

- The Emergency Response Plan should include hazard-specific actions and post-disaster mitigation activities.

Coordinating Organization: Clackamas Fire District #1, Police Department, City Commission
Timeline: 5 years
Plan Goals Addressed: Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, Partnerships and Implementation

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LT-MH#2: Improve vegetation management throughout Oregon City.

Ideas for Implementation:

- Partner with Union Pacific and ODOT to control vegetation along transportation corridors;
- Identify appropriate practices for eliminating English ivy and other invasive species;
- Maintain healthy urban canopy;
- Maintain vegetation coverage for slope stability;
- Identify hazardous trees for remediation or removal;
- Develop a written set of procedures to minimize damage from wildfires erosion, and downed power lines; and
- Coordinate with Greater Oregon City Watershed Council and others.

Coordinating Organization: Community Services Department, Community Development Department
Timeline: Ongoing
Plan Goals Addressed: Protect Life and Property, Emergency Services, Natural Systems, Partnerships and Implementation

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Section 5: Mitigation Planning Priority System

5.1 Action Item Prioritization Methodology

As Oregon City works toward action item implementation, the Hazard Mitigation Plan Committee (HMPC) has prioritized the identified mitigation actions in order to better allocate resources for implementation. The criteria used for prioritizing the action items are the plan goals, hazards addressed, criticality of need, population served, and likelihood of success. This methodology is used by the HMPC to prioritize the plan's action items during the annual review and update process.

Step 1: Prioritize Plan Goals

The Oregon City mitigation goals including Protect Life and Property, Public Awareness, Emergency Services, Natural Systems, and Partnerships and Implementation were considered during each phase of the mitigation planning process. As the mitigation action items were developed, the HMPC identified which plan goals were addressed by each action item. The HMPC ranked the plan goals to determine the priorities for Oregon City, and each goal was given a score of one to five points, in ascending order of importance. The points for the plan goals were then totaled for each action item. The prioritized plan goals are as follows:

5 Points:	Protect Life and Property
4 Points:	Emergency Services
3 Points:	Public Awareness
2 Points:	Natural Systems
1 Point:	Partnerships and Implementation

Step 2: Prioritize Hazards

The natural hazards addressed by the Oregon City Natural Hazards Mitigation Plan Addendum were prioritized using the FEMA-accepted hazard analysis methodology for Emergency Operations Plans. This methodology considers the history of the hazard, the vulnerability to the hazard, the maximum threat of the hazard (worst case scenario), and the probability of the hazard. Each of these criteria was weighted and the final score was used for prioritizing the hazards. The following is a full description of the methodology used:

Categories Considered:

HISTORY:	The record of occurrences of previous major emergencies or disasters (weight factor = 2).
LOW	0 - 1 event per 100 years
MEDIUM	2 - 3 events per 100 years
HIGH	4 + events per 100 years
VULNERABILITY:	The percentage of population and property likely to be affected (weight factor = 5).
LOW	< 1% affected
MEDIUM	1 - 10% affected
HIGH	> 10% affected
MAXIMUM THREAT:	The maximum percentage of population and property that could be impacted under a worst case scenario (weight factor = 10).
LOW	< 5% affected
MEDIUM	5 - 25% affected
HIGH	> 25% affected
PROBABILITY:	The likelihood of occurrence within a specified period of time (weight factor = 7).
LOW	> 1 chance per 100 years
MEDIUM	> 1 chance per 50 years
HIGH	> 1 chance per 10 years

Severity Ratings:

LOW	= 1 - 3 points
MEDIUM	= 4 - 6 points
HIGH	= 7 - 10 points

Although the methodology allows Oregon City to quantify and compare natural hazards, it is flawed in that it compares hazards with high probabilities and relatively low consequences with hazards that have high probabilities and low consequences. The HMPC took this into consideration during the prioritization process, and the results are shown in Table 5.1 below. The hazards were given a score of one point to seven points, in ascending order. The multi-hazard action items were given the highest score (8), as they address more than one hazard. The points for the hazard scores were then totaled for each action item.

Table 5.1 Natural Hazards Prioritization Score

Hazard Weight Factor	History 2	Vulnerability 5	Max. Threat 10	Probability 7	Total	Points Assigned
Multi-Hazard	-	-	-	-	-	8
Winter Storms	18	40	80	49	187	7
Flood	20	25	50	70	165	6
Landslide	20	15	30	70	135	5
Wildfire	10	20	60	35	125	4
Earthquake	4	25	60	35	124	3
Wind Storms	8	30	50	35	123	2
Volcano	2	10	70	7	89	1

Step 3: Incorporate Criticality of Need, Large Number of Population Served, Likelihood of Success

The final score for each action item was computed by summing the plan goal score and the hazard score. The committee then considered the criticality of need, the percentage of population served, and the likelihood of success. The HMPC was given an opportunity to add five points to an action item that is highly critical, four points to an action item that has a high probability of success, and three points to an action item that serves a large percentage of the population. The prioritized action items are as follows:

Table 5.2 Action Item Prioritization Scores:

Existing Resources		Funding Required	
Long Term Multi-Hazard #1	28	Short Term Multi-Hazard #5	27
Short Term Multi Hazard #3	23	Short Term Multi-Hazard #4	23
Short Term Flood #3	20	Short Term Multi-Hazard #2	23
Long Term Wildfire #2	19	Short Term Flood #2	21
Short Term Multi-Hazard #1	18	Long Term Multi-Hazard #2	20
Short Term Flood #1	18	Long Term Severe Storm #1	19
Long Term Flood #1	18	Short Term Wildfire #1	19
Short Term Land Slide #2	17	Short Term Landslide #1	17
Long Term Wildfire #1	16	Long Term Earthquake #1	16
		Short Term Landslide #3	16

5.2 Implementing Mitigation Actions

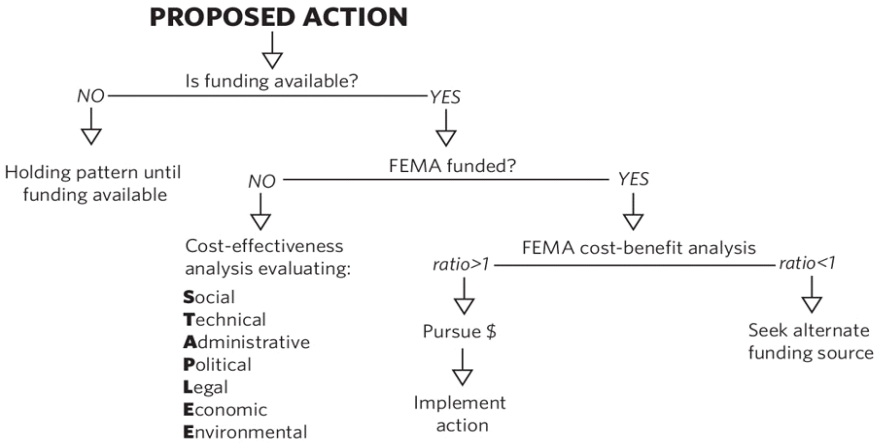
Depending on the project's intent and implementation methods, several funding sources may be appropriate. Examples of mitigation funding sources include, but are not limited to: FEMA's Pre-Disaster Mitigation competitive grant program (PDM), Flood Mitigation Assistance program (FMA), National Fire Plan (NFP), Community Development Block Grants (CDBG), local general funds, and private foundations.

The Hazard Mitigation Plan Committee and the community's leadership have the option to implement any of the action items at any time, (regardless of the prioritized order). This allows the HMPC to consider mitigation strategies as new opportunities arise, such as funding for action items that may not be of the highest priority.

Given the opportunity for federal funding, the Hazard Mitigation Planning Committee will use a FEMA-approved benefit/cost analysis approach to identify which of the prioritized mitigation action items are eligible for funding. A project must have a benefit/cost ratio of greater than one in order to be eligible for FEMA grant funding.

FEMA's approaches to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effective analysis. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later. Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating natural hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Figure 5.1 shows decision criteria for selecting the appropriate method of analysis.

Figure 5.1 Benefit Cost Decision Criteria



For non-federally funded or nonstructural projects, a qualitative assessment will be completed to determine the project's cost effectiveness. The committee will use a multivariable assessment technique called STAPLE/E to prioritize these actions. STAPLE/E stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Assessing projects based upon these seven variables can help define a project's qualitative cost effectiveness. For more information regarding economic analysis of mitigation action items, please see Appendix C of the Clackamas County Natural Hazards Mitigation Plan.

Section 6: Resource Directory

In addition to the Clackamas County Master Resource Directory, the following list provides contact information for local agencies, organizations, and departments that may deal with natural hazard mitigation, and could be potential partners in implementation of Oregon City's mitigation action items.

Agency	Contact Information	Type of Assistance
City of Oregon City Building Department	Phone: 503-722-3789 Fax: 503-722-3880	Plan Implementation; Emergency Operations; Public Information; Public Safety; Technical Support
City of Oregon City Engineering	Phone: 503-657-0891 Fax: 503-657-7892	Plan Implementation; Emergency Operations; Public Information; Public Safety; Technical Support
City of Oregon City Geographic Information Systems	GIS Coordinator Phone: 503-657-0819 x557 Fax: 503-722-3880	Plan Implementation; Emergency Operations; Public Information; Public Safety; Technical Support; Mapping
City of Oregon City Planning Department	Phone: 503-722-3789 Fax: 503-722-3880	Plan Implementation; Emergency Operations; Public Information; Public Safety; Technical Support
City of Oregon City Police Department	Phone: 503-657-4964 Fax: 503-655-0530	Emergency Operations; Emergency Response; Public Information; Public Safety; Technical Support
City of Oregon City Public Works Department	Phone: 503-657-8240 Fax: 503-650-9590	Plan Implementation; Emergency Operations; Public Information; Public Safety; Technical Support
Clackamas Fire District #1	Administration Division Phone: 503-742-2600 Fax: 503-742-2870	Plan Implementation; Emergency Operations; Emergency Response; Public Information; Public Safety; Technical Support
Clackamas County Emergency Management	Phone: 503-655-8378 Fax: 503-655-8531 http://www.clackamas.us/emergency/	Coordination; Emergency Operations; Emergency Response, Public Safety; Financing; Technical Support
City of Portland Office of Emergency Management	Phone: 503-823-4375 Fax: 503-823-3903 http://www.portlandonline.com/oem/	Coordination; Emergency Response, Public Safety; Technical Support
City of Lake Oswego	Planning and Development Phone: 503-635-0290 Fax: 503-635-0269	Coordination; Emergency Response; Public Safety; Technical Support
City of West Linn	Planning Department Phone: 503-656-4211 Fax: 503-656-4106	Coordination; Emergency Response; Public Safety; Technical Support
City of Gladstone	Phone: 503-656-5225 Email: bannick@ci.gladstone.or.us	Coordination; Emergency Response; Public Safety; Technical Support
City of Happy Valley	Planning Department Phone: 503-783-3800 Fax: 503-658-5174	Coordination; Emergency Response; Public Safety; Technical Support
Oregon City Chamber of Commerce	Phone: 503-656-1619 Fax: 503-656-2274 www.oregoncity.org	Plan Implementation; Public Information
Multnomah County - Emergency Management	Phone: 503-988-6700 Fax: 503-988-5710	Coordination; Emergency Response; Public Safety; Technical Support

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[11] (Madin, 1990)
[12] (Yeats et at., 1996; Werner et at., 1992).
[13] (Goldfinger et at., 1996)
[14] http://www.oregongeology.org/sub/earthquakes/Coastal/OrGeoEqNTsu.htm

Appendix A: Planning & Public Process

AGENDA

Meeting: Oregon City Natural Hazard Mitigation Plan Introductory Meeting
Date: November 5, 2008
Time: 11:00am to 1:00pm
Location: Oregon City City Hall

1. Meeting Attendees
    a. Kevin Donegan, Clackamas County Fire District #1 Emergency Manger
    b. Kathy Griffin, Oregon City Public Works Administrative Assistant
    c. David Knoll, Oregon City GIS Coordinator
    d. Nancy Kraushaar, Oregon City Public Works Directory/Engineer
    e. Laurel Reimer, Resource Assistance for Rural Environments
    f. Jay Wilson, Clackamas County Emergency Management

2. Project Overview (Laurel and Jay) *(See handout)*
    a. The group reviewed the handout

3. Planning Process (Laurel and Jay)
    a. Laurel informed the group of the items to be discussed during the first planning meeting
        i. First Planning Meeting:
            – Review plan update requirements
            – Review benefits of having a plan
            – Gather information about meetings and public involvement that have taken place
            – Plan Mission Statement, Goals, and Objectives
            – Determine who will be the Coordinating Body
            – Determine who will be the Convener
            – Review community profile data and get feedback
            – Review hazard data and history and get feedback
            – Discuss community issues related to each hazard addressed in the plan
            – Review next steps – action item updates
        ii. The group came up with potential members for the coordinating body representing:
            – Building Official
            – Chamber of Commerce
            – Community Development Department
            – Fire Department
            – GIS Department
            – McLoughlin Neighborhood Association
            – Planning Department
            – Police Department
            – Public Works Department
            – School District
            – South Fork Water Board

            *All members will be confirmed at the first planning meeting
        iii. The group decided the Public Works Director would be the most appropriate Convener. This will be confirmed at the first planning meeting.

iv. The group came up with a few recent hazard events such as the flooding of Newell Creek. These items were not discussed in detail, as they will be discussed with the entire coordinating body at the first planning meeting.

b. Laurel informed the group of items to be discussed during the second planning meeting
   i. Second Planning Meeting:
      - Review status of existing mitigation actions
      - Review and gather feedback on proposed actions
      - Review plan implementation components and update as necessary
      - Discuss the formal review process and plan maintenance
      - Discuss continued public involvement
      - Review timeline for city review, OPDR review, FEMA review
      - Review process for adoption
   ii. The group mentioned a few mitigation actions the city has already undertaken. These items were not discussed in detail, as they will be discussed with the entire coordinating body at the first planning meeting.

4. Today's needs (Laurel)
   a. Laurel will be working on the community profile but may ask for help finding the most recent data on:
      i. Employment and economics
      ii. Land use and development
      iii. Historic and cultural resources
      iv. Community organizations and programs
      v. Existing mitigation activities (plans, projects, education, etc)
   b. The group identified point people that Laurel may be able to get this data from.
   c. Maps will need to be updated using GIS
      i. Maps will be updated as we update the plan
      ii. David mentioned the city geocoded hazmat data, this data may be used in the plan

5. Next Steps
   a. The group decided on dates and times for the next two meetings:
      i. November 19, 2008 from 9am to 1pm at Oregon City City Hall
      ii. December 10, 2008 from 10am to 2pm at Oregon City City Hall
   b. People were assigned to contact potential coordinating body representatives:
      i. David: McLoughlin Neighborhood Association, School District, Community Development
      ii. Kathy: Chamber of Commerce
      iii. Kevin: Police Department
      iv. Nancy: South Fork Water Board, Planning Department
   c. For the next meeting the group will review natural hazard history and data

HANDOUT

What is 'natural hazards mitigation'?

Natural hazards mitigation is defined as permanently reducing or alleviating the losses of life, property and injuries resulting from natural hazards through long and short-term strategies.

Engaging in mitigation activities provides jurisdictions with a number of benefits, including reduced loss of life, property, essential services, critical facilities and economic hardship; reduced short-term and long-term recovery and reconstruction costs; increased cooperation and communication within the community through the planning process; and increased potential for state and federal funding for recovery and reconstruction projects.

Why develop a natural hazards mitigation plan?

A natural hazards mitigation plan provides a community with a set of goals, action items, and resources designed to reduce risk from future natural disaster events. The process of developing a mitigation plan can also forge new partnerships among community organizations, businesses, and local citizens. These partnerships can lead to the development and implementation of risk reduction strategies that assist the community in reducing losses from any future natural disaster events.

In 2000, Congress approved the Disaster Mitigation Act of 2000 (DMA2K). DMA2K set forth requirements for communities to develop and adopt local natural hazard mitigation plans to become eligible for mitigation grant funding, including FEMA's Hazard Mitigation Grant Program (HMGP), and Pre-Disaster Mitigation (PDM) Grant Program.

What does a mitigation plan do?

Natural hazards mitigation plans document knowledge about the problems associated with natural hazards in a community. A mitigation plan articulates goals that will guide the community in implementing short- and long-term risk reduction activities, recommending appropriate mitigation action items, and identifying resources to implement activities. Preparing a mitigation plan for your community can reduce public and private costs resulting from natural disaster events. Successes in risk reduction and loss prevention are achieved by implementing programs that address and mitigate the potential impacts natural disasters may have on society, the economy, and the environment.

How will the county help with this process?

In an effort to assist each city in their addendum development process, Clackamas County partnered with the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon to hire a Resource Assistance for Rural Environments Participant (RARE Participant). The RARE Participant was hired using funds made available through the Hazard Mitigation Grant Program, and she will work with each participating city in developing an addendum to Clackamas County's Natural Hazards Mitigation Plan. The planning processes will occur between February and August 2009.

The RARE Participant will be responsible for developing and facilitating all natural hazards mitigation plan meetings within each city. Likewise, the RARE Participant will be responsible for documenting the results of each meeting, and preparing a draft addendum for all cities involved.

Meeting: Oregon City Natural Hazard Mitigation Plan Meeting 1
Date: November 19, 2008
Time: 9:00am to 1:00pm
Location: City Hall, Oregon City

MINUTES

1. Meeting Attendees
    a. Kevin Donegan, Clackamas County Fire District #1
    b. Kathy Griffin, Oregon City Public Works
    c. Alice James, McLoughlin Neighborhood Association
    d. David Knoll, Oregon City GIS
    e. Nancy Kraushaar, Oregon City Public Works
    f. Julie Paulsen, Oregon City Chamber of Commerce
    g. Laurel Reimer, Clackamas County Emergency Management
    h. Guy Sperb, Oregon City Building Division
    i. Pete Walter, Oregon City Planning

2. Planning Process Discussion
    a. Plan Participants
        i. The group assembled did not previously have an official name for itself. At the meeting the group decided to call themselves the "Hazard Mitigation Plan Committee."
        ii. While not in attendance at today's meeting, representatives from the school district and police department will be attending the next meeting.
    b. Coordinating Body
        i. This is the group that is intended to meet between the plan's adoption and update to review and implement items in the plan.
        ii. The Hazard Mitigation Plan Committee (HMPC) will serve as the coordinating body.
    c. Convener
        i. This section describes who is responsible for convening the HMPC. The Convener will schedule meetings, create agendas, and send out meeting minutes.
        ii. The Public Works Director will serve as the convener for the HMPC.
    d. Public Involvement
        i. The City will keep the public involved in the following ways:
            1. Press releases
            2. City can put brochures at front desk
            3. City Commission meetings are live online so they can have a presentation of the plan at a City Commission meeting
            4. "Trail News", a local news quarterly publication
            5. Willamette Falls TV does free public service announcements

6. The Chamber of Commerce can help advertise with e-blast, newsletter and website
7. Good Morning Oregon City program can distribute pamphlets to businesses
8. Neighborhood associations can advertise it in their newsletters
9. The HMPC can call a public meeting when deemed necessary, such as after a natural disaster
10. The City can have post-hazard public announcements and educate the public on how to avoid damages

3. Critical/Essential Facilities and Infrastructure
    a. The HMPC went over a list of potentially critical/essential facilities and infrastructures to determine which facilities were critical vs. essential, and to add or take off items that were not critical or essential.
    b. Two committee members (Pete and Alice) will contact the churches within the city to see if they are willing to work with the Red Cross to become shelter sites
    c. The group decided to list facilities under the headings "City" and "County" because the county seat is in Oregon City
    d. David will update the maps to include the updated list of critical (C)/essential (E) facilities and infrastructure:
        i. City Facilities
            1. Oregon City Main Fire Station/Emergency Operations Center (C)
            2. Holcomb Fire Station (C)
            3. South End Fire Station (C)
            4. Oregon City Police Department (C)
            5. Willamette Falls Hospital (C)
            6. Operations Center (C)
            7. Oregon City Carnegie Center
            8. National Guard Armory (E)
            9. City Hall (E)
            10. Pioneer Community Center (E)
            11. Abernethy Center (E)
            12. City Office Buildings (E)

        ii. County Facilities
            1. Beavercreek Fire Station (C)
            2. C-COM (C)
            3. Clackamas County Emergency Operations Center (C)
            4. Clackamas County Jail (E)
        iii. Schools (Potential Shelter Sites)
            1. John McLoughlin Elementary
            2. Gaffney Lane Elementary
            3. Holcomb Elementary

4. King Elementary
5. Mt. Pleasant Elementary
6. Park Place Elementary
7. Gardiner Middle School
8. Ogden Middle School
9. Oregon City High School
10. Oregon City High School – Jackson Campus
11. Clackamas Community College
12. Eastham Community School
13. North Clackamas Christian
14. St. John the Apostle

iv. Churches (Potential Shelter Sites)
1. Christ Church Apostolic
2. Great Day Fellowship Church
3. Light on the Hill Fellowship
4. Logan Community Church
5. Maranatha Baptist Church
6. Mountain View Community Church
7. St. John the Apostle Catholic Church
8. St. Paul's Episcopal Church
9. St Philip Benizi Church
10. Stone Creek Christian Church
11. Trinity Lutheran Church – LCMS
12. Victorious Faith Family Church
13. Oregon City Christian
14. Oregon City Evangelical
15. First United Methodist Church
16. First Presbyterian
17. Oregon City Church of the Nazarene
18. The Church of Jesus Christ of Latter-Day Saints

v. Infrastructure
1. Private Utilities
    a. Natural Gas System (C)
    b. Electrical Power System (C)
    c. Cellular Tower System (E)
    d. Telephone System (E)

2. Wastewater
    a. Tri City Wastewater Treatment Plant (C)
    b. Wastewater Collection System (C)
    c. Settler's Point Lift Station (E)
    d. Amanda Lift Station (E)
    e. Barclay Hills Lift Station (E)

f. Boynton Lift Station (E)
g. Brendon Estates Lift Station (E)
h. Canemah Lift Station (E)
i. Cook Street Lift Station (E)
j. Elevator Lift Station (E)
k. Hilltop Acres Lift Station (E)
l. Parrish Road Lift Station (E)
m. Pease Road Lift Station (E)
n. Hidden Creek Lift Station (E)
o. Nobel Ridge Lift Station (E)
p. Newell Crest Lift Station (E)

3. Water
    a. Hunter Pump Station (C)
    b. Mountain View Pump Station (C)
    c. Barlow Crest Reservoir (C)
    d. Boynton Standpipe Reservoir (C)
    e. Henrici Reservoir (C)
    f. Mountainview Reservoir #1 (C)
    g. Mountainview Reservoir #2 (C)
    h. South Fork Water Filter Plant (C)
    i. South Fork Water Intake (C)
    j. South Fork/Division Street Pump Station (C)
    k. Clear River Water/South Fork Water Intertie (C)
    l. South Fork Water Transmission Line (C)
    m. Water Distribution System (C)
    n. Fairway Downs Pump Station (E)
    o. Livesay Pump Station (E)
4. Stormwater
    a. Stormwater Management System (E)

5. Bridges, Overpasses and Main Culverts (C)
    a. Willamette River Bridge
    b. I-205 at Clackamas River
    c. McLoughlin Blvd at Willamette River
    d. I-205 at Main Street
    e. Washington Street at Abernethy Creek
    f. Holcomb Blvd at Oregon 213
    g. McLoughlin Tunnel at UPRR
    h. Anchor Way at Abernethy
    i. George Abernethy Bridge/I-205 over Willamette
    j. Hwy 213/Redland Road overpass
    k. McLoughlin Blvd. at Clackamas Road
    l. McLoughlin at Abernethy Culvert
    m. S.E. 82nd Pedestrian Bridge

6. Major Arterials (C)
    a. Meyers Road
    b. Central Point Road
    c. South End Road
    d. Leland Road
    e. Molalla Ave
    f. Beavercreek Road
    g. Warner Milne Road
    h. Warner Parrott Road
    i. Linn Avenue
    j. Division Street
    k. McLoughlin Blvd/Highway 99E
    l. High Street
    m. 5th Street
    n. 7th Street
    o. Anchor Way
    p. Redland Road
    q. Abernethy Road
    r. Washington Street
    s. Holcomb Boulevard
    t. Main Street (7th to McLoughlin Blvd)
    u. Glen Oak Road
    v. Maple Lane Road
    w. Highway 213
    x. Interstate 205

4. Hazard Identification
    a. During this portion of the meeting the group went over each of the hazards affecting the city and discussing their:
        i. History
            1. Where does the hazard occur?
            2. What is the extent of the hazard?
            3. How much of the community is affected by the hazard?
            4. What was damaged in the hazard?
            5. Any new development in areas affected by the hazard?
        ii. Existing Mitigation Strategies and Improvement Activities
        iii. Vulnerability and Probability Assessment: The group used the following guidelines to determine their vulnerability and probability. These rankings were expanded upon later in the meeting.

HISTORY: The record of occurrences of previous major emergencies or disasters.

LOW	0 - 1 event per 100 years
MEDIUM	2 - 3 events per 100 years
HIGH	4 + events per 100 years

VULNERABILITY: The percentage of population and property likely to be affected.

LOW	< 1% affected
MEDIUM	1 - 10% affected
HIGH	> 10% affected

MAXIMUM THREAT: The maximum percentage of population and property that could be impacted under a worst case scenario.

LOW	< 5% affected
MEDIUM	5 - 25% affected
HIGH	> 25% affected

PROBABILITY: The likelihood of occurrence within a specified period of time.

LOW	> 1 chance per 100 years
MEDIUM	> 1 chance per 50 years
HIGH	> 1 chance per 10 years

b. Flood
    i. In December 2005/January 2006 the Willamette and Clackamas Rivers flooded. This led to some bank erosion in Oregon City. Cleanup was required at Clackamette Park, for which FEMA provided some funding.
    ii. Mitigation actions
        1. Oregon City increased public information online
        2. Greater Oregon Watershed Council did plantings along Abernethy Creek
        3. Culvert cleaning – removed sediment from culverts to allow better water flow
        4. Willamette Rive bank stabilization and restoration work at Jon Storm Park
        5. Amended the flood ordinance to be in accordance with FEMA ordinance requirements and adopted a new set of FEMA floodplain maps
        6. Oregon City's FEMA rating went down from a 9 to a 7
    iii. The City participates in the National Flood Insurance Plan
    iv. Vulnerability and Probability Assessment
        1. History: High
        2. Vulnerability: Medium
        3. Maximum Threat: Medium
        4. Probability: High
c. Landslide
    i. In 1996 a sanitary sewer pump station began sliding downhill.
        1. MITIGATION – put seismic isolation piles under the foundation of the building.
    ii. Oregon City experienced numerous landslides as a result of the December 2005/January 2006 floods
        1. Trillium Drive – a storm sewer manhole was supposed to deflect water but it wasn't maintained properly, resulting in water flowing down the side of a slope and eroding the slope significantly enough to cause the slope to creep.

a. MITIGATION – the City repaired the storm water manhole and installed monitoring wells with inclinometers to allow the City to continue to monitor the slope.

2. Morton Road - Poor surface water management led to a landslide that threatened an apartment building.
    a. MITIGATION – the owner installed a crib wall
3. Newell Creek Village Apartments – A landslide occurred on site leading to two waterline breaks. Two buildings were evacuated and ultimately demolished.
    a. MITIGATION – the City temporarily repaired one of the water lines and permanently abandoned the waterline on the slope and reconfigured the second water line. The repaired line that remained at risk was later replaced with a new water line with flexible couplings at the joints. The City required relocation and reconstruction of the apartment complex's private sanitary sewer pump station.
4. Newell Crest Drive – a landslide impacted three homes and required the vacation of one home.
    a. MITIGATION – The homeowner constructed a retaining wall, costing approximately $100,000.
5. Oregon City High School Jackson Campus – a portion of a slope slid near the football field but it caused no structural damage

iii. Mitigation efforts
1. The City has a water pipe line leak detection system and does annual assessment in slide hazard areas.
2. The City is amending their geologic hazard overlay, Code 17.44. DOGAMI maps are being updated using the City's LIDAR data.
3. In the unstable slope overlay zone, new development requires peer review by engineers and geologists
4. Sites with greater than 25% slope are subject to more review and requirements. If the hazard cannot be mitigated, construction is not allowed

iv. Vulnerability and Probability Assessment
1. History: High
2. Vulnerability: Low
3. Maximum Threat: Low
4. Probability: High

d. Wildfire
i. The Canemah Bluffs area is an urban/wildland interface with heavy tree coverage. There is a dense neighborhood at the top of a steep wooded area.

1. In August 2005 a wildfire on the Canemah Bluffs burned down a non-occupied historic structure.
2. Another fire in this same area struck in 2007. This fire began at Highway 99E and spread up the rock cliff face.

ii. Potential Fires
1. Newell Creek Canyon has potential for catastrophic fire. This area is Metro open space and it does not have a master plan. This area is a major wildland urban interface. Transients often have campfires in this area, creating a potential for fire to start. Highway 213 is part of Newell Creek and a cigarette thrown from a car can also start a fire.
2. Waterboard Park is located along the bluff below Promontory Avenue. Transients live there and have campfires. This is considered a charter park, meaning trees cannot be cut to reduce fuel load.

iii. Vulnerability and Probability Assessment
1. History: Medium
2. Vulnerability: Medium
3. Maximum Threat: Medium
4. Probability: Medium

e. Winter Storm
i. The County plan's description of winter storms is sufficient for Oregon City.
ii. Mitigation efforts
1. As a result of the December 26, 2003 to January 14, 2004 winter storm, Oregon City developed their snow route priorities map. This map informs Public Works which roads should be cleared first and what roads require closure with sign placement procedures.
2. The City has now changed from exclusively using sand to a combination of sand and a de-icing compound for use on their streets.
3. The City is installing emergency generators for sanitary sewer pump stations in susceptible hazard areas. In winter storms, it is difficult for the City to bring portable generators to those sites.

iii. Vulnerability and Probability Assessment
1. History: High
2. Vulnerability: High
3. Maximum Threat: High
4. Probability: High

f. Wind Storm
i. The County plan's description of wind storms is sufficient
ii. Vulnerability and Probability Assessment
1. History: Medium
2. Vulnerability: Low

3. Maximum Threat: Medium
4. Probability: Medium

g. Earthquake
   i. The County plan's description of earthquakes is sufficient
   ii. The "Spring Break Quake" of 1993 caused rocks to loosen up and fall in Waterboard Park. No one was injured and reported damages were limited.
   iii. Mitigation efforts
      1. The City has many structures that have been built or retrofitted for seismic activity
         a. Carnegie Center restoration
         b. Oregon City High School
         c. Oregon City Main Fire Station
         d. Clackamas Community College has upgraded a few of their buildings
         e. Mountain Reservoir #2, 10.5 million gallon drinking water reservoir
         f. All water and sanitary sewer pump stations are built in accordance with applicable seismic building codes.
         g. The City constructs and has replaced at-risk waterlines that include flexible couplings between sections of the pipe.
   iv. Vulnerability and Probability Assessment
      1. History: Low
      2. Vulnerability: Medium
      3. Maximum Threat: Medium
      4. Probability: Medium

h. Volcano
   i. The County plan's description of volcanoes is sufficient
   ii. Vulnerability and Probability Assessment
      1. History: Low
      2. Vulnerability: Low
      3. Maximum Threat: High
      4. Probability: Low

5. Mitigation Planning Priority System
   a. In this section the group revisited the rankings for each hazard and assigned point values to their ranking based on severity. Severity ratings are as follows:
      i. Low = 1 – 3 points
      ii. Medium = 4 – 6 points
      iii. High = 7 – 10 points
   b. Each severity score also has a weight factor
      i. History: weight factor = 2
      ii. Vulnerability: weight factor = 5

iii. Max Threat: weight factor = 10
iv. Probability: weight factor = 7

c. Ultimately the group came up with the following chart:

Hazard	History	Vulnerability	Max. Threat	Probability	Total
Winter Storms	18	40	80	49	187
Flood	20	25	50	70	165
Landslide	20	15	30	70	135
Wildfire	10	20	60	35	125
Earthquake	4	25	60	35	124
Wind Storms	8	30	50	35	123
Volcano	2	10	70	7	89