CLATSOP COUNTY

Natural Hazards Mitigation Plan

APRIL 2015

PREPARED BY:

CLATSOP COUNTY
CITY OF ASTORIA
CITY OF CANNON BEACH
CITY OF GEARHART
CITY OF SEASIDE
CITY OF WARRENTON

Acknowledgements

The 2014 update of the Clatsop County Natural Hazard Mitigation Plan is the result of a collaborative effort between the County, cities, special districts, citizens, public agencies, non-profit organizations, the private sector and regional organizations. A project steering committee guided the plan development process. The steering committee was comprised of the following representatives:

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I. Basic Plan

This volume includes the following sections:

- Introduction
- Community Overview
- Mission, Goals, and Action Items
- Plan Implementation and Maintenance

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Executive Summary

Hazard mitigation planning is a process that identifies actions to reduce the dangers to life and property from natural hazard events. The Clatsop County Multi-Jurisdiction Natural Hazard Mitigation Plan has been developed to comply with the requirements of the Federal Disaster Mitigation Act (FDMA) of 2000 and subsequent updates, and it meets the guidelines for the hazard mitigation planning program administered by the Federal Emergency Management Agency (FEMA). While cities are not required to adopt hazard mitigation plans, the FDMA requires all municipalities that wish to be eligible to receive FEMA hazard mitigation grants to adopt a local multi-hazard mitigation plan and update the plan every five years. Clatsop County's first hazard mitigation plan was approved by FEMA in 2008, and update provides the first five-year update. An approved Hazard Mitigation Plan renders cities eligible for FEMA's hazard mitigation Grant Program, Flood Assistance Mitigation grants, and Pre-Disaster Mitigation grants.

The mission statement of the plan remains unchanged: *To Create a Disaster-Resilient Clatsop County.* Through an evaluation of local jurisdictions and their assets, a review of natural hazard risks present in the community, and a strategic approach to mitigating hazard risks, the updated plan fulfills the original mission statement. Future efforts to evaluate and revise the plan will build upon this update.

This plan shows that communities within Clatsop County continue to be subject to a number of natural hazards, including coastal erosion, drought, earthquake, flood, landslide, tsunami, volcanic ash fall, wildfire and wind/winter storm. While all of these hazard events could occur, and have occurred within the County and its communities, earthquake, flood, landslide, tsunami and wind/winter storm stand out as the predominant hazard risks. Annually, flooding and severe storms occur. The location, extent, history and vulnerability of these events is documented in this update. Also documented are the local existing natural hazard policies and programs that could mitigate some of the effects of natural disasters if sufficient resources were available.

Mitigation strategies outline various actions that, given sufficient funding, could be implemented to address natural hazard disasters. From developing disaster response plans to encouraging landowners through incentive programs to avoid disaster areas, the plan covers a breadth of activities that would mitigate the effects of natural disasters. These actions have been prioritized by the local community and represent a sounds approach to addressing local hazards that is most acceptable to the local community. The update produced minor adjustments to the mitigation strategy that more accurately reflect current approaches to address natural hazard disasters.

Finally, the updated jurisdiction-specific sub-plans provide a focused and strategic approach to addressing natural hazard risks in the cities of Astoria, Cannon Beach, Gearhart, Seaside and Warrenton. Building upon a larger plan that addresses natural hazards at the county level, these sub-plans provide a close look at the demographics, critical facilities, development trends, and vulnerabilities of the cities in Clatsop County. The unincorporated areas of the county rely on the larger mitigation strategy for mitigation actions.

Point of Contact

The Point of Contact for information regarding the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan is the following:

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Introduction

Purpose

This natural hazard mitigation plan is intended to assist Clatsop County, City of Astoria, City of Warrenton, City of Gearhart, City of Seaside, and the City of Cannon Beach in reducing the risk from natural hazards by identifying resources, information, and strategies for risk reduction. It will also help guide and coordinate mitigation activities throughout the County. The figure below is utilized throughout the plan to illustrate the concept of risk reduction.

Natural hazard mitigation plans can assist jurisdictions in understanding what puts the community at risk. By identifying and understanding the relationship between natural hazards, vulnerable systems, and existing capacity, communities in Clatsop County become better equipped to identify and implement actions aimed at reducing the overall risk to natural hazards.

Plan History

This Natural Hazard Mitigation Plan was initially developed through a regional partnership funded by the Federal Emergency Management Agency's Pre- Disaster Mitigation Competitive Grant Program. The Oregon Coast Region grant was awarded to support the development of natural hazard mitigation plans for the region. The region's planning process utilized a four-phased planning process, plan templates and plan development support provided by the Partnership for Disaster Resilience at the University of Oregon. Regional partners included:

- Oregon Partnership for Disaster Resilience/University of Oregon Community Service Center
- Oregon Emergency Management
- Department of Homeland Security, FEMA Region X
- Clatsop County

Municipality and initial Project Steering Committee included representatives from the following:

- Columbia River Estuary Study Taskforce
- Clatsop County Emergency Management Division
- Clatsop County Transportation and Services Department
- Clatsop County Planning Department
- Clatsop County Public Health Department
- Clatsop County Planning Commission
- City of Astoria
- City of Warrenton
- City of Gearhart
- City of Seaside
- City of Cannon Beach
- Fire Defense Board
- Columbia Memorial Hospital

- Coast River Business Journal
- Port of Astoria
- Seaside School District
- OSU Sea Grant Extension
- Clatsop Community College

The planning process and associated resources used to create Clatsop County's multi-jurisdictional Natural Hazards Mitigation Plan were developed and designed to: (1) Result in a plan that is DMA 2000 compliant; (2) Coordinate with the State's plan and activities of The Partnership; and (3) Build a network of jurisdictions and organizations that can play an active role in plan implementation. During the fall of 2013, the Clatsop County co-conveners worked collectively with the steering committee to update the Clatsop County Natural Hazard Mitigation Plan.

Clatsop County's Planning Department and Emergency Management Division were designated as the Plan's co-conveners, following the development of the plan. They will continue to take the lead after plan adoption, including implementing, maintaining and updating the plan. Public participation plays a key role in the development of goals and action items.

Who participated in the plan update?

The 2014 update of the Clatsop County Natural Hazard Mitigation Plan is the result of a collaborative effort between the County, cities, special districts, citizens, public agencies, non-profit organizations, the private sector and regional organizations. A project steering committee guided the plan development process. The steering committee was comprised of representatives from the following agencies:

- Clatsop County Emergency Management Division
- Clatsop County Planning Department
- Clatsop County Information Services (GIS)
- City of Astoria
- City of Warrenton
- City of Gearhart
- City of Seaside
- City of Cannon Beach
- OSU Sea Grant Extension
- Oregon Department of Land Conservation and Development (DLCD)
- Clatsop County Fire Defense Board
- Seaside School District

Mission

The mission of the Clatsop County Natural Hazards Mitigation Plan is to create a disaster resilient Clatsop County.

Goals

The plan goals describe the overall direction that the participating jurisdiction's agencies, organizations, and citizens can take toward mitigating risk from natural hazards. They are as follows:

- Protect life
- Minimize damage to public and private buildings and infrastructure
- Reduce economic loss
- Decrease disruption to critical services
- Protect natural and cultural resources
- Increase education and awareness of the risks and hazards in Clatsop County
- Increase cooperation and collaboration among County partners

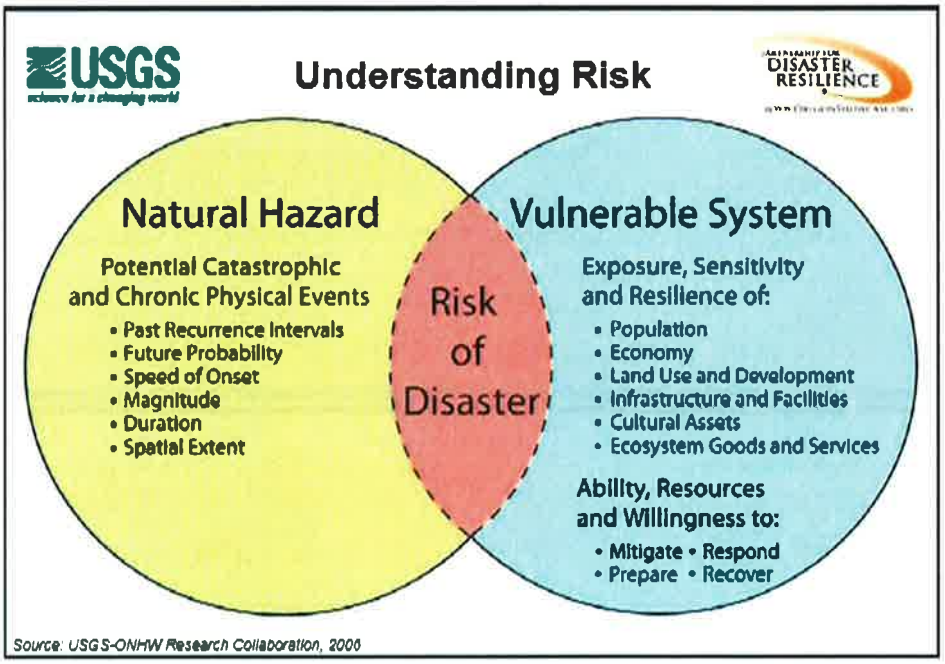
What Is Natural Hazard Mitigation?

Natural hazard 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. Example strategies include policy changes, such as updated ordinances; projects, such as seismic retrofits to critical facilities; education and outreach to targeted audiences, such as Spanish speaking residents, or the elderly. Mitigation is the responsibility of individuals, private businesses and industries, state and local governments, and the federal government.

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 Mitigation Plan?

Clatsop County developed this multi-jurisdictional Natural Hazards Mitigation Plan in an effort to reduce future loss of life and damage to property resulting from natural hazards. This plan was developed with and for the following jurisdictions: Clatsop County, City of Astoria, City of Warrenton, City of Gearhart, City of Seaside, City of Cannon Beach, and the Port of Astoria. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the County. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards. The figure on the next page illustrates the concepts of risk reduction.



A natural hazard mitigation plan can assist the community in understanding what puts the community at risk. By identifying and understanding the relationship between natural hazards, vulnerable systems, and existing capabilities, communities in Clatsop County become better equipped to identify and implement actions aimed at reducing the overall risk of hazards.

This plan focuses on the primary natural hazards that could affect Clatsop County, which include Coastal Erosion, Drought, Earthquake, Flood, Landslide, Tsunami, Volcanic Ash Fall, Wildfire, and Winter Storm/Windstorm. The dramatic increase in the costs associated with natural disasters over the past decades has fostered interest in identifying and implementing effective means of reducing vulnerability. This multi-jurisdictional Natural Hazards Mitigation Plan is intended to assist all participating jurisdictions in reducing their risk from natural hazards by identifying resources, information, and strategies for risk reduction.

The plan is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) A foundation for coordination and collaboration among agencies and the public in the County; (2) Identification and prioritization of future mitigation activities; and (3) Aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other County and City plans and programs including, Comprehensive Land Use Plans, Emergency Response and Recovery Plans, Economic Development Strategic Plans, Capital Improvement Plans, Buildable Lands Inventories, as well as the State of Oregon Natural Hazards Mitigation Plan.

The plan provides a set of actions to prepare for and reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, the implementation of preventative activities such as land use and watershed management programs, and infrastructure retrofitting programs. The actions described in the plan are intended to be implemented through existing plans and programs within the county and/or city.

Policy Framework for Natural Hazards In Oregon

Planning for natural hazards is an integral element of Oregon's statewide land use planning program, which began in 1973. All Oregon cities and counties have comprehensive plans and implementing ordinances that are required to comply with the statewide planning goals. The challenge faced by state and local governments is to keep this network of local plans coordinated in response to the changing conditions and needs of Oregon communities.

Statewide land use planning "Goal 7: Areas Subject to Natural Hazards" calls for local plans to include inventories, policies and ordinances to guide development in or away from hazard areas. Goal 7, along with other land use planning goals, has helped to reduce losses from natural hazards. Through risk identification and the recommendation of risk-reduction actions, this plan aligns with the goals of the jurisdictions' comprehensive plans, and helps each jurisdiction meet the requirements of statewide land use planning Goal 7.

The primary responsibility for the development and implementation of risk reduction strategies and policies lies with local jurisdictions. However, resources exist at the state and federal levels. Some of the key agencies in this area include Oregon Emergency Management (OEM), Oregon Building Codes Division (BCD), Oregon Department of Forestry (ODF), Oregon Department of Geology and Mineral Industries (DOGAMI), and the Department of Land Conservation and Development (DLCD).

The Disaster Mitigation Act of 2000 (DMA 2000) reinforces the importance of mitigation planning and emphasizes planning for natural hazards before they occur. Section 322 of the Act specifically addresses mitigation planning at the state and local levels. Mitigation plans must demonstrate that their proposed mitigation measures are based on a sound planning process that accounts for the risk to individuals and their capabilities. State and local jurisdictions must have approved mitigation plans in place in order to qualify to receive pre-disaster or post-disaster funding.

How Is the Plan Organized?

Each volume of the mitigation plan provides specific information and resources to assist readers in understanding the hazard-specific issues facing citizens, businesses, and the environment. Combined, the sections work in synergy to create a mitigation plan that furthers the community's mission to create a disaster resilient Clatsop County. This plan structure enables stakeholders to use the section(s) of interest to them.

Volume I: Multi-jurisdictional Natural Hazard Mitigation Plan

Introduction

The Introduction briefly describes the countywide mitigation planning efforts and the methodology used to develop the plan. City specific planning efforts are documented in *Volume III: City/Special District Addendums*.

Community Overview

This section provides an overall description of Clatsop County. The section includes a brief community profile, discussion of the government structure, listing of existing plans, policies, and programs, listing of community organizations, summary of existing mitigation actions, and an overview of the hazards addressed in the plan. This section allows readers to gain an understanding of the County's sensitivities – those community assets and characteristics that may be impacted by natural hazards, as well as the County's resilience – the ability to manage risk and adapt to hazard event impacts. A Community Overview for each participating city and special district is located in *Volume III: City/Special District Addendums.*

Mission, Goals and Action Items

This section documents the plan mission, goals, and actions and also describes the components that guide implementation of the identified mitigation strategies. Actions are based on community sensitivity and resilience factors and the hazard assessments in the Community Overview and Hazard Annexes. Action items specific to cities and special districts are located in *Volume III: City/Special District Addendums.*

Plan Implementation and Maintenance

This section provides information on the implementation and maintenance of the plan. It describes the process for prioritizing projects, and includes a suggested list of tasks for updating the plan that can be completed at the semi-annual and 5-year review meetings. The participating cities and special districts will utilize this implementation and maintenance process as well.

Volume II: Hazard-Specific Annexes

The hazard annexes describe the risk assessment process and summarize the best available local hazard data. A hazard summary is provided for each of the hazards addressed in the plan. The summary includes hazard history, location, extent, vulnerability, impacts, and probability. The hazard specific annexes included with this plan are the following:

- Coastal Erosion
- Drought
- Earthquake
- Flood
- Landslide/Debris Flow
- Tsunami /Coastal Debris
- Volcanic Ash Fall
- Wildfire
- Windstorm/Winter Storm

Volume III: City/Special District Addendums

Volume III of the plan is reserved for city or special district addendums developed through the multi-jurisdictional planning process.

Volume IV: Resource Appendices

The resource appendices are designed to provide the users of the Clatsop County multi-jurisdictional Natural Hazards Mitigation Plan with additional information to assist them in understanding the contents of the mitigation plan, and provide them with potential resources to assist with plan implementation and are as follows:

Appendix A: Action Item Forms

This appendix contains the detailed action item forms for each of the mitigation strategies identified in this plan.

Appendix B: Planning & Public Process

This appendix includes documentation of all the countywide public processes utilized to develop the plan. It includes invitation lists, agendas, sign-in sheets, and summaries of Steering Committee meetings as well as any other public involvement methods.

Appendix C: Economic Analysis of Natural Hazards Mitigation Projects

This appendix describes the Federal Emergency Management Agency's (FEMA) requirements for benefit cost analysis in natural hazards mitigation, as well as various approaches for conducting economic analysis of proposed mitigation activities. This appendix was developed by The Partnership. It has been reviewed and accepted by the Federal Emergency Management Agency as a means of documenting how the prioritization of actions shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Appendix D: Regional Profile, Risk Assessment and County Hazard Analysis

This report was developed by The Partnership and it serves as the nexus between the State Natural Hazard Mitigation Plan and local plans. A component of the State Plan, the report is utilized by local communities to identify specific issues locally and to develop potential action items. Communities review and update the data in the report based on their best available local data. The updates are then incorporated into the State Plan, creating a state level plan that is built upon information and data from the local level.

Using the best available data, the regional profile includes a demographic profile that discusses the population in the region, an Infrastructure Profile that addresses the region's critical facilities and transportation and power transmission systems, and an Economic Profile that discusses the scale and scope of the regional economy with a focus on the key industries. In addition to describing characteristics and trends, each profile section identifies the traits that indicate sensitivity to natural hazards.

This report also includes the regional risk assessment that describes historical impacts, general location, extent, and severity of past natural hazard events as well as the probability of future events. This information is aggregated at the regional level and provides counties with a baseline understanding of past and potential natural hazards.

These assessments were based on best available data from various state agencies related to historical events, repetitive losses, county hazard analysis rankings, and general development trends. The risk assessment was written in 2003 by The Partnership as part of the State Natural Hazards Mitigation Plan and The Clatsop County Hazard Analysis updated every 5 years.

Appendix E: Regional Household Preparedness Survey

This appendix includes the survey instrument and results from the regional household preparedness survey implemented by The Partnership. The survey aims to gauge household knowledge of mitigation tools and techniques to assist in reducing the risk and loss from natural hazards, as well as assessing household disaster preparedness.

Appendix F: Clatsop County Natural Hazard Mitigation Plan Update Survey

This appendix includes the instrument and results from the Clatsop County Natural Hazard Mitigation Plan survey implemented by Clatsop County in 2014. The survey aimed to gauge citizen knowledge of local hazards and mitigation planning in the community as well as solicit suggestions for future mitigation activities.

Appendix G: Community Organizations

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 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. This appendix lists community organizations that are active within Clatsop County.

Community Overview

The following section describes Clatsop County from a number of perspectives in order to help define and understand the County'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 in this section represents a snapshot in time of the current sensitivity and resilience factors in the County when the plan was developed. The information documented below, along with the hazard assessments located in the Hazard Annex, should be used as the local level rationale for the risk reduction actions identified in Section 3 – Mission, Goals, and Action Items. The identification of actions that reduce the County's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in the figure below.

Community Profile

Geography and Climate

Clatsop County, the most northwest county in Oregon, has a land area of 1,085 square miles, including 873 square miles of land and 212 square miles of water. It is bordered on the north by the Columbia River, on the west by the Pacific Ocean, south by Tillamook County, and on the east with the Oregon Coast range.[1]

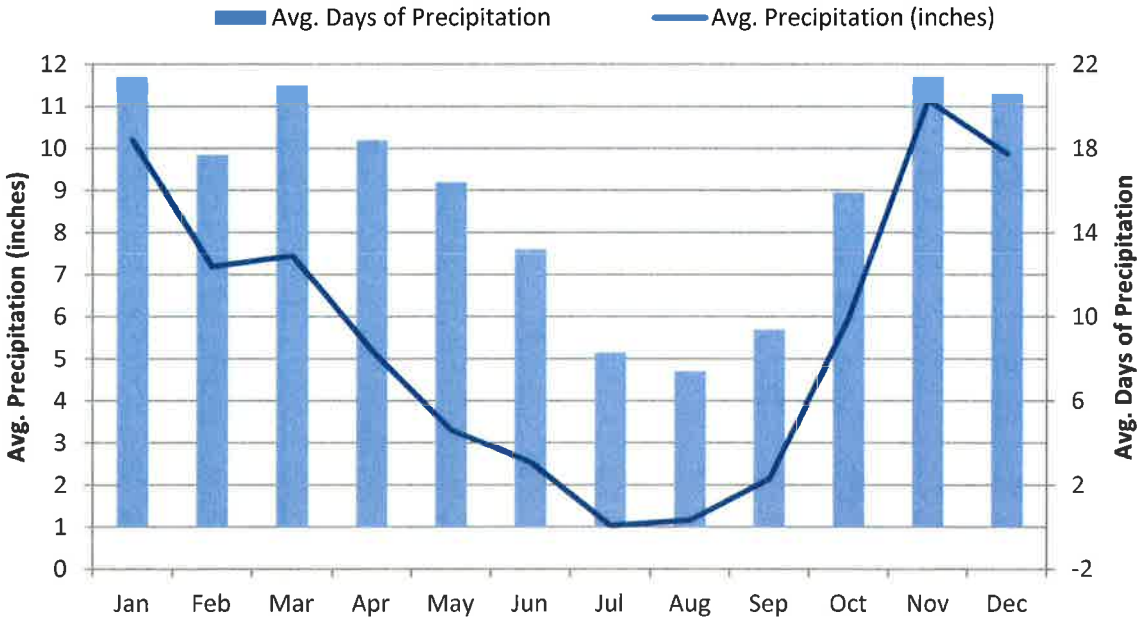
Figure 2.1 Clatsop County, Oregon

Source: US Census, 2000

Much of Clatsop County is dominated by coastal terrain, and features include a coastal plain (extending from just less than a mile to a few tens of miles in width), numerous coastal valleys, and the Coast Range, whose peaks range from 2,000 to 5,500 feet above sea level and extend down the full length of the state.[ii]

Clatsop County is characterized by wet winters, relatively dry summers, and mild temperatures throughout the year. The area's heavy precipitation results from moist air masses moving off the Pacific Ocean onto land, especially during winter months. Along the lower elevations of the immediate coast, normal annual precipitation is between 65 and 90 inches. However, spots high on the west slopes of the range may get up to 200 inches per year. Several days of abundant rainfall can cause strong flood events. As is typical of western Oregon, the highest monthly precipitation values for the coast occur in the winter months of November, December, and January.

Table 2.1 Precipitation, Monthly and Annual Averages (1981-2010)

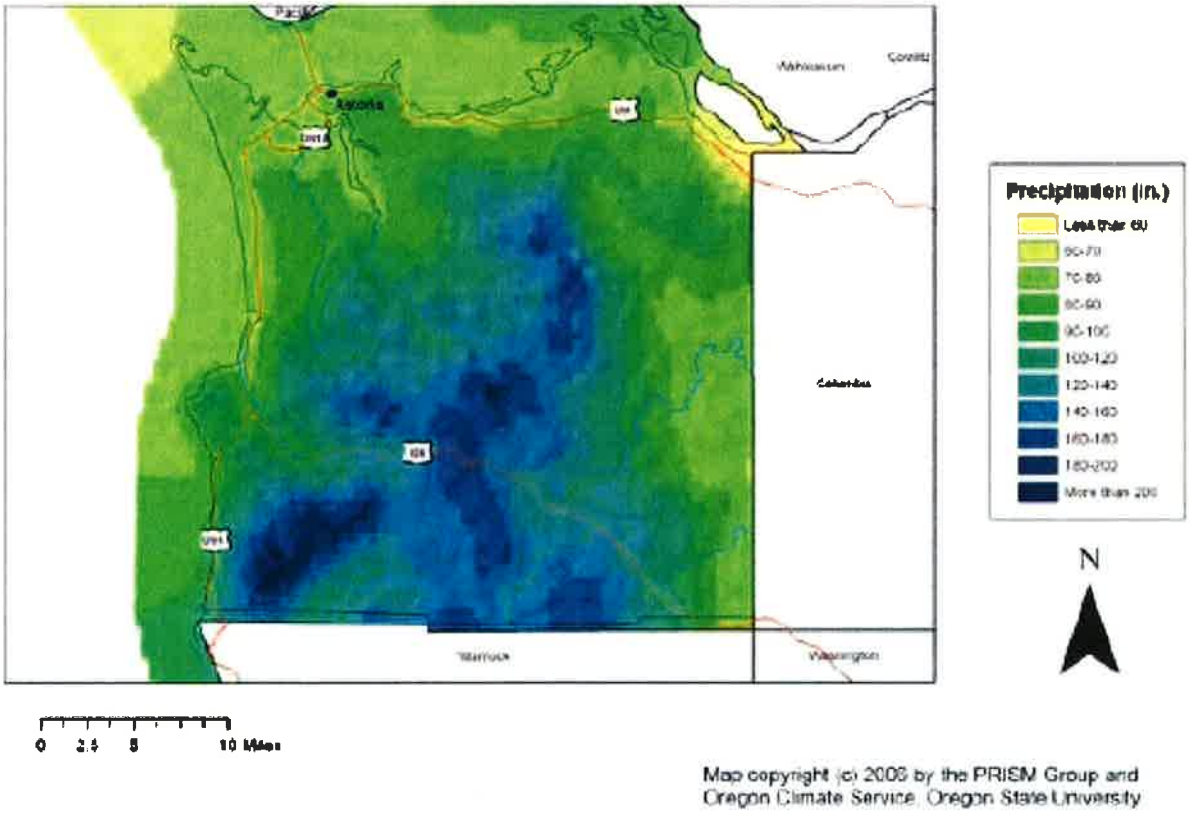


Source: Oregon Climate Service, 2005

Clatsop County is coldest in January with an average temperature of 41.9 degrees and warmest in July, with an average temperature of 60.1 degrees Fahrenheit. Extremely high or low temperatures are rare, and the annual temperature range is lower than any other Oregon climate zone. Temperatures of 90 degrees Fahrenheit or above occur, on average, less than once per year, and freezing temperatures are infrequent.

Occasional strong winds strike the Oregon Coast, usually in advance of winter storms. Wind speeds can exceed hurricane force, and in rare cases have caused significant damage to structures or vegetation. Skies are likely to be cloudy during winter and only partly cloudy during summer. In Astoria, average winter cloud cover is over 80 percent, dropping only to about 65 percent in summer. Summer cloud cover is due mostly to fog and low clouds. As a result of the persistent cloudiness, total solar radiation is lower here than in any other part of the state.[iii]

Figure 2.2 Average Annual Precipitation, Clatsop County, Oregon



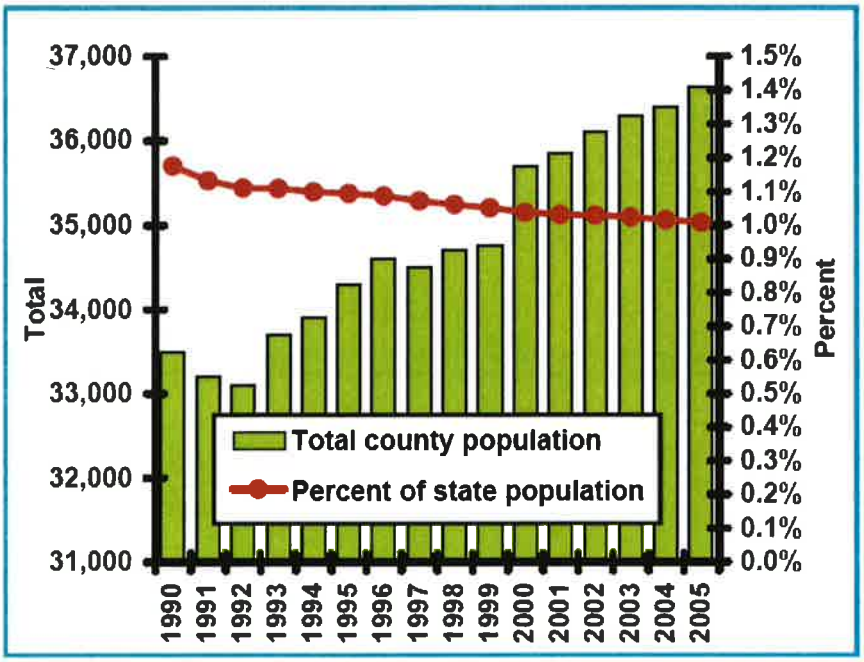
Source: Oregon Climate Service, 2005

Population and Demographics

The population of Clatsop County in 2013 is estimated to be **37,244**.[iv] In 2010, the population of the County was **37,153** with an average population density of **44.7** persons per square mile of land area.[v] The largest incorporated cities in Clatsop County are Astoria (population 9,477), Seaside (population 6,169), Warrenton (population 4,096), Cannon Beach (population 1,690), and Gearhart (population 1,462).[vi]

Population growth is a factor in a community's vulnerability to disaster. This is because development patterns, economic development characteristics, and so on may contribute to vulnerability. Most importantly, a rapid growth rate may stress a local government's ability to plan, regulate and serve the new population. Using the census data from 1990 and 2000, Clatsop County's average annual growth rate (AAGR) was calculated to be 0.68%, less than half of Oregon's AAGR for that same period, 1.87%.[vii]

Figure 2.3 Population Growth in Clatsop County, 1990-2005



Source: ORDHS, Office of Community Health and Health Planning, 2007

Vulnerable Populations

Vulnerable populations are those groups that possess specific characteristics that inhibit their ability to prepare for, respond to, or recover from a disaster. These characteristics include physical and developmental disabilities, mental illness, poverty, old age, or an inability to speak or understand English. These groups are more heavily impacted because they may lack the necessary knowledge, skills, social support structures, or the mental and physical abilities necessary to take care of themselves. Historically, vulnerable populations present a special challenge to emergency managers and response agencies and they are more likely to be victims of a disaster.

Non-English speaking and special cultural characteristics

According to the 2000 census estimates, approximately 7.1% of the Clatsop County population over the age of five speaks a language other than English at home.[viii] A lack of ability to speak or read the English language can present a challenge to emergency managers, since instructions for self-protective action and general disaster information are usually provided only in English. The non-English speaking population would be uninformed unless they have assistance from friends or service providers who may provide them with instruction and information in English. In certain areas of Clatsop County it may be advisable for emergency managers and emergency response agencies to arrange for translation of instruction and information into different languages.

Elderly

In 2010, persons 65 and older made up 16.6% of the total Clatsop County population.[ix] Nationwide, as the "baby boomer" generation enters their 60s, the senior population is expected to dramatically increase. Elderly populations are typically more vulnerable to temperature extremes than other residents.

Tourists

Tourists are particularly vulnerable during natural hazard events. This is because tourists are usually unfamiliar with the hazards in the region and because they do not have the knowledge or the materials needed to take care of themselves in a disaster. For example, a typical tourist, unfamiliar with Clatsop County, may have difficulty using evacuation routes, or finding shelters. A light traveling tourist would also not have their own supply of food, water, flashlights, radios, and other supplies that locals can use to take care of themselves in a disaster. And finally, tourists usually do not have a local support structure of family, friends, and neighbors.

Due to its proximity to the Oregon Coast and the Columbia River, Clatsop County is considered a major Northwest tourist destination. Because of the tourist destinations in Clatsop County, there is a large transient population during the summer, when most visitors come into the County. Of the 19,685 households, over 16% (3,297) are used for seasonal, recreational or occasional use. Points of Interest include: Astoria Column, Port of Astoria, Flavel House, Liberty Theatre, Fort Clatsop National Memorial, Lewis and Clark salt cairn, Fort Stevens State Park, Columbia River Maritime Museum, Tillamook Head, Ecola State Park, Jewell elk refuge, Young's River falls, Twilight Eagle Sanctuary, and the Port of Astoria that caters to cruise ships.[x]

Physically Disabled

According to 2000 census estimates 3.8% of the population of Clatsop County over the age of 16 has a mobility limitation. These disabilities may or may not be permanent.[xi]

Developmentally Disabled

There is a wide variation in the vulnerability of the developmentally disabled population. Some developmentally disabled individuals may have strong support structures and a high level of care provided to them by friends, neighbors, and care providers. Others may not have such a high level of support. Some individuals may be largely self-reliant. Some may have additional disabilities in additional to their developmental disabilities.

Mentally Ill

Disaster conditions can aggravate the symptoms of those who suffer from mental illness. The mentally ill tend to be very sensitive to changes in their environment. A case study of this phenomenon from Clark County, Washington showed that during the Mt. St. Helens eruption disaster several individuals incorporated the fall of ash into their delusional symptoms. There was a marked increase in the caseload for mental health crisis services at the Columbia River Mental Health Services. Another important consideration is the ability of disaster conditions to cause mental illness. It is estimated that 10% of disaster victims can develop mental health problems, including depression, and substance abuse.[xii]

Low Income

Not having sufficient financial resources during and after a disaster can be a great disadvantage. Lower income people are more likely to live in mobile homes or other homes that are less able to resist damage from flooding, windstorms, and severe weather. Low-income people tend to have the greatest difficulty recovering from a disaster. According to 1999 estimates approximately 13.2% of the total population and 9.1% of all families have incomes below the national poverty level.[xiii]

Table 2.2 Poverty Rates in Clatsop County, 2012

Percent of Total Population	Percent of Children Under 18	Percent of Seniors over 65
15.8%	25.0%	8.0%

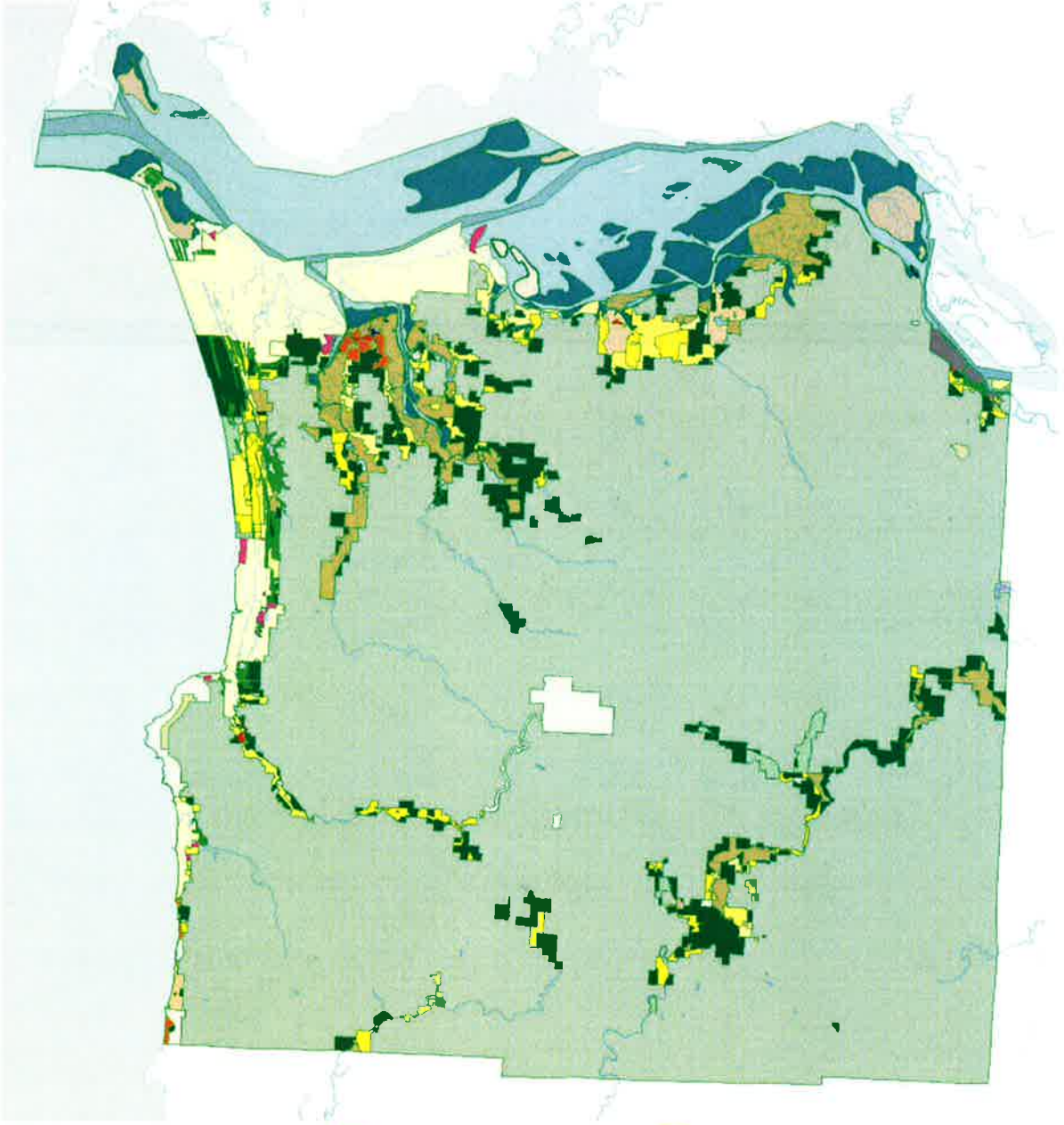
Source: US Census Bureau, American Community Survey, 2012

Land and Development

Clatsop County has a total area of 1,085 square miles–873 square miles of land and 212 square miles of water. The latter represents about 20% of the County's total area and includes a large area within the Columbia River. [xiv] Land ownership within Clatsop County is primarily private. More than 80% of the land is forested, and much of this is privately owned industrial forest land. At present, the major private timber landowners are Weyerhaeuser Company, Longview Fibre and Hampton Affiliates.[xv] Most of the development in Clatsop County is in or around Astoria, Cannon Beach, Gearhart, Seaside or Warrenton.

Total lands: 694,400 acres /1,085 square miles
Public ownership: 83,328 acres / 130 square miles (12%)
Private ownership: 611,072 acres / 955 square miles (88%)

Figure 2.4 Zoning Map, Clatsop County

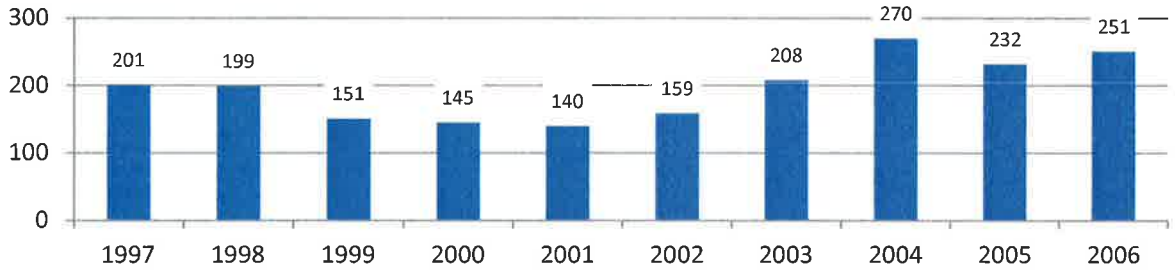


Housing and Community Development

Housing development types and year-built dates 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 homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation. Housing characteristics for Clatsop County are provided in the tables below.

In 2000, Clatsop County had 19,685 housing units. Of those, 48% (9,437) were owner occupied, 27% (5,266) were renter occupied, and 4,982 (25%) were vacant. Of the vacant homes almost three-quarters of the city's housing stock was built prior to 1980, before stronger seismic building codes were put into place.

Table 2.5 Building Permits Issued in Clatsop County (1997-2005)



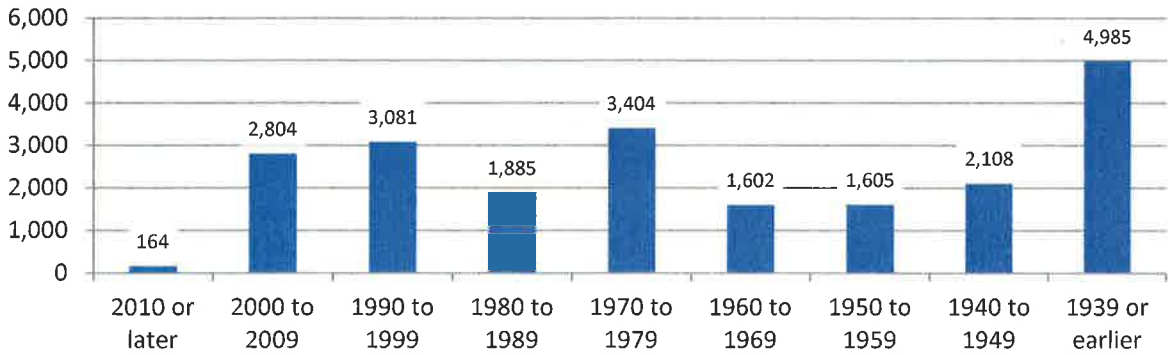
Source: US Census, 2000 http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl

Table 2.3 County Housing Development

Single-Family	Multi-Family	Mobile Homes	Boat, RV, Van, etc.
69.2%	22%	8.3%	0.5%

Source: US Census, 2000

Figure 2.6 Housing Year Built



Source: US Census, 2000

Typical move-in costs are in the range of $500 for a two-bedroom apartment. According to the Clatsop County Association of Realtors®, MLS, Inc., database, in Clatsop County on November 6, 2003, 587 listings were found, including the following single family homes for sale: 15 priced under $100,000; 45 priced from $100,000 to $150,000; 38 priced from $150,000 to $200,000; 19 priced from $200,000 to $250,000; 24 priced from $250,000 to $350,000; and 57 priced above $350,000.

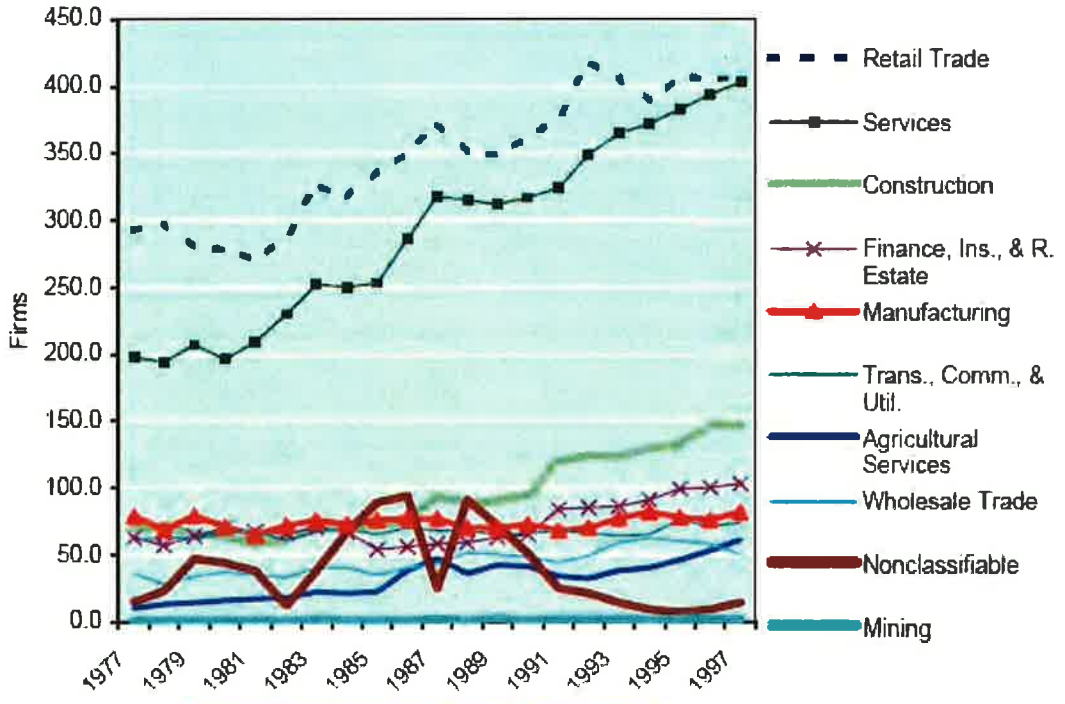
The majority of those priced over $250,000 were in the oceanfront communities located in the southern portion of the County. The approximate average single family home "sold" price for 2003 was $193,000.[xvi]

Local government revenues are largely derived from a tax levied on real property. In 1997, voters approved Measure 50, which changed Oregon's tax system from levy-based to rate-based. It created fixed tax rates and limited assessed value growth to three percent a year, except for new construction.

Growth pattern of Clatsop County

Clatsop County's economy relies on government-related activity, service businesses, retail sales, forestry, forest products processing, fishing and seafood processing, and tourism. The growth and decline of various sectors are shown in Figure 2.5. As the County's economy experiences growth in service industries, the region's income has fallen significantly below that of both the state and the nation, despite general growth in the economy.

Figure 2.7

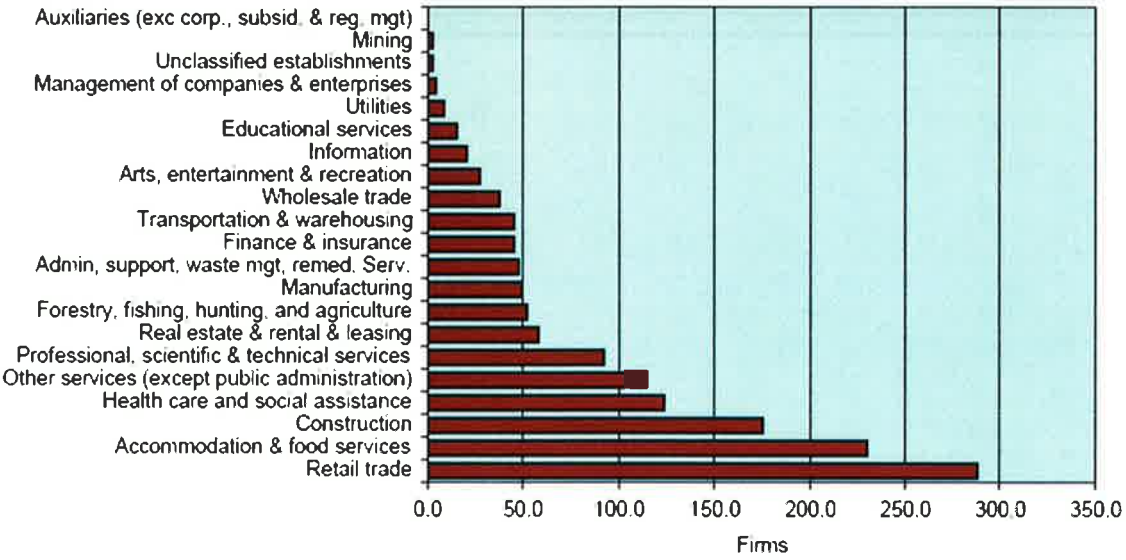


Source: EPS, 2006. http://www.coastrange.org/Clatsop_County_EP.pdf

Clatsop County's nonfarm employment grew by an impressive 6.5 percent or 1,010 jobs from 2001 through 2005. In contrast, the nation managed only 1.2 percent growth. Clatsop County's manufacturing employment grew 7.4 percent whereas the nation's manufacturing employment declined by 13.4 percent. If Clatsop County had followed the nation, it would have lost 273 manufacturing jobs over the period instead of adding 150.[xvii]

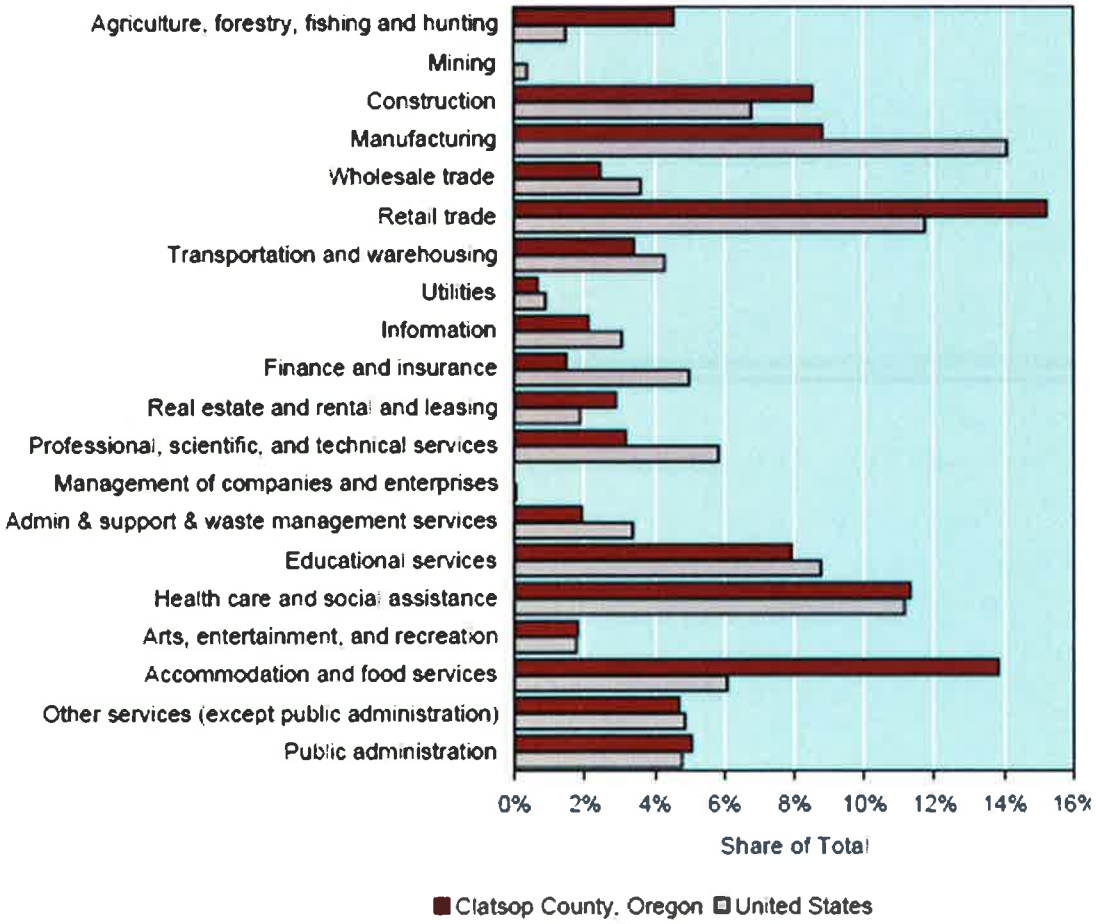
Figures 2.8 and 2.9 show the number of firms in Clatsop County by industry and the share of employment per industry, respectively, versus the United States.

Figure 2.8 Firms by Industry in 2004



Source: EPS, 2006. http://www.coastrange.org/Clatsop_County_EP.pdf

Figure 2.9 Employment Share of Total (2000 Census)

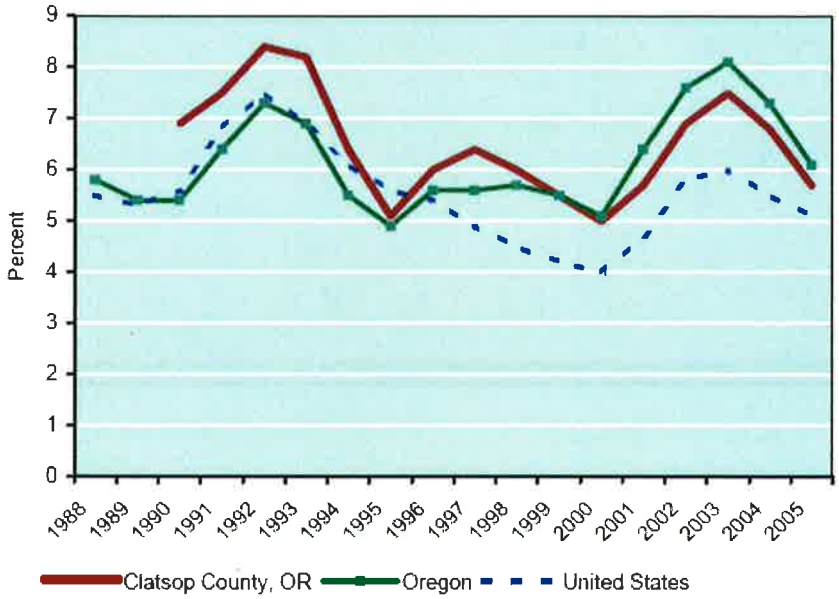


Source: EPS, 2006. http://www.coastrange.org/Clatsop_County_EP.pdf

Like other Norwest Coastal resource-based communities, Clatsop County is working to diversify its economy to offset the loss of family-wage jobs in the timber and fishing industries. Major employers currently include Georgia Pacific, Columbia Memorial Hospital, Providence Seaside Hospital, Management Training Corporation, State of Oregon, U.S. Coast Guard, Fred Meyer, Safeway, Steve Martin Management (visitor accommodations), Clatsop County government, and the Astoria School District.

The 2006 annual average unemployment rate in Clatsop County was 5.0%, below Oregon's 5.4% and above the nation's 4.6%. Clatsop County's unemployment rates from 1988-2005 compared to Oregon's and the United States is shown in Figure 2.10.

Figure 2.10 Unemployment Rates



Source: EPS, 2006. http://www.coastrange.org/Clatsop_County_EP.pdf

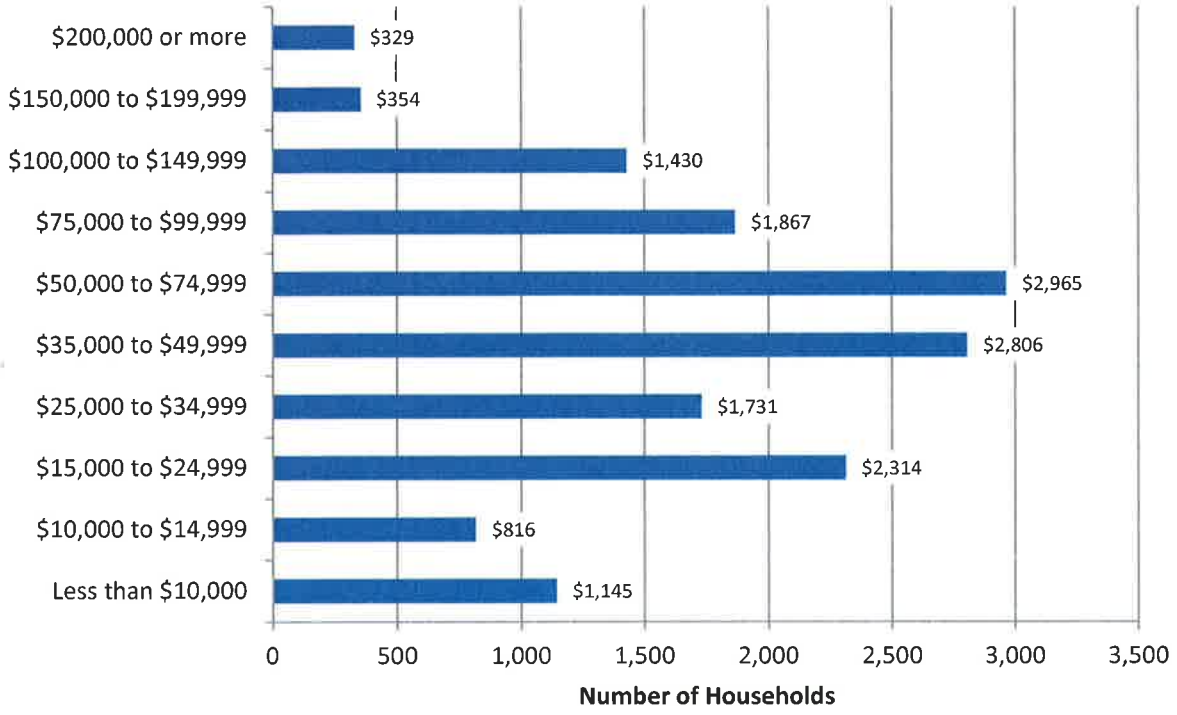
Wage Rates

Clatsop County salaries on average are lower than salaries in the state for comparable work. The 2002 average covered wage was $25,196, based on a 40-hour week. The Per Capita Incomes related to Oregon and the United States are shown in Table 2.7. Figure 2.10 displays that distribution of incomes throughout the County.

Figure 2.11: Comparison of income in Clatsop County, Oregon State and the U.S.

Source: 2012 American Community Survey. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

Figure 2.12 Household Income Distribution (in 2012 inflation-adjusted dollars)



Source: 2012 American Community Survey. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

Transportation and Commuting Patterns

Three major highways converge in Clatsop County: Highway 101 (Pacific Coast Scenic Byway), Highway 26, and Highway 30. The Interstate I-5 four-lane, north-south freeway is at Longview, Washington, about 50 minutes east of Astoria.

Clatsop County is served by the Sunset Empire Transportation District, which provides intra- and intercity transit service. Transit routes and schedules are established to best serve the needs of residents and employers. The Astoria-Warrenton area currently is served with nearly hourly transit service from 7:00 a.m. to 6:00 p.m. Monday through Saturday. The Sunset Empire Transportation District Executive Director has assured that the District would work with private employers to make sure transit needs are met and to determine whether employer tax credits, shared costs, etc. are appropriate. The District's new Inter-model Transit Facility is located at the corner of 9th and Marine in Astoria.

The Astoria Regional Airport is located on 870 acres in Warrenton, four miles south of downtown Astoria. The facility has a 5,796-foot runway serviced by ILS and VOR and an additional 4,990-foot VFR runway. This enables the facility to handle air traffic under all weather conditions. Fixed- base operators with fuel and tie-downs spaces are available.

Coast Guard Sector Columbia River, Coast Guard Air Station is located at the airport. The airport is supported by a NWS - ASOS automated weather Station. There is no scheduled passenger service at this time. United Parcel Service has twice-daily service to and from the airport and Federal Express uses the airport as warrants.

Portland International Airport is located approximately 96 miles from Astoria. The drive is just about an hour and 57 minutes from Astoria and about 90 minutes from the County line and is only 40 minutes by air from Astoria Regional Airport.

Clatsop County is bordered by the Columbia River on the north and the Pacific Ocean on the west. The Port of Astoria is located at Columbia River Mile 13 from the open sea and less than 10 minutes from either the North Coast Business Park or the Airport Industrial Park. The Port's facilities are the first on the Columbia River and include three piers with five deep-water ship berths and a barge ramp.

The Port of Astoria has been a port of call for cruise ships since 1982, and has invested $10 million in pier improvements to accommodate cruise vessels.[xviii] Twenty-one cruise ships visited the Port of Astoria in 2013. The Port has secured agreements with several cruise lines as a port of call during the next 5-10 years.

Critical Facilities and Infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. Individual communities should inventory their critical facilities to include locally designated shelters and other essential assets, such as fire stations, and water and waste treatment facilities. Clatsop County has 11 fire station, 2 hospitals, 5 school districts and one community college.

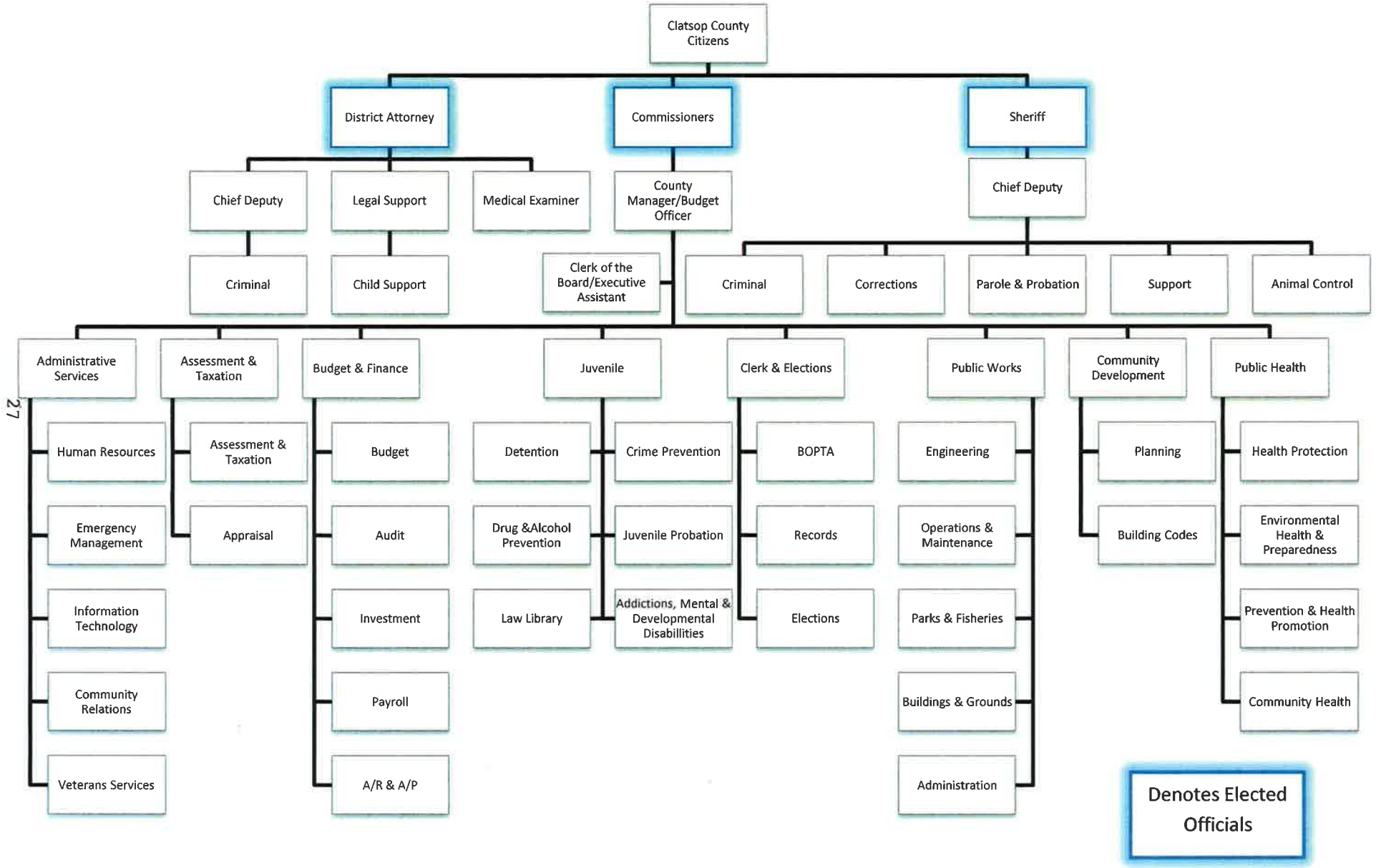
Critical transportation infrastructure is also necessary in preparation for and action after an emergency. Clatsop County's transportation system currently consists of approximately 250 miles of roads, 68 bridges and four ocean beach approaches.[xix]

Construction of a telecommunications fiber ring and the electronics necessary to establish route diversity via fiber to and from the Portland metropolitan area was completed in September 2002. DSL (Digital Subscriber Line) equipment was installed at the same time. A mini-ring to serve the North Coast Business Park and other Warrenton businesses and residences with full route diversity within the City was completed shortly thereafter, as well.

Government Structure

Clatsop County currently uses the following organizational structure:

Clatsop County Organization Chart



Government Structure

The voters of Clatsop County currently elect the District Attorney, the Sheriff and the Board of Commissioners. The Board of Commissioners consists of five volunteer elected Commissioners to establish policies and set the vision of the County. The Commissioners are elected by geographic districts to four-year terms. The Board hires the County Manager / Administrator to carry out its policies and oversee the day-to-day operations of the County. Each year, the Commissioners choose a Chairperson and a Vice Chairperson. An organizational chart of Clatsop County's government is seen on the previous page.

Departments

Administrative Services:

The Clatsop County Department of Administrative Services is part of the County Manager's office and encompasses the following departments: Human Resources, Information Technology, Community Relations and Emergency Management.

Assessment and Taxation:

The Clatsop County Department of Assessment and Taxation determines the value of all property according to state law. The department sends billing statements and collects all property taxes and penalties in the County and distributes the tax money to the appropriate taxing districts.

Budget & Finance

Budget & Finance is responsible for the finance, treasurer, payroll, data processing, mail room, telecommunications, and office automation needs of Clatsop County. In addition, Budget & Finance oversees building and grounds maintenance and is responsible for maintaining the County's parks. Budget & Finance handles the banking and investments of County funds as well as several other taxing districts. It works with the County Administrator in the preparation of the County Budget and with the monitoring of revenues and expenditures of all funds. This office also develops and plans for data processing and communication needs for all the County Departments.

District Attorney's Office

The District Attorney's Office is responsible for reviewing, preparing and prosecuting all criminal cases brought in the state courts of Clatsop County, including juvenile court and dependency cases. The District Attorney's Office houses the County Medical Examiner and supervises the investigation of child abuse and death investigations. The office advises the grand jury as to the law and presents cases to the grand jury for consideration. The office provides 24-hour legal assistance to all local law enforcement agencies.

Clerk and Elections

The Clerk, Records and Elections Division encompasses three functions:

- The County Clerk is the official record keeper for Clatsop County. The Records Division administers public records, legal recordings, marriage licenses, passports, OLCC licenses, County archives and abandoned personal property in accordance with federal, state and local laws. The division records the following documents for public record: deeds, mortgages, military discharges, marriage licenses, town and partition plat maps. County records include: Board of County commissioners, County Planning Commission, and special district and cities.
- The County Clerk issues marriage licenses, County park passes, accepts applications for passports and OLCC licenses; performs marriages; and coordinates and records Board of Property Tax Appeal hearings. The County Clerk is the chief election official of the County.
- The County Clerk conducts all elections within Clatsop County and registers voters, insuring compliance with federal, state and local laws. The office checks ballot measures for timeliness and to make sure they are worded accurately as required by law. The office prepares and maintains records related to voting activities and candidate services. The clerk provides uniformity in the application, operation and interpretation of election laws and ensures that the public is provided with complete and accurate information.

Community Corrections

Community Corrections supervises adult criminal offenders living in Clatsop County who have been sentenced to probation by the court or released to post-prison supervision from a correctional facility. The County-administered, state-funded program offers an array of program services, supervision and sanctions to reform offenders and enhance safety of the community. Community Corrections operates using state grants via an intergovernmental agreement between Clatsop County and the State of Oregon. Clatsop County has administered the Community Corrections program since 1997.

Community Development

The Community Development Division reviews and issues permits for land use development throughout rural Clatsop County, including zoning subdivisions and land partitions. It is responsible for developing, maintaining, updating and implementing the County's comprehensive land use plan in compliance with Oregon's statewide land use goals and planning laws. The Planning Commission, a citizen panel appointed by the Board of Commissioners, reviews applications and recommends changes in the County's comprehensive land use plan.

Public Health

Clatsop County Public Health provides immunizations, communicable disease control, HIV counseling and testing and sexually-transmitted disease testing and services, vital statistics, maternal and child health, WIC nutrition program, family planning, education and community outreach.

Sheriff's Office

The Clatsop County Sheriff's Office is the primary criminal investigation and law enforcement agency for rural Clatsop County. The Sheriff's Office includes several divisions and programs: the Correctional Facility, Countywide Inter-agency Narcotics Task Force, Marine Patrol, High Angle Rescue, Search and Rescue and the Underwater Recovery (Dive) Team.

Juvenile Department

The Clatsop County Juvenile Department is responsible for the supervision of juvenile offenders younger than 18 years old upon apprehension. The department provides intake screening, restitution and assistance to victims, programs to divert youth from the formal court process (when appropriate), due-process in the preparation of legal documents that initiate court action, adjudication and disposition of allegations of delinquent behavior, and supervision of those youth on probation. State agencies such as the Oregon Youth Authority and Department of Family Services provide institutional care and supervision of youth.

Public Works

The Public Works Department is responsible for the creation, improvement and maintenance of services and infrastructure. Public works oversees Building & Grounds maintenance for County buildings. Public Works consists of the following divisions:

- The Road division of the Department of Transportation and Development houses the offices of the Roads, County Engineer, County Surveyor, Parks and Westport Sewer Service District.
- The administrative staff plans and administers the budget and contracts for the department and represents Clatsop County on federal, state and local transportation issues.
- The Roads Maintenance section provides brush control, pot hole patching, culvert cleaning and replacement, shoulder and ditch maintenance, oiling, road rebasing and grading. Improvements include contracted bridge replacement and A.C. paving and major road construction and reconstruction.
- The County Engineer plans, designs and coordinates projects for the County's road system, consisting of approximately 250 miles of roads, 68 bridges and three ocean beach approaches.

- The office of the Surveyor is responsible for checking, filing and indexing boundary surveys by private and public surveyors. The office maintains all records of surveys and provides means by which the public can use these records. The surveyor checks and approves subdivisions, condominiums and land partitions. The surveyor surveys County owned land and County roads. The surveyor is responsible for the recovery, restoration and preservation of public Land corners. These are section corners, quarter corners and donation land claim corners.
- The Parks program is responsible for the Fisheries Project, as well as the operation and maintenance of the County's parks and recreational areas.

Existing Plan & 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.[xx]

The Clatsop County multi-jurisdictional Natural Hazards Mitigation Plan includes a range of recommended action items that, when implemented, will reduce the County's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the County's existing plans and policies. Linking existing plans and policies to the Natural Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the Plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the County's resources.

Community Organizations and Programs

More information on community organizations and programs can be found in *Appendix F.*

Existing Mitigation Activities

Existing mitigation activities that are being implemented by the community are documented in each Hazard Annex.

Hazard Summary

The following is a brief overview of the hazards that can impact Clatsop County. Each of the hazards is described in more detail in Volume II Hazard Annexes.

Coastal Erosion

Coastal erosion is a natural process that continually affects the entire coast. Erosion becomes a hazard when human development, life and safety are threatened. Coastal erosion processes create special challenges for people living near the ocean, requiring sound planning in order to minimize the potential dangers to life and property. Attempts to stabilize the shoreline or beach are often futile because the forces that shape the coast are persistent and powerful. Inadequate understanding of the complex interaction of coastal land forms and waters and the various types of coastal erosion can result in serious threats to people, communities and infrastructure.

Drought

Droughts are not uncommon in the State of Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state, in both summer and winter. There are no records of a severe drought in Clatsop County. Drought is averted as a result of the County's high rainfall from moist air masses moving onto land from the Pacific Ocean, especially during winter months.

Earthquake

Seismic events were once thought to pose little or no threat to Oregon communities. However, recent earthquakes and scientific evidence indicate that the risk to people and property is much greater than previously thought. Oregon is rated third highest in the nation for potential losses due to earthquakes. This is due in part to the fact that until recently Oregon was not considered to be an area of high seismicity, and consequently the majority of buildings and infrastructure were not designed to withstand the magnitude of ground shaking that would occur in conjunction with a major seismic occurrence.

Flood

Oregon has a detailed history of flooding with flood records dating back to the 1860s. The principal types of flood that occur in Clatsop County include: (1) riverine and (2) ocean flooding from high tides and wind-driven waves or tsunami event. There are two distinct periods of riverine flooding in this region, winter and late spring. The most serious flooding occurs during December, January, and February. The situation is especially severe when riverine flooding, caused by prolonged rain and melting snow, coincides with high tides and coastal storm surges.

Landslide

Landslides are a major geologic threat in almost every state in the United States. In Oregon, a significant number of locations are at risk from dangerous landslides and debris flows. While not all landslides result in property damage, many landslides do pose serious risk to people and property. Rain-induced landslides and debris flows can potentially occur during any winter in Clatsop County.

Tsunami

Tsunamis have historically been rare in Oregon. Since 1812, Oregon has experienced about a dozen tsunamis with wave heights greater than 3 feet; some of these were destructive. The City of Seaside is the most vulnerable city due to its low elevation and high number of residents and tourist population within the predicted inundation zone. Although many communities have evacuation maps and evacuation plans, many casualties are expected. The built environment in the inundation zone will be especially hard hit.

Volcanic Ash Fall

The Cascade Range of the Pacific Northwest has more than a dozen active volcanoes. These snow-clad peaks are part of a 1,000 mile-long chain of mountains, which extend from southern British Columbia to northern California. Although there are no active volcanoes in Clatsop County it is important for counties to know the potential impacts of nearby volcanoes. While immediate danger area around a volcano is approximately 20 miles, ash fall problems may occur as much as 100 miles or more from a volcano's location; therefore, ash fall my affect Clatsop County.

Wildfire

Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property particularly in the state's growing rural communities. Wildfires are fires occurring in areas having large areas of flammable vegetation that require a suppression response. Areas of wildfire risk exist throughout the state with areas in central, southwest and northeast Oregon having the highest risk.

Windstorms & Severe Winter Storms

Destructive wind and winter storms that produce ice, rain and freezing rain, and high winds have a long history in Clatsop County. Severe storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March. Destructive windstorms are less frequent, and their pattern is fairly well known. They form over the North Pacific during the cool months (October through March), move along the coast and swing inland in a northeasterly direction. Wind speeds vary with the storms. Gusts exceeding 100 miles per hour have been recorded at several coastal locations.

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[i] Clatsop County, County Info 2008, http://www.co.clatsop.or.us/default.asp?deptid=0&pageid=42

[ii] Oregon State University. 1993, Oregon Climate Service. The Climate of Oregon: Climate Zone 1, http://ir.library.oregonstate.edu/dspace/bitstream/1957/5908/1/SR+no.+91 3_OCR.pdf

[iii] Oregon Climate Service. February 2005, Climate of Clatsop County, http://ocs.orst.edu/county_climate/Clatsop_files/Clatsop.html

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[v] United States Census Bureau. 2010 Census, www.census.gov

[vi] Ibid.

[vii] Portland State University Population Research Center. 2006, 2006 Oregon Population Report, http://www.pdx.edu/prc/annualorpopulation.html

[viii] United States Census Bureau. 2000, Fact Sheet: Cannon Beach, www.census.gov.

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[x] Clatsop County Information. 2008, http://www.co.clatsop.or.us/default.asp?deptid=0&pageid=42

[xi] United States Census Bureau. 2000, Fact Sheet: Cannon Beach, www.census.gov

[xii] Resource Assistance for Rural Environments. August 2006. Hood River County Natural Hazards Mitigation Plan.

[xiii] United States Census Bureau. 2000. County Quick Facts: Clatsop County, http://quickfacts.census.gov/qfd/states/41/41007.html.

[xiv] Clatsop County Information. 2008, http://www.co.clatsop.or.us/default.asp?deptid=0&pageid=42

[xv] Clatsop County. 2003. Clatsop County Recreational Lands Master Plan

[xvi] Clatsop County Department of Community Development. Clatsop County Community Profile.

[xvii] Oregon Employment Department, qualityinfo.org

[xviii] www.portofastoria.com

[xix] Clatsop County Roads Division, http://www.co.clatsop.or.us/default.asp?deptid=8&pageid=13

[xx] Burby, Raymond J., ed. 1998, Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.

Mission, Goals, and Action Items

Overview

This section describes the components that guide implementation of the identified mitigation strategies and is based on strategic planning principles. This section provides information on the process used to develop the Plan's mission, goals and action items. This section also includes an explanation of how the County intends to incorporate the mitigation strategies outlined in the plan into existing planning mechanisms and programs such as the County comprehensive land use planning process, capital improvement planning process, and building codes enforcement and implementation. Documentation of how actions will be implemented through existing plans and policies within cities and/or special districts is located in Volume III: City/Special District Addendums.

- **Mission**—an action-oriented statement of the Plan's purpose and primary function.
- **Goals**—principles that represent the general end toward which the County effort is directed and guide the specific recommendations outlined in the action items.
- **Action Items**—detailed risk-reducing strategies for local departments, citizens and others.

Methods

The Mission Statement was developed by the Plan Facilitator upon consultation with OPDR and other resources. It was presented to the Steering Committee and adopted with no corrections requested.

The Plan Goals were developed using a variety of sources. The initial list of goals were researched and created by the Plan Facilitator. The information for doing so was found in the OPDR plan support documents, FEMA support documents and from reviewing the completed Pre-Disaster Mitigation Plans of other jurisdictions. This initial list was then presented to the Steering Committee during the third meeting on April 16, 2008. At the meeting, Committee members reviewed the goals and provided feedback. A few minor changes in the language of the goals resulted from this discussion. There was some discussion over adding more goals to the list; however, the group decided that all of the new goals proposed were included within the scope of the goals already listed.

The Action Items were generated from a variety of sources. The initial list of was born of a work session during the third meeting of the Steering Committee during which all members contributed their ideas. This session generated the largest share of mitigation actions, about 35. Additional contributions came from two public forums in which the public was given blank action forms and asked to offer any mitigation project ideas they may have. Over the course of Phase Three, more mitigation ideas were submitted to the planning team from Steering Committee members, local officials, and the general public. The complete list of mitigation actions for the County can be found in Appendix A.

Mitigation Plan Mission

"To create a disaster resilient Clatsop County."

Mitigation Plan Goals

The plan goals help guide the direction of future activities aimed at reducing risk and preventing loss from natural hazards. The goals listed here serve as checkpoints as agencies and organizations begin implementing mitigation action items.

- Protect life
- Minimize damage to public and private buildings and infrastructure
- Reduce economic loss
- Decrease disruption to critical services
- Protect natural and cultural resources
- Increase education and awareness of the risks and hazards in Clatsop County
- Increase cooperation and collaboration among County partners

Mitigation Plan Action Items

Action items are detailed recommendations for short-term and long-term activities that local departments, citizens and others could engage in to reduce risk. They address both multi-hazard (MH) and hazard-specific issues.

Each action item has a corresponding worksheet describing the activity, identifying the rationale for the project, identifying potential ideas for implementation, and assigning coordinating and partner organizations. The action item worksheets can assist the community in pre-packaging potential projects for grant funding. Action item worksheets are located in **Appendix A.**

Multi-Hazard Action Items

- Centralize Countywide 911 system
- Develop a pre-plan of how to accommodate visitors to the coast following a major disaster.
- Evaluate the vulnerability of wastewater treatment facilities in the County.
- Evaluate the feasibility of undergrounding utilities where appropriate.
- Identify and develop emergency shelter facilities throughout the County.
- Develop secondary back-up power, communication, and lighting for the Port of Astoria airport.
- Develop Post-Disaster Recovery Plans for communities in Clatsop County.
- Encourage residents to maintain and update 72 hour kits.
- Develop an inventory of available generators and fuel distribution.
- Partner with Clatsop County Community College on mitigation efforts.
- Post-disaster pet/animal shelter.
- Food and Emergency Supply Stations.
- Relocate Lewis and Clark RFPD – Station #1.
- CERT Program support.

- Upgrade Wickiup Grange to become shelter for both short and long term disasters.
- Public Emergency Information Boards.
- Outreach and education to volunteer organizations that may be designated relief sites in a disaster regarding safe food, water, and sanitation practices.
- Mitigating the risk of communicable disease in vulnerable, congregate settings.
- Develop a Tsunami and disaster debris management plan.
- Increase public education and outreach in natural hazards which affect the north coast.
- Develop a Hazardous Materials Operations Plan
- Develop a Debris Management Plan to include Tsunami Debris
- RACES/ARES emergency communications support, training and coordination.

Tsunami Action Items

- Rebuild four Seaside School District schools outside of the tsunami inundation zone.
- Build "tsunami towers" for vertical evacuations in coastal cities.
- Improve public notification and warning system.
- Elevate Brownsmead Rural Fire District Station.
- Implement new DOGMAI Tsunami Hazard Inundation Maps for hazard mitigation planning.
- Establish long term supply and assembly areas outside of inundation zones.
- Upgrade and improve evacuation routes as well as assembly areas outside of tsunami inundation zones.
- Seismic vulnerability assessment/vertical evacuation routes.
- Conduct preliminary research on the development of a County Land Use Ordinance relating to Tsunami Hazards.
- Establish high ground commercial districts (above tsunami lines).

Wind & Winter Storms

- Develop and implement hazard tree program.
- Promote tree planting projects on private and public properties.
- Have one to three ISA-certified arborists in each community that know how to properly prune storm damaged trees.
- Heightened awareness by First Responders and appropriate staff of the factors contributing to tree stability.
- Educate homeowners about methods to tie down metal roofs and metal sheds.

Earthquake

- Retrofit County bridges that are identified by a seismic vulnerability assessment.
- Complete assessment of County owned bridges.
- Seismic upgrades for the Ecola Creek Bridge in Cannon Beach (Hwy 101).
- Complete a seismic vulnerability assessment for Port of Astoria facilities.
- Develop incentive programs to encourage homeowners to do seismic retrofits.
- Seismic retrofitting of old Hamlet Fire Station.

Flood

- Elevate runway at Port of Astoria airport and improve diking around the airport.
- Complete a risk assessment related to levees in the County and adjacent development.

- Westport Railroad Bridge (71.3) replacement.
- Provide support and assistance to Diking Districts in respect to accreditation of the County's levees.
- Continue compliance with the National Flood Insurance Program (NFIP).
- Investigate the possibility to participate in the Community Rating System (CRS).

Landslide

- Build new access road on east side of Astoria from Hwy 30.
- Continue upgrading and enhancing GIS data in order to more efficiently identify areas prone to landslide and mass movement.
- Develop alternative transportation routes around slide-prone areas in County.

Drought

- Investigate the viability of county wide public awareness activities regarding water conservation.

Wildfire

- Update, exercise, and maintain the Community Wildfire Protection Plan.

Plan Implementation and Maintenance

This section details the formal process that will ensure that the Clatsop County multi-jurisdictional Natural Hazards Mitigation Plan remains an active and relevant document. The plan implementation and maintenance process includes a schedule for monitoring and evaluating the Plan annually, as well as producing an updated plan every five years. Finally, this section describes how the County and participating jurisdictions will integrate public participation throughout the plan maintenance and implementation process.

Implementing the Plan

After the Plan is locally reviewed and deemed complete, the Clatsop County Emergency Management Division submits it to the State Hazard Mitigation Officer at Oregon Emergency Management. Oregon Emergency Management submits the plan to the Federal Emergency Management Agency (FEMA--Region X) for review. This review addresses the federal criteria outlined in the FEMA Interim Final Rule 44 CFR Part 201. Upon acceptance by FEMA, the County will adopt the plan via resolution. At that point the County will gain eligibility for the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program funds, and Flood Mitigation Assistance program funds. Following County adoption, the participating jurisdictions should adopt their addendums.

Convener

The Clatsop County Planning Department and Clatsop County Emergency Management Division will serve as co-conveners and are responsible for the implementation and maintenance of the plan.

The roles and responsibilities of the Convener include, but are not limited to, the following:

- Coordinate Steering Committee meeting dates, times, locations, agendas, and member notification;
- Document outcomes of Steering Committee meetings;
- Serve as a communication conduit between the Coordinating Body and key plan stakeholders;
- Identify emergency management-related funding sources for hazard mitigation projects;
- Incorporate, maintain, and update the County's natural hazard risk GIS data elements; and
- Utilize the Risk Assessment to prioritize proposed natural hazard risk reduction projects.

Coordinating Body

The Steering Committee will serve as the coordinating body for the life of the mitigation plan. The Coordinating Body will include, at the minimum, the members of the Steering Committee, as well as those individuals identified by the Coordinating Body as critical to the Body's duties. Examples of additions to the Coordinating Body include school district representatives that were not included in the original Steering Committee, and additional members from the business community.

The roles and responsibilities of the Coordinating Body include, but are not limited to:

The roles and responsibilities of the Coordinating Body include, but are not limited to:

- Serving as the local evaluation committee for funding programs such as the Pre-Disaster Mitigation Grant Program, the Hazard Mitigation Grant Program, and Flood Mitigation Assistance program;
- Prioritizing and recommending funding for natural hazard risk reduction projects;
- Documenting successes and lessons learned;
- Evaluating and updating the Natural Hazards Mitigation Plan following a disaster;
- Evaluating and updating the Natural Hazards Mitigation Plan in accordance with the prescribed maintenance schedule; and
- Developing and coordinating ad hoc and/or standing subcommittees as needed.

Members

The following people and their respective organizations were represented on the Steering Committee during the development of the Clatsop County multi-jurisdictional Natural Hazards Mitigation Plan:

- CREST
- Clatsop County Emergency Management
- Clatsop County Planning Department
- Clatsop County Planning Commissioner
- Clatsop County Public Health
- City of Astoria
- City of Warrenton
- City of Seaside
- City of Cannon Beach
- City of Gearhart
- OSU Sea Grant Extension, Clatsop County
- Columbia Memorial Hospital
- Coast River Business Journal
- Port of Astoria
- Seaside School District
- Fire Defense Board
- Clatsop Community College

To make the coordination and review of the Clatsop County multi- jurisdictional Natural Hazard Mitigation Plan as broad and useful as possible, the Steering Committee will engage additional stakeholders and other relevant hazard mitigation organizations and agencies to implement the identified action items. Specific organizations have been identified as either internal or external partners on the individual action item forms found in Appendix A.

Plan Maintenance

Plan maintenance is a critical component of the natural hazard mitigation plan. Proper maintenance of the plan ensures that this plan will maximize the County's and city/special district's efforts to reduce the risks posed by natural hazards. This section was developed by the University of Oregon's Partnership for Disaster Resilience and includes a process to ensure that a regular review and update of the plan occurs. The Steering Committee and local staff are responsible for implementing this process, in addition to maintaining and updating the plan through a series of meetings outlined in the maintenance schedule below.

Semi-Annual Meetings

The Committee will meet on a semi-annual basis to complete the following tasks.

During the first meeting the Committee will:

- Review existing action items to determine appropriateness for funding;
- Educate and train new members on the plan and mitigation in general;
- Identify issues that may not have been identified when the plan was developed; and
- Prioritize potential mitigation projects using the methodology described below.

During the second meeting of the year the Committee will:

- Review existing and new risk assessment data;
- Discuss methods for continued public involvement; and
- Document successes and lessons learned during the year.
- Update and perform the required 5 year Plan maintenance.

The convener will be responsible for documenting the outcome of the semi- annual meetings in Appendix B. The process the Committee will use to prioritize mitigation projects is detailed in the section below. The plan's format allows the County and participating jurisdictions to review and update sections when new data becomes available. New data can be easily incorporated, resulting in a natural hazards mitigation plan that remains current and relevant to the participating jurisdictions.

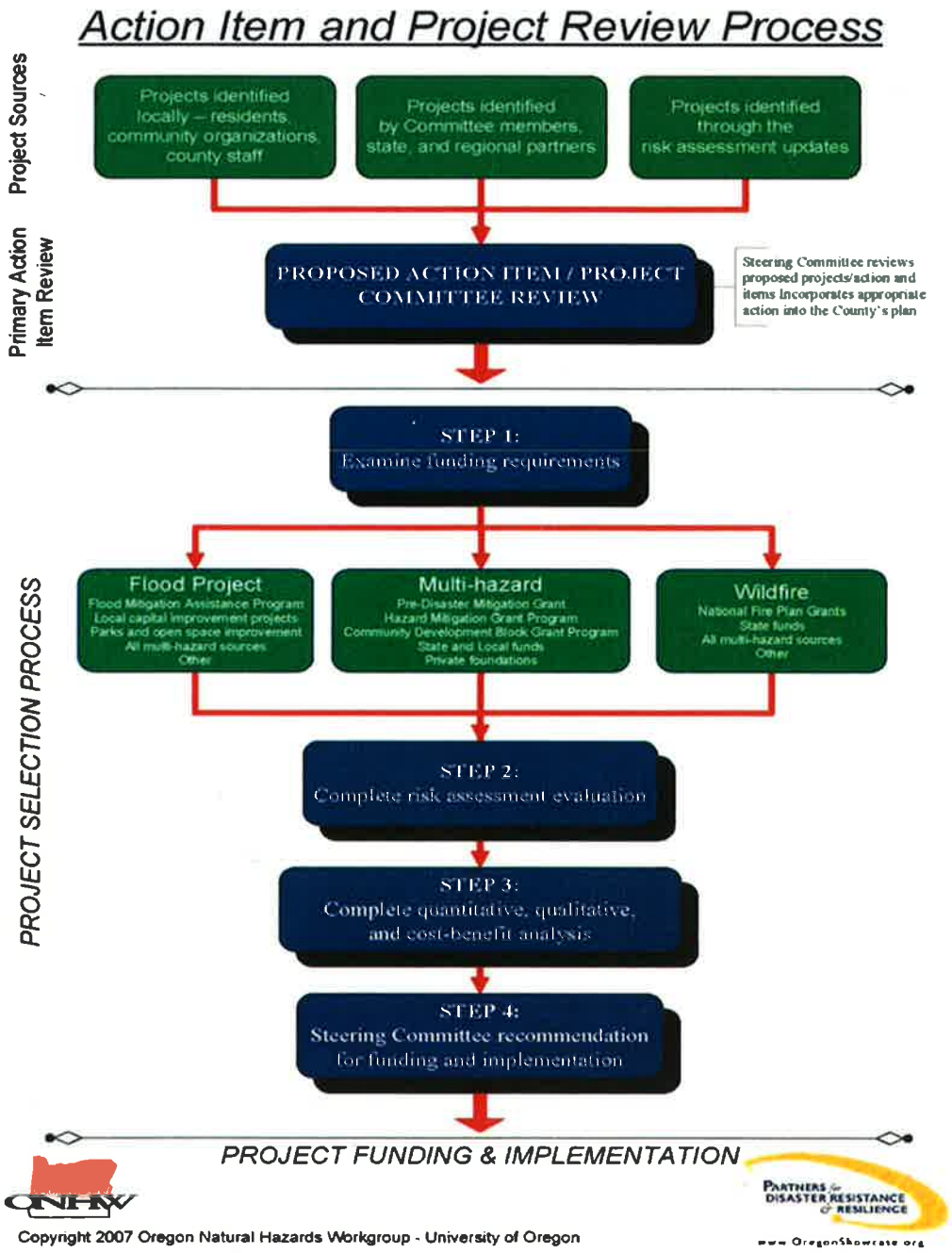
Project Prioritization Process

The Disaster Mitigation Act of 2000 requires that jurisdictions identify a process for prioritizing potential actions. Potential mitigation activities often come from a variety of sources; therefore the project prioritization process needs to be flexible. Projects may be identified by committee members, local government staff, other planning documents, or the risk assessment.

The prioritization process has not changed since the previous plan adoption nor did the Committee reorganize priorities so this update validates information outlined in the original (2008) plan. In some cases, projects were completed outside the established prioritization because a specific funding opportunity was made available.

Depending on the potential 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. Some of these examples are used in Figure 4.1 on the next page to illustrate the project development and prioritization process.

Figure 4.1: Project Prioritization Process



Source: Partnership for Disaster Resilience, 2006.

Step 1: Examine funding requirements

The Steering Committee will identify how to best implement individual actions within the appropriate existing plans, policies, and programs. The committee will examine each funding stream's requirements to ensure the eligibility of mitigation activities. The Committee may consult with the funding entity, Oregon Emergency Management, or other appropriate state or regional organizations about the project's eligibility.

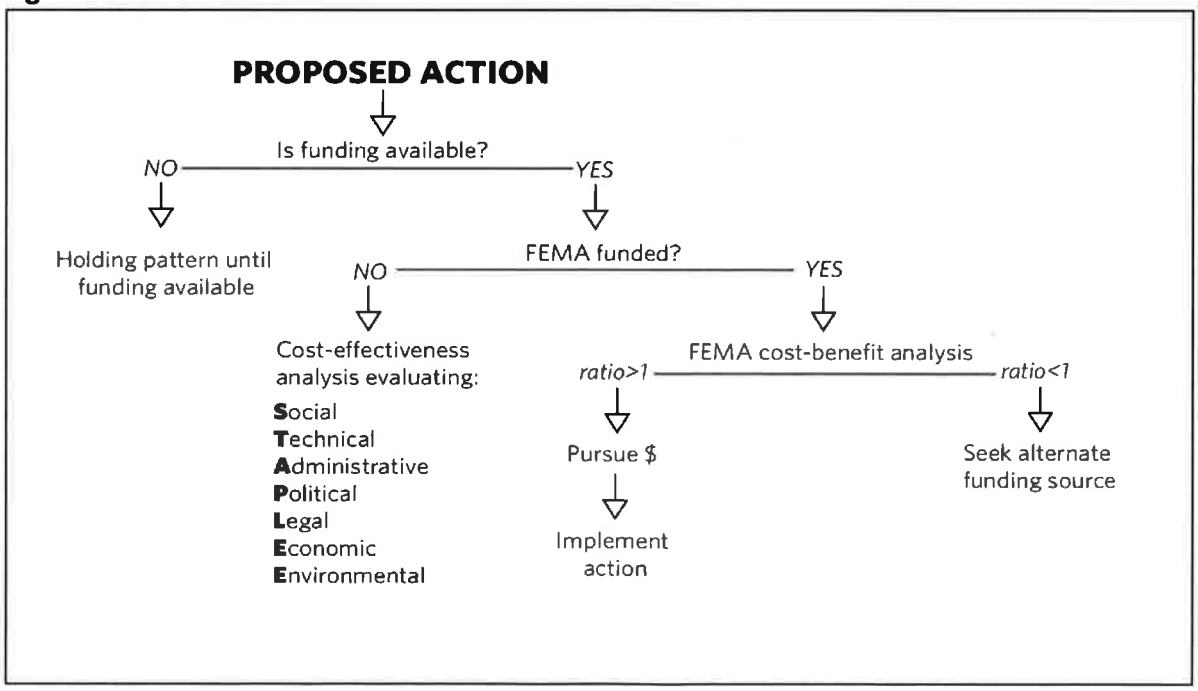
Step 2: Complete risk assessment evaluation

The second step in prioritizing the plan's action items is to examine which hazards they are associated with and where these hazards rank in terms of community risk. The Committee will determine whether or not the plan's risk assessment supports the implementation of the mitigation activity. This determination will be based on the location of the potential activity and the proximity to known hazard areas, historic hazard occurrence, vulnerable community assets at risk, and the probability of future occurrence documented in the plan.

Step 3: Complete quantitative and qualitative assessment, and economic analysis

The third step is to identify the costs and benefits associated with natural hazard mitigation strategies, measures or projects. Two categories of analysis that are used in this step are: (1) benefit/cost analysis, and (2) cost- effectiveness analysis. Conducting benefit/cost analysis for a mitigation activity assists 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 provides 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 4.2 shows decision criteria for selecting the method of analysis.

Figure 4.2: Benefit Cost Decision Criteria



Source: Community Service Center's Partnership for Disaster Resilience at the University of Oregon, 2006.

If the activity requires federal funding for a structural project, the Committee will use a Federal Emergency Management Agency-approved cost-benefit analysis tool to evaluate the appropriateness of the activity. A project must have a benefit/cost ratio of greater than one in order to be eligible for FEMA grant funding.

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. The STAPLE/E technique has been tailored for use in natural hazard action item prioritization by the Partnership for Disaster Resilience at the University of Oregon's Community Service Center. See Appendix C for a description of the STAPLE/E evaluation methodology.

Step 4: Committee Recommendation

Based on the steps above, the committee will recommend whether or not the mitigation activity should be moved forward. If the committee decides to move forward with the action, the coordinating organization designated on the action item form will be responsible for taking further action and documenting success upon project completion. The Committee will convene a meeting to review the issues surrounding grant applications and to share knowledge and/or resources. This process will afford greater coordination and less competition for limited funds. When the Committee selects a project for inclusion in the plan, the committee may write a letter of support signed by all members of the Committee. This letter can be utilized in grant applications to show community support for the mitigation action.

The 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 committee to consider mitigation strategies as new opportunities arise, such as funding for action items that may not be of the highest priority. This methodology is used by the Committee to prioritize the plan's action items during the annual review and update process.

Continued Public Involvement & Participation

The participating jurisdictions are dedicated to involving the public directly in the continual reshaping and updating of the Clatsop County multi-jurisdictional Natural Hazard Mitigation Plan. Although members of the Steering Committee represent the public to some extent, the public will also have the opportunity to continue to provide feedback about the Plan.

During plan development, public participation was incorporated into every stage of the plan and development process. To ensure that these opportunities will continue, the County and participating jurisdictions will provide for public participation at one or more of the following events each year: Home Depot Annual Safety Fair, Emergency Operation Center Open Houses, National Night Out, Astoria Service Fair, Clatsop County Fair, and the NW Natural Gas Preparedness Fair. In addition, the Clatsop County Planning Department will post interactive GIS maps of hazards affecting the County on its website, as well as subsequent updates to the plan.

In addition to the involvement activities listed above, the County's multi- jurisdictional Natural Hazard Mitigation Plan has been archived and posted on the Partnership website via the University of Oregon Libraries' Scholar's Bank Digital Archive.

Five-Year Review of Plan

This plan will be updated every five years in accordance with the update schedule outlined in the Disaster Mitigation Act of 2000. During this plan update, the following questions will be asked to determine what actions are necessary to update the plan. The convener will be responsible for convening the Committee to address the questions outlined below.

- Are the plan's goals still applicable?
- Do the plan's priorities align with State priorities?
- Are there new partners that should be brought to the table?
- Are there new local, regional, state or federal policies influencing natural hazards that should be addressed?
- Has the community successfully implemented any mitigation activities since the plan was last updated?
- Have new issues or problems related to hazards been identified in the community?
- Do existing actions need to be reprioritized for implementation?
- Are the actions still appropriate, given current resources?
- Have there been any changes in development patterns that could influence the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Has the community been affected by any disasters? Did the plan accurately address the impacts of this event?

The Committee will be responsible for updating any deficiencies found in the plan based on the questions above.

II: Hazard Annexes

This volume includes the following sections:

- Coastal Erosion
- Drought
- Earthquake
- Flood
- Landslide
- Tsunami
- Volcanic Ash Fall
- Wildfire
- Wind/Winter Storm

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Coastal Erosion

Causes and Characteristics of the Hazard

Coastal erosion is a natural process that continually affects the entire coast. Erosion becomes a hazard when human development, life and safety are threatened. Beaches, sand spits, dunes and bluffs are constantly affected by waves, currents, tides and storms resulting in chronic erosion, landslides and flooding. Changes may be gradual over a season or many years. Changes may also be drastic, occurring during the course of a single storm event.

Erosion may be caused by large waves, storm surges, rip cell embayments, high winds, rain, runoff, flooding, or increased water levels and ocean conditions caused by periodic El Niño's. Coastal dunes and bluffs comprised of uplifted marine terrace deposits are especially vulnerable to chronic and catastrophic hazards.

Natural hazards that cause erosion and other impacts on coastal areas can be divided into two general classes, chronic and catastrophic.

Chronic hazards are those that we can often see clear evidence of along the ocean shore and include the following:

- Periodic high rates of beach, dune and bluff erosion;
- Mass wasting of sea cliffs in the form of landslides and slumps due to wave attack and geologic instability;
- Storm surges, high ocean waves and the flooding of low-lying lands during major storms;
- Sand inundation;
- Erosion due to the occurrence of El Niño's and from rip embayments; and
- Recession of coastal bluffs due to long-term changes in mean sea level and the magnitude and frequency of storm systems.

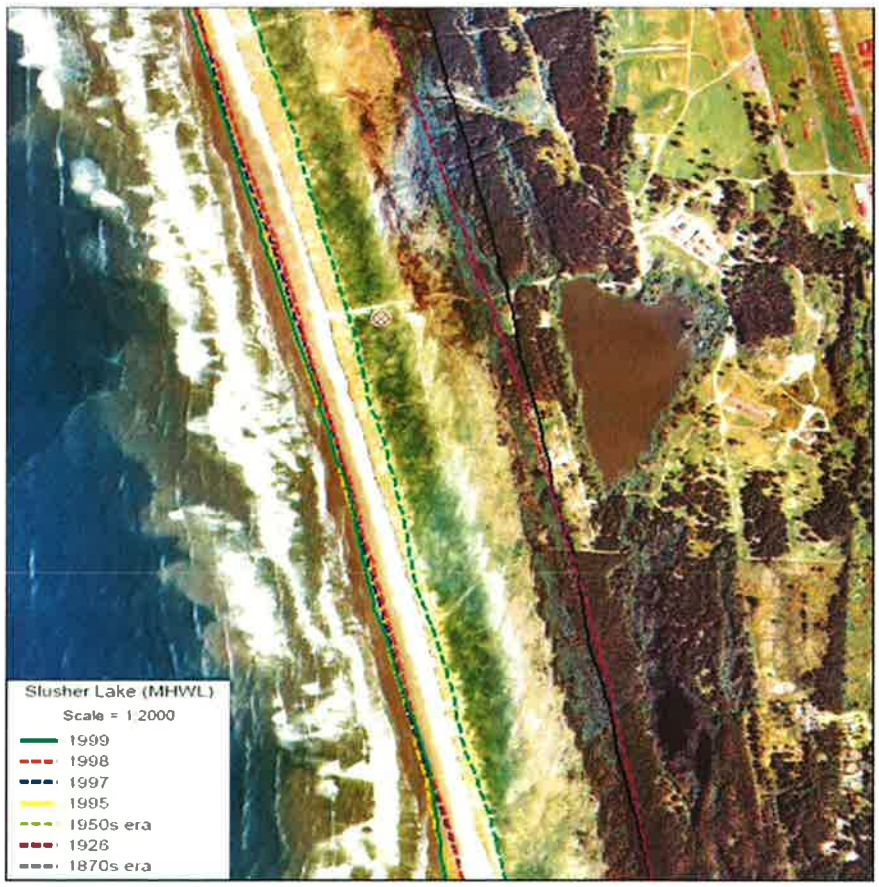
Chronic hazards are usually local in nature, and the threats to human life and property that arise from them are generally less severe than those associated with catastrophic hazards. However, wide distribution and frequent occurrence of chronic hazards makes them more of an immediate concern.

The damage caused by chronic hazards is usually gradual and cumulative. However, storms that produce large winter waves, heavy rainfall and/or high winds may result in very rapid erosion or other damage that can affect properties and infrastructure over a matter of hours. The regional, oceanic and climatic environments that result in intense winter storms determine the severity of chronic hazards along the Oregon coast.

Catastrophic hazards are regional in scale and scope. Though very infrequent, Cascadia Subduction Zone earthquakes, and the ground shaking, subsidence, land sliding, liquefaction and tsunamis that accompany them are very destructive in their effect causing extensive property losses and high numbers of deaths and injuries, both on the coast and inland.

History of the Hazard in Your Community

Coastal erosion is constantly shaping the coastal shoreline environment. The map below illustrates the erosion patterns of one section of coastal land which lies within Clatsop County. This type of erosion is indicative of the County's entire coast line.



Source: OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES Report on Coastal Erosion from Clatsop Spit to Gearhart (2001).

Risk Assessment

How Are Hazard Areas Identified?

In 2001, The Oregon Department of Geology and Mineral Industries mapped the location and extent of coastal erosion zones. Additionally, the Clatsop County Planning Department developed a Beaches and Dunes Overlay that is identified as being between Highway 101 and the beach. Developments are required to submit erosion control plans; no removal of soil or sand is allowed in order to maintain the integrity of the dune system.

An example of coastal erosion near Arch Cape. (2008 Clatsop County photo)

Probability of Future Occurrence

Coastal erosion is a chronic hazard along the Clatsop County Coast, especially on sand spits, bluffed coastline, and dune-backed beaches. The damage caused by chronic hazards is usually gradual and cumulative. The regional, oceanic, and climatic environments that result in intense winter storms determine the severity of chronic hazards along the coast. Based on the chronic nature of coastal erosion, the Clatsop County Steering Committee estimates a 'high' probability that coastal erosion will occur.

Vulnerability Assessment

A number of buildings, parks, infrastructure, and critical facilities in Region 1 are vulnerable to coastal erosion. This is most obvious in low-lying areas adjacent to bays or the ocean; it is also evident at higher elevations where buildings and infrastructure have been located on readily erodible materials (e.g., consolidated sand, weakly cemented sandstone, siltstone, etc.). The problem is historic. There are numerous examples of buildings and infrastructure destroyed by wave attack/erosion --- some of which are classic (e.g., Bay Ocean development, Salishan Spit, Jumpoff Joe, Rogue Shores, The Capes development, etc.). Buildings and infrastructure probably will continue to be built in harm's way despite stringent building requirements and enlightened planning commissions.

Few of Oregon's coastal developments are within FEMA-designated Velocity (V) zones. Those that are appear to be constructed according to V- zone standards. A number of coastal developments are protected by primary frontal dunes (as defined in 44 CFR) that are in various stages of accretion or erosion. In some situations, FEMA has allowed accreting dunes to be lowered in order for property owners to retain unobstructed ocean views. The vulnerability of the homes has not been increased. This policy would change, however, should erosion surpass accretion.

Coastal highways are always problematic. In Clatsop County much of the problem is linked to the local geology. This has been mapped as part of DOGAMI's environmental geology series. Bedrock conditions can and do change abruptly within very short distances. This results in an inconsistent highway foundation; some sections are more susceptible to erosion than others and require continuous maintenance. There is no practical solution outside of relocation of the highway; this option is not financially feasible at this point in time. On the positive side, the State Highway Division and Region 1 counties are adept in rerouting traffic. This will continue to be part of the solution.

The Clatsop County Steering Committee estimates 'high' vulnerability for coastal erosion, meaning more than 10% of the population or regional assets are likely to be affected by this hazard. The vulnerability of occurrence is high due to the large amount of coastal land area and the amount of dwellings in or near erosion zones.

Risk Analysis

Approximately 807 dwellings are within the Beaches and Dunes Overlay. This makes them susceptible to coastal erosion.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Coastal erosion processes create special challenges for people living near the ocean, requiring sound planning in order to minimize the potential dangers to life and property. Attempts to stabilize the shoreline or beach are often futile because the forces that shape the coast are persistent and powerful. Inadequate understanding of the complex interaction of coastal land forms and waters and the various types of coastal erosion can result in serious threats to people, communities and infrastructure.

The degree of damage to structures, as well as injury and death to people caused by coastal erosion and related hazards (e.g., ocean, urban and riverine flooding, landslides and slumping, storm surges and high ocean wave action, sand inundation, wind storms, tsunamis and earthquakes, etc.) will depend upon: 1) whether the hazard events are catastrophic or chronic in nature and, 2) the proximity of people and property to the event and its magnitude and duration.

The effects from more frequent chronic hazards will in most instances be much less severe than catastrophic events and cover a much smaller area. However, a significant chronic hazard can still result in dangerous slides, flooding, high winds and dangerous wave effects causing major damage to roads, bridges, homes, schools, businesses and infrastructure. Such impacts can be particularly hard on smaller-sized communities, isolated rural homes and farms, and large residential, resort, tourist and commercial developments located in or near areas of known hazards due to erosion, slides and slumping, high wave action and storm surges and ocean or river flooding.

Human activities also influence, and in some cases, intensify the effects of erosion and other coastal hazards. Major actions such as jetty construction and maintenance dredging can have long-term effects on large sections of the coast. This is particularly true along dune-backed and inlet-affected shorelines such as the Columbia River littoral cell. The planting of European bunchgrass since the early 1900s has locked up sand in the form of high dunes. This in turn has contributed to the net loss of beach sand and increased beach erosion. Residential and commercial development can affect shoreline stability over shorter periods of time and in smaller geographic areas. Activities such as grading and excavation, surface and subsurface drainage alterations, vegetation removal, and vegetative as well as structural shoreline stabilization can all reduce shoreline stability.

Finally heavy recreational use in the form of pedestrian and vehicular traffic can affect shoreline stability over shorter time frames and smaller spaces. Because these activities may result in the loss of fragile vegetative cover they are a particular concern along dune-backed shorelines. Graffiti carving along bluff-backed shorelines is another byproduct of recreational use that can damage fragile shoreline stability.

Obviously, as compared to the lesser impacts from a chronic hazard, a rare catastrophic event striking the coast will likely result in much more extensive property damage and higher numbers of dead and injured people. A catastrophic incident potentially can seriously damage, disrupt and destroy large numbers of homes, buildings, schools, utilities, infrastructure, boats and port facilities, roads and bridges, and communication and other lifeline systems. Such damage also can seriously impede or prevent the movement of people and goods and may disrupt the response of police, fire and Emergency Management Division. Such consequences in turn can produce serious impacts on community and regional economic activity by disconnecting people from home, jobs, school, food and needed commercial, medical and social services. On the coast, the interruption of the tourist industry for any prolonged time could have very dire economic effects.

There is no location on the Oregon coast that is immune to coastal hazards. Clatsop County is especially vulnerable given the amount of land considered in the coastal zone (Fig 1). Without question, the most important natural variables for coastal change are the beach sand budget (balance of sand entering and leaving the system) and processes (waves, currents, tides, and wind) that drive the changes.

Furthermore, human influences associated with jetty construction, dredging practices, and coastal engineering have affected the shoreline profile and the amount of sand on a number of Oregon's beaches, ultimately influencing the stability or instability of these beaches.

Existing Hazard Mitigation Activities

Clatsop County, working with DLCD and DOGAMI, amended and upgraded all of its local plan policies, zoning ordinances and hazard maps associated with coastal erosion through the periodic review process. This project was completed in 2003.

Oregon Parks and Recreation Department (OPRD)

The Oregon Parks and Recreation Department (OPRD) is responsible for protecting the scenic, recreational, and natural resource values of the Oregon coast. OPRD accomplishes this through an extensive permitting program for shoreline protection under the authority of The Ocean Shores Statutes (ORS 390.605 - 390.770), also known as the Beach Bill. OPRD is the permitting authority for actions affecting the ocean shorelands up to the statutory vegetation line. The Ocean Shores Statutes require that a permit be obtained from the OPRD for all "beach improvements" seaward of the Statutory Vegetation Line or the actual vegetation line, whichever is farther inland. Permits for shoreline protective structures may be issued only for developments that existed prior to January 1, 1977.

OPRD approval is also required for dune management plans and subsequent dune management, resloping or other alterations of bluff slopes below the vegetation line, alteration of stream channels on the ocean shore, and other ocean shore alterations associated with hazard mitigation.

Oregon Department of Forestry has been given legislative authority to develop a landslide hazard map. These maps are based on historical data and the new Lidar mapping system. New maps were printed in 2007.

Permit Requirements

The Department of State Lands (DSL) regulates removal and filling of the seabed (seaward of the extreme low tide line) and estuaries, including any dredged materials or seabed materials. DSL manages the state-owned seabed within three nautical miles of the low tide line. In some instances, a permit may also be required from the U.S. Army Corps of Engineers. When a Corps permit is required, the Oregon Department of Environmental Quality may also need to issue a water quality certification and the Department of Land Conservation and Development (DLCD) a coastal zone concurrence before the Corps can issue a final permit.

The U.S. Army Corps of Engineers is responsible for the protection and development of the nation's water resources to ensure that they are used in the public interest (Figure CE-5). Any person, firm, or agency planning work in the waters of the United States must first obtain a permit from the Corps.

Permits are required even when land next to or under the water is privately owned. Examples of activities in waters that may require a permit include: construction of a pier, placement of intake and outfall pipes, dredging, excavation and depositing of fill. Permits are generally issued only if the activity is found to be in the public interest. DLCD reviews and certifies that Corps permits and other federal activities are consistent with state and local requirements for protecting coastal resources.

- Erosion control plans are required for all excavation activities in the coastal area. The County has an identified Beaches and Dune Overlay, which prohibits removal of soil and sand from the overlay area. This is intended to maintain the integrity of the coastal dune system.
- Continuing coordination between Clatsop County, OPRD, and DLCD on all development activities affecting ocean beaches.
- The Clatsop County Dredged Material Disposal plan identifies specific areas that are appropriate for disposal of materials for beneficial use; such as coastal erosion. The County also requires a 50-foot setback for riparian vegetation in order to maintain naturally occurring erosion control.

Hazard Mitigation Action Items

- Increase public education and outreach in natural hazards which affect the north coast. Pre-identify disposal sites for dredge tailings, woody debris with non-contaminated soils, for contaminated soils and solid waste sites. These sites can be a temporary holding area or a permanent site as defined in the Clatsop County Master Plan.
- Develop intergovernmental agreements or contracts for solid waste disposal in compliance with local, state and federal rules and regulations.
- Develop a comprehensive Debris Management Plan that incorporates the process of removal, transportation, storage and disposal for all type of debris management. Tsunami or coastal debris, storm debris or all traffic accidents that can occur on land, sea and air.
- Coastal erosion and flooding can kill livestock in great numbers, a dead animal pit should be developed and these dead animal carcasses taken to a safe disposal site approved and in our master plan. This can cause a public health emergency, if these carcasses are not disposed of properly.

Drought

Causes and Characteristics of the Hazard

Drought can be defined in several ways. The American Heritage Dictionary defines drought as "a long period with no rain, especially during a planting season." Another definition of drought is a deficiency in surface and sub-surface water supplies. In socioeconomic terms, drought occurs when a physical water shortage begins to affect people, individually and collectively and the area's economy.

Drought is typically measured in terms of water availability in a defined geographical area. It is common to express drought with a numerical index that ranks severity. The Oregon Drought Severity Index is the most commonly used drought measurement in the state because it incorporates both local conditions and mountain snow pack. The Oregon Drought Severity Index categorizes droughts as mild, moderate, severe, and extreme.

History of the Hazard in Your Community

Droughts are not uncommon in the State of Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state, in both summer and winter. They appear to be cyclic, and can have a profound effect on the State's economy, particularly the hydropower and agricultural sectors. The environmental consequences also are far-reaching, including insect infestations in Oregon forests and a reduction in the stream flows that support endangered fish species.

There are no records of a severe drought in Clatsop County. Drought is averted as a result of the County's high rainfall from moist air masses moving onto land from the Pacific Ocean, especially during winter months. Table 1 describes drought that affected the entire state of Oregon, but no recorded damages in Clatsop County could be found.

Due to low rainfall in the winter of 2000-01 a drought-like event resulted in summertime water rationing in the incorporated areas of Clatsop County.

Table 1: Historic Droughts in Oregon

DATE	DESCRIPTION
1904-1905	A drought period of about 18 months throughout Oregon
1917-1931	A very dry period, punctuated by brief wet spells in 1920-21 and 1927 throughout Oregon
1939-1941	A three-year intense drought in Oregon
1976-1981	Intense drought in western Oregon; 1976-77 single driest year of century
1985-1997	Generally a dry period, capped by statewide droughts in 1992 and 1994
2000-2001	General statewide drought

Source: Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book*.

Risk Assessment

How Are Hazard Areas Identified?

In recent years, the State has addressed drought emergencies through the Oregon Drought Council. This interagency (state/federal) council meets to discuss climate outlooks, water and soil conditions, and advise the Governor as the need arises. At the time the plan was developed, no data existed to assist in identifying the location or extent of the drought hazard in Clatsop County. In general, drought hazards tend to affect an entire community; therefore, the location and extent for the hazard can be considered to be the whole of the County.

Probability of Future Occurrence

Due to the extensive rainfall (100+ inches) received each year, the Clatsop County Steering Committee estimates a 'low' probability that drought will occur. A 'low' ranking indicates that no more than one incident is likely within a 75-100 year period.

Vulnerability Assessment

The Clatsop County Steering Committee estimates a 'low' vulnerability to drought hazards. A 'low' ranking indicates that less than 1% of the population or regional assets would be affected by a major drought event.

Risk Analysis

No data is available to analyze the losses and damages from drought hazards for Clatsop County.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Drought is frequently an "incremental" hazard; the onset and end are often difficult to determine. Also, its effects may accumulate slowly over a considerable period of time and may linger for years after the termination of the event.

Droughts are not just a summer-time phenomenon; winter droughts can have a profound impact on agriculture, particularly east of the Cascade Mountains. Also, below average snowfall in higher elevations has far- reaching affect, especially in terms of hydroelectric power, irrigation, recreational opportunities and a variety of industrial uses.

Drought can affect all segments of a jurisdiction's population, particularly those employed in water-dependent activities (e.g., agriculture, hydroelectric generation, recreation, etc.). Also, domestic water-users may be subject to stringent conservation measures (e.g., rationing) and could be faced with significant increases in electricity rates. In addition, water-borne transportation systems (e.g., ferries, barges, etc.) could be impacted by periods of low water.

There also are environmental consequences. A prolonged drought in forests promotes an increase of insect pests, which in turn, damage trees already weakened by a lack of water. A moisture-deficient forest constitutes a significant fire hazard (see the Wildfire summary). In addition, drought and water scarcity add another dimension of stress to species listed pursuant to the Endangered Species Act (ESA) of 1973.

For more information on the drought hazard, please visit the state plans Drought chapter.

Existing Hazard Mitigation Activities

- During summer 2001, due to a drought-like event, several incorporated cities instituted water-rationing programs.
- Several cities have developed Water System Master Plans and Capital Improvement Projects that include the addition or construction of water storage facilities.

Hazard Mitigation Action Items

- Investigate the viability of county wide public awareness activities regarding water conservation.
- Increase public education and outreach in natural hazards which affect the north coast.
- Work with our local Water Master and Oregon Department of Water Resources to reallocate water within the existing water rights and other regulations.
- Water restrictions for watering lawns and washing cars. Residents with even house numbers can wash and water on even days and those residents with odd number wash and water on odd days.

Earthquake

Causes and Characteristics of the Hazard

Seismic events were once thought to pose little or no threat to Oregon communities. However, recent earthquakes and scientific evidence indicate that the risk to people and property is much greater than previously thought. Oregon and the Pacific Northwest in general are susceptible to earthquakes from three sources: 1) the off-shore Cascadian Subduction Zone; 2) deep intra-plate events within the subducting Juan de Fuca Plate; and 3) shallow crustal events within the North American Plate.

While all three types of quakes possess the potential to cause major damage, Subduction zone earthquakes pose the greatest danger. The source for such events lies off the Oregon coast and is known as the Cascadia Subduction Zone (CSZ). A major CSZ event could generate an earthquake with a magnitude of 9.0 or greater resulting in devastating damage and loss of life.

The severity of an earthquake is dependent upon a number of factors including: 1) the distance from the quake's source (or epicenter); 2) the ability of the soil and rock to conduct the quake's seismic energy; 3) the degree (i.e., angle) of slope materials; 4) the composition of slope materials; 5) The magnitude of the earthquake; and 6) the type of earthquake.

The specific hazards associated with an earthquake include the following:

Ground Shaking

Ground shaking is defined as the motion of seismic waves felt on the Earth's surface caused by an earthquake. Ground shaking is the primary cause of earthquake damage.

Ground Shaking Amplification

Ground shaking amplification refers to the soils and soft sedimentary rocks near the surface that can modify ground shaking from an earthquake. Such factors can increase or decrease the amplification (i.e., strength) as well as the frequency of the shaking.

Surface Faulting

Surface faulting are planes or surfaces in Earth materials along which failure occurs. Such faults can be found deep within the earth or on the surface. Earthquakes occurring from deep lying faults usually create only ground shaking.

Earthquake-Induced Landslides

These landslides are secondary hazards that occur from ground shaking.

Liquefaction

Liquefaction takes place when ground shaking causes granular soils to turn from a solid into a liquid state. This in turn causes soils to lose their strength and their ability to support weight.

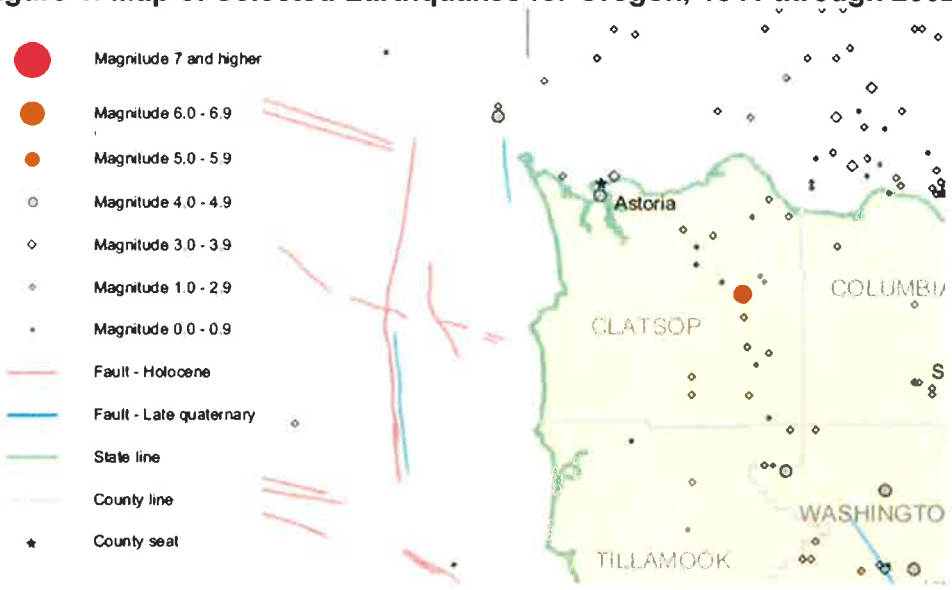
Tsunamis

Tsunamis are another secondary earthquake hazard created by events occurring under the ocean. A tsunami, often incorrectly referred to a "tidal wave," is a series of gravity-induced waves that can travel great distances from the earthquake's origin and can cause serious flooding and damage to coastal communities. There are two sources of tsunamis that can affect Clatsop County: earthquakes in or near the County (CSZ) or earthquakes from distant areas (e.g., Japan).

History of the Earthquakes in Clatsop County

Although Clatsop County has not been the center point of any recorded earthquakes, on April 13, 1949, a major earthquake (magnitude 7.0) caused eight deaths and estimated $25 million damage at Olympia, Washington, and a broad area around the capital city. The depth was greater than normal, which, in part, accounted for the large felt area - 388,000 square kilometers in the United States. In Oregon, widespread damage was observed, including injuries in Astoria.[1] Figure EQ.1 shows the locations of past earthquakes in Clatsop County from 1841-2002.

Figure 1: Map of Selected Earthquakes for Oregon, 1841 through 2002



Source: DOGAMI, 2003 http://www.oregongeology.com/sub/earthquakes/images/EpicenterMap.pdf

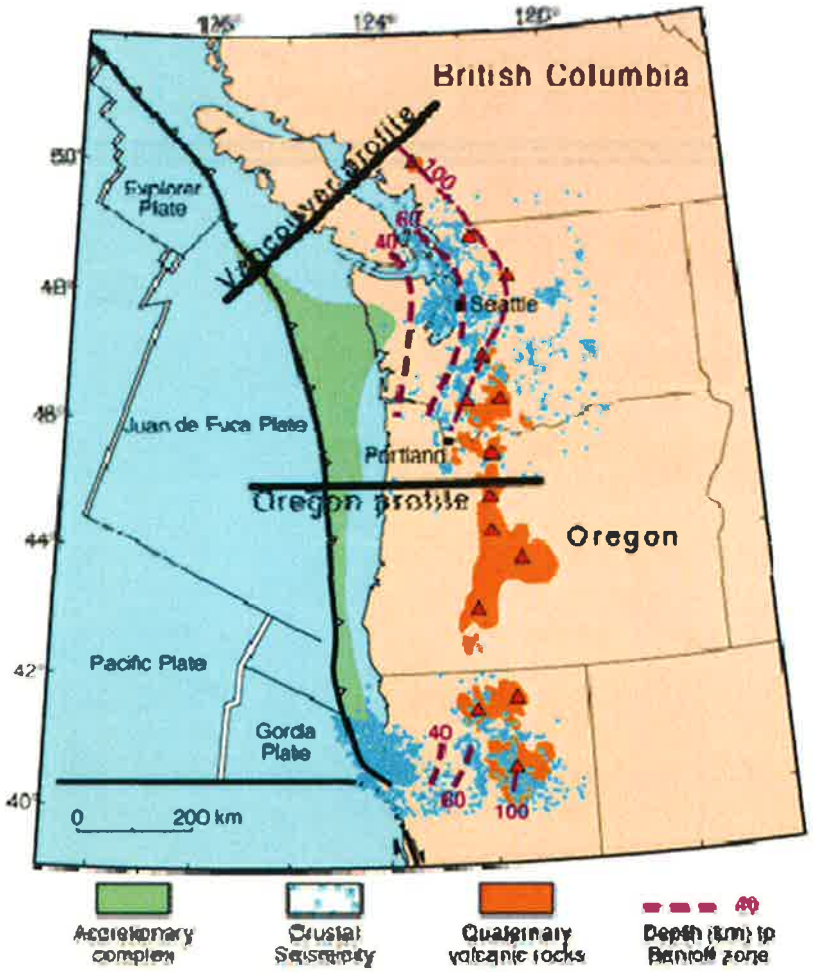
Risk Assessment

How Are Hazard Areas Identified?

DOGAMI has developed city-specific earthquake hazard maps for the majority of cities in Clatsop County. These maps are included in the city addendums and highlight the location and extent of the earthquake hazard in each city. Similar maps at the County level have not been identified.

[1] USGS. 2007. Earthquake History: Oregon, http://earthquake.usgs.gov/regional/states/oregon/history.php

The Clatsop County Land and Water Development and Use Ordinance (LWDUO) contains a Geological Hazard Overlay (GHO) District used to recognize potentially hazardous areas. The ordinance identifies several geological studies for use in determining such hazards. These hazards include but are not limited to: Mass Movement Topography, Active and Inactive Faults, Active and Inactive Landslides. The ordinance also identifies standards for geotechnical reports required to develop lands located within the GHO.



Map: Showing Cascadian Subduction Zone off Oregon Coast

Probability of Future Occurrence

It is difficult to estimate recurrence intervals from available data. Paleoseismic studies along the Oregon coast indicate that the state has experienced seven Cascadia Subduction Zone (CSZ) events possibly as large as M9 in the last 3500 years. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1000 years. The last CSZ event occurred approximately 300 years ago. Scientists estimate that there is a 10-20% probability that a subduction zone earthquake will occur within the next 50 years.[1] Based on this information, Clatsop County estimates a 'high' probability than an earthquake will occur in the future.

Vulnerability Assessment

Clatsop County's Hazard Analysis Report (July 2011) ranked Clatsop County's vulnerability to future earthquakes as high due to the proximity to the CSZ. A 'high' vulnerability ranking indicates that more than 10% of the County's population or regional assets are likely to be affected by a major earthquake. The Clatsop County Steering Committee agrees with the County's Hazard Analysis Report ranking.

Oregon is rated third highest in the nation for potential losses due to earthquakes. This is due in part to the fact that until recently Oregon was not considered to be an area of high seismicity, and consequently the majority of buildings and infrastructure were not designed to withstand the magnitude of ground shaking that would occur in conjunction with a major seismic occurrence. Experts predict that in the event of a magnitude 8.5 Cascadia Subduction Zone earthquake, losses in the Cascadia Region (Northern California, Oregon, Washington and British Columbia) could exceed $12 billion, 30,000 buildings could be destroyed, and 8,000 lives lost.[ii]

The degree of damage to structures and injury and death to people will depend upon the type of earthquake, proximity to the epicenter and the magnitude and duration of the event. Buildings, ports, dams, levees and lifelines including water, sewer, storm water and gas lines, transportation systems, and utility and communication networks are particularly at risk. Also, damage to roads and water systems will make it difficult to respond to post-earthquake fires. Clatsop County is especially vulnerable to earthquake hazards. This is because of the development near the Cascadia Subduction Zone (CSZ), regional seismicity, topography, bedrock geology and local soil profiles. For example, a large number of buildings are constructed of unreinforced masonry (URM) or are constructed on soils that are subject to liquefaction during severe ground shaking. Also, some principal roads and highways are susceptible to earthquake induced landslides. Bridges and tunnels need to be retrofitted to withstand ground shaking and the ability of dams to withstand earthquake forces should be considered. This is especially important as three dams in Clatsop County have been designated as "high hazard": Bear Creek (Astoria), Middle Reservoir, and Wickiup Lake.[iii] Tables EQ.1 and EQ.2 and Figure EQ.2 describe the major bridges along Highway 101 in Clatsop County. These bridges, among others, will be vulnerable from an earthquake and may cut communities off.

Table 1: Bridges in Clatsop County

County	State Highway Bridges	State Highway Culverts	County Highway Bridges	County Highway Culverts	City/ Municipal Highway Bridges	City/ Municipal Highway Culverts	Historic Covered Bridges	2006 Total
Clatsop	109	72	65	78	12	4	0	340

Source: Oregon Department of Transportation 2006, Oregon Department of Fish and Wildlife, Statewide Culvert Inventory

Table 2: Bridges in Clatsop County on Highway 101

Mile Post Location	Name	Year Built
0.00	Junction	
0.17	Skipanon River	1978
1.55	Junction	
1.75	Warrenton	
4.78	Lewis and Clark River, Hwy 105	1924
6.80	Youngs Bay, Hwy 105	1921
7.06	Astoria	
7.10	Hwy 105 over Port of Astoria (Abandoned)	1921
7.25	Junction	

Source: Oregon Department of Transportation http://www.oregon.gov/ODOT/HWY/BRIDGE/docs/brlog.pdf

Figure 2: Highway 101 Bridges of Clatsop County

1.Astoria - Megler Bridge

1966, MP 4.1. The longest three-span, continuous cantilever, through-truss bridge in the world. It crosses the Columbia River linking Oregon to Washington. It completed US 101 as an unbroken link between the Canadian and the Mexican borders. Designed by Washington State Bridge Engineer William A. Burgee.

2.Old Youngs Bay Bridge

1921, Warrenton Highway, Astoria, MP 6.89. This bridge is an example of a double leaf bascule drawspan. The large Art Deco Style wood and concrete pylons on both ends of the bridge are McCullough hallmarks. The buildings located at the bascules are the bridge operator's houses.

3.Lewis and Clark River Bridge

1924, Warrenton Highway, Astoria, MP 4.78. The only remaining single leaf bascule drawspan in Oregon. Four double leaf bascule bridges remain on Oregon's highway system.

Source: Oregon Department of Transportation

www.oregon.gov/ODOT/HWY/BRIDGE/docs/SpanningOregonsCoast/newest_spanning_brochure.pdf

In 2007, DOGAMI conducted a Statewide Seismic Needs Assessment Using Rapid Visual Screening (RVS) to assess public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings. Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. The following map identifies the locations of the RVS Assessments. The complete report (and list of buildings at risk in Clatsop County) is available at http://www.oregongeology.com/sub/projects/rvs/county/county-clatsop.htm.

Risk Analysis

Problem areas within the region are readily identifiable on earthquake hazard maps prepared by the Oregon Department of Geology and Mineral Industries (DOGAMI). DOGAMI has developed two earthquake loss models for Oregon based on the two most likely sources of seismic events: (1) the Cascadia Subduction Zone (CSZ), and (2) combined crustal events (500-year Model). Both models are based on HAZUS, a computerized program, currently used by the Federal Emergency Management Agency (FEMA) as a means of determining potential losses from earthquakes. The CSZ event is based on a potential 8.5 earthquake generated off the Oregon coast. The model does not take into account a tsunami, which probably would develop from the event. The 500-Year crustal model does not look at a single earthquake (as in the CSZ model); it encompasses many faults, each with a 10% chance of producing an earthquake in the next 50 years. Neither model takes unreinforced masonry buildings into consideration.

DOGAMI has calculated financial, human and operational risks associated with an M8.5 earthquake. DOGAMI investigators caution that the models contain a high degree of uncertainty and should be used only for general planning purposes. Despite their limitations, the models do provide some approximate estimates of damage. Tables 3 - 6 project the dollar losses, economic losses, human effects and the facilities that would be operational after an M 8.5 event:

Table 3: Projected dollar losses from a M8.5 CSZ event and 500-year Model

County	Economic Base in Thousands (1999)	Greatest Absolute Loss in Thousands from a M8.5 CSZ Event	Greatest Absolute Loss in Thousands from a 500-Year Model
Clatsop	$2,198,000	$549,000	$760,000

Source: DOGAMI. 1999. Special Paper 29. Earthquake Damage in Oregon

Table 4: Estimated effects of a M8.5 Subduction Event in Clatsop County

	Injuries	Deaths	Displaced
Number of Residents	296	6	788
Percent of Residents	1%	0%	4%

Source: DOGAMI. 1999. Special Paper 29. Earthquake Damage in Oregon

Table 5: Operational facilities in Clatsop County 24hr after a M8.5 CSZ Event

Fire Stations	Police Stations	Schools	Bridges
16%	15%	16%	58%

Source: DOGAMI. 1999. Special Paper 29. Earthquake Damage in Oregon

Table 6: Economic Losses to Clatsop County after a M8.5 Subduction Event

Highways	Airports	Communications
$18 million	$5 million	$6 million

Source: DOGAMI. 1999. Special Paper 29. Earthquake Damage in Oregon

Community Hazard Issues

What is susceptible to damage during a hazard event?

Earthquake damage occurs because we have built structures that cannot withstand severe shaking. Buildings, ports, and lifelines (highways, telephone lines, gas, water, etc.) suffer damage in earthquakes. Damage and loss of life can be very severe if structures are not designed to withstand shaking, are on ground that amplifies shaking, or ground which liquefies due to shaking. Unreinforced masonry buildings are known to be the most susceptible to damage. While it is not impossible to design structures to withstand earthquakes, it can be prohibitively expensive to design for significant events. Most buildings are designed with life-safety integrity for the occupants to safely survive the event and evacuate, but not necessarily to protect the building from damage. The advantage of improved seismic design requirements is that they can protect lives, and maintain the functionality of the structure in lesser magnitude events. Buildings that were not built to an adequate seismic standard often can be retrofitted and strengthened to help withstand earthquakes and provide life safety.

Earthquake damage to roads and bridges can be particularly serious by hampering or cutting off the movement of people and goods and disrupting the provision of emergency response services. Such effects in turn can produce serious impacts on the local and regional economy by disconnecting people from work, home, food, school and needed commercial, medical and social services. A major earthquake can separate businesses and other employers from their employees, customers, and suppliers thereby further hurting the economy. Finally, following an earthquake event, the cleanup of debris can be a huge challenge for the community.

Clatsop County is also vulnerable because of the age of the homes. Table EQ.7 shows the age of homes in Clatsop County. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest use earthquake resistant designs and construction techniques. Those built before 1960 (47.1% of homes in Clatsop County) are not likely to be earthquake resistant.

Table 7: Housing Year Built

Pre 1959	1960-1979	1980-2000
47.1%	26.1%	26.7%

Source: US Census, 2000

Existing Hazard Mitigation Activities

- Clatsop County enforces International Building Codes and Oregon State Structural Specialty Code that addresses earthquake mitigation measures for new construction.
- In 2007, DOGAMI conducted a Seismic Needs Assessment in Clatsop County using Rapid Visual Screening on educational facilities and public buildings.
- Clatsop County requires a geotechnical investigation in areas identified as geological hazard areas prior to issuance of a development and building permits. This was adopted as part of Statewide Planning Goal #7.
- Clatsop County public service buildings have undergone major renovations in recent years. A large part of the renovation revolved around retrofitting to protect against earthquake damage.
- As County bridges are replaced, they are brought to seismic standards.

Hazard Mitigation Action Items

- Retrofit County bridges that are identified by a seismic vulnerability assessment (County priority action)
- Complete assessment of County owned bridges
- Seismic upgrades for the Ecola Creek Bridge in Cannon Beach (Hwy 101)
- Complete a seismic vulnerability assessment for Port of Astoria facilities.
- Develop incentive programs to encourage homeowners to do seismic retrofits.
- Seismic retrofitting of old Hamlet Fire Station

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[i] Geologic Hazards on the Oregon Coast. Oregon Department of Geology and Mineral Industries. http://www.oregongeology.com/sub/earthquakes/Coastal/OrGeoEqNTsu.htm

[ii] State of Oregon Natural Hazard Mitigation Plan, Part 3: Hazard Chapters. Earthquakes, p. 2 (Wang and Clark, 1999).

[iii] Oregon Water Resources Department. Dam Inventory: Clatsop County, http://apps.wrd.state.or.us/apps/sw/dam_inventory/dam_inventory.php

Flood

Causes and Characteristics of the Hazard

Oregon has a detailed history of flooding with flood records dating back to the 1860s. The principal types of flood that occur in Clatsop County include: (1) riverine and (2) ocean flooding from high tides and wind- driven waves or tsunami event. There are two distinct periods of riverine flooding in this region, winter and late spring. The most serious flooding occurs during December, January, and February. The situation is especially severe when riverine flooding, caused by prolonged rain and melting snow, coincides with high tides and coastal storm surges. In short, the rivers back up and flood the lowlands. There are other circumstances as well. Several coastal rivers carry heavy silt loads from areas covered with volcanic ash during the Mt. St. Helens eruption (1980). Consequently, some rivers actually may be elevated above local floodplains, which increases flood hazards. The costs and long-term benefits of dredging these rivers have not been determined.

Riverine Floods

Riverine floods occur when water levels in rivers and streams overflow their banks. Most communities located along such water bodies have the potential to experience this type of flooding after spring rains, heavy thunderstorms or rapid runoff from snow melt. Riverine floods can be slow or fast-rising, but usually develop over a period of days. The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with melting of snow in the Coast Range.

Ocean Flooding / Wave Action / Velocity (V) Zones

Flooding from wind-driven waves is a common event on the Oregon coast. This is particularly true during the winter storm season, during El Niño events, and when spring and perigean tides occur. The Federal Emergency Management Agency has identified and mapped coastal areas subject to direct wave action (V zones) and sand dune overtopping (AH and AO zones). Direct wave action was especially severe during the winter storm events of 1972 (Siletz Spit), 1978 (Nestucca Spit), and the El Niño events of 1982-83 and 1997-98. Beach and cliff erosion were significant during these periods and a number of homes were destroyed. The following lessons were learned (and oftentimes forgotten between damaging events):

- Oregon coastal processes are complex and dynamic, sometimes eroding, sometimes aggrading;
- Some sections of the Oregon coast are rising in relation to ocean levels, others remain fairly constant or are becoming lower (Komar 1992, 40-41);
- Primary frontal dunes provide protection from ocean storms;
- Sand spits are not permanent features; and
- Erosion rates vary and are dependent on several factors including storm duration and intensity, composition of sea cliff, time of year, and impact of human activities (e.g., altering the base of sea cliffs, interfering with the natural movement of beach sand).

Table 1: History of the Flooding in Clatsop County

Date	Location	Comments
March 1876	Columbia	
June 1880	Columbia	
May-June 1984	Columbia River Basin	Rain on snow pack
February 1907	Western Oregon & John Day	
June 1913	Columbia	
May 1928	Columbia	
May-June 1948	Columbia River Basin	Rain on snow pack
March 1964	Oregon Coast	
December 1964-January 1965		Rain on snow; record flood on many rivers
January 1972	Western Oregon & John Day	Record flows on coastal rivers
January 1974	Western Oregon and John Day	$65 million damages
November-December 1977	Western Oregon	Rain on snow event; $16.5 million damages
November 27, 1995	Clatsop & Clackamas counties	Road damage from landslides; high velocity flows, damage from erosion and undermining of structures
February 1996	Nearly Statewide	
November 5, 2006	Western Oregon	
December 1-3, 2007	Northwest Oregon	Heavy flooding in Clatsop

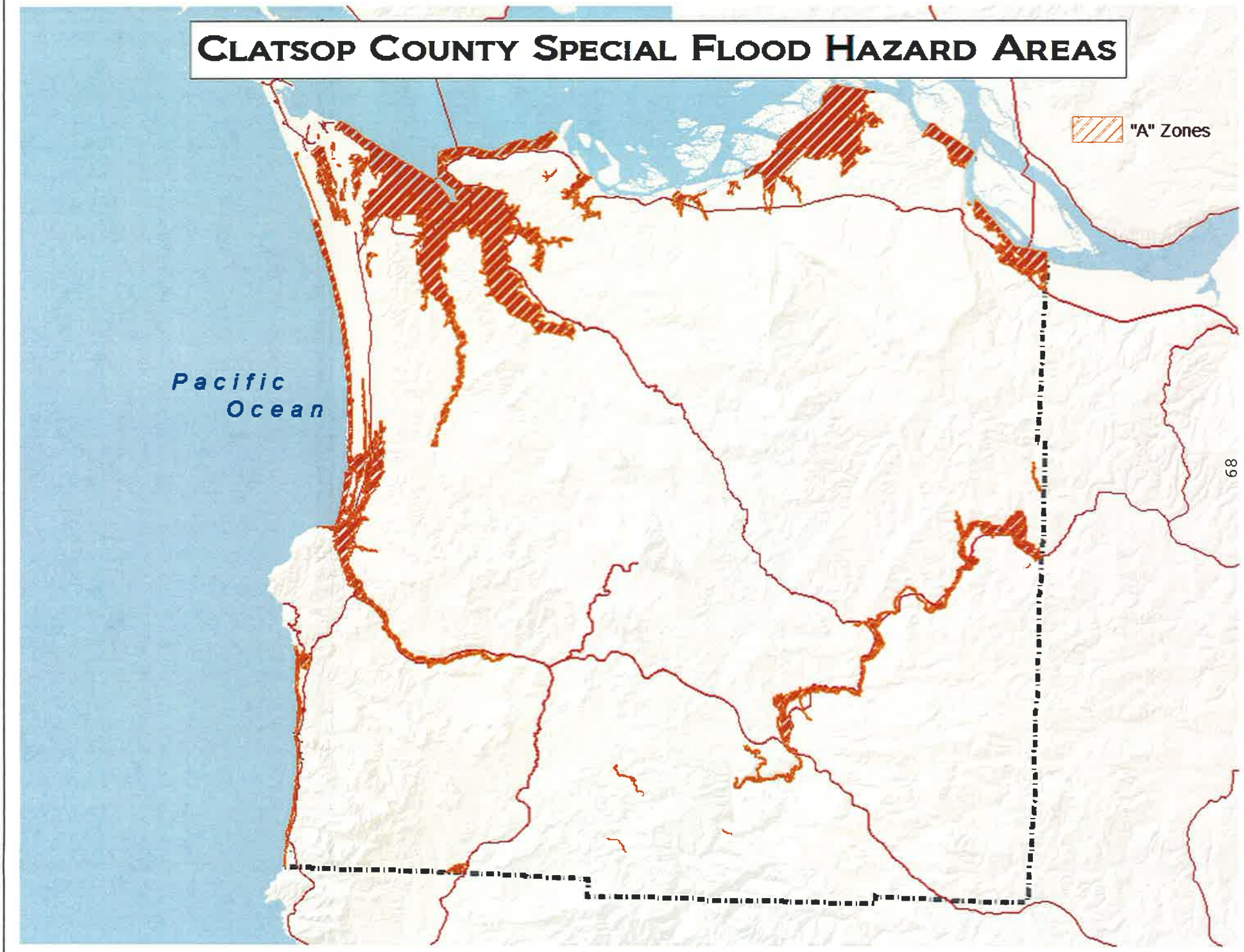
In addition, according to the National Climatic Data Center, Clatsop County experienced heavy rain events in August 2001, January 2003, March 2003, December 2003, January 2004, November 2006, and December 2007.

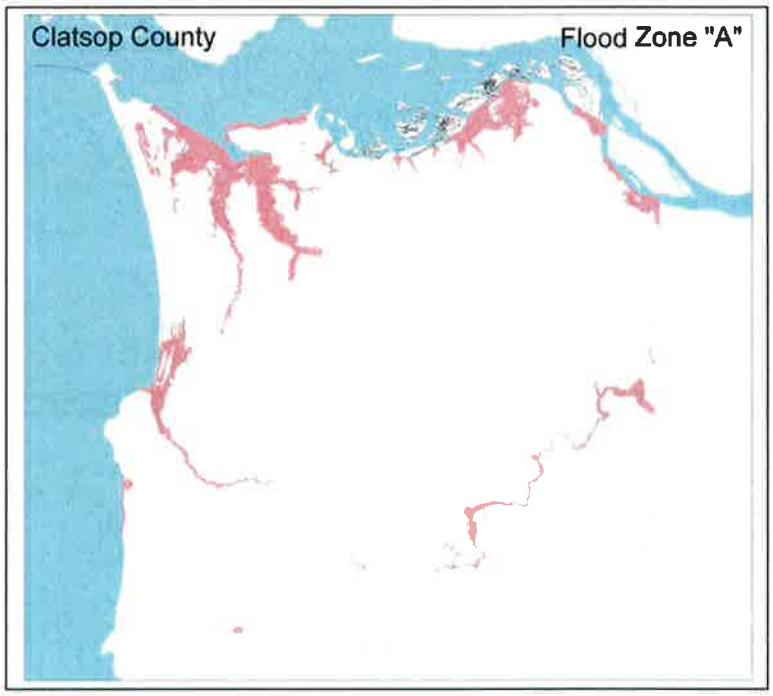
Risk Assessment

How Are Hazard Areas Identified?

FEMA Flood Insurance Rate Maps (FIRMs) are the most comprehensive resource for identifying hazards in Clatsop County. FIRMs depict flood conditions; however, many old maps are inaccurate. Clatsop County's most recent FIRM was developed on September 17, 2010.

Clatsop County Special Flood Hazard Areas





Map: Federal Emergency Management Agency - National Flood Insurance Program

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Clatsop County Rivers & Streams Prone to Flooding

- Bear Creek
- Beerman Creek
- Big Creek
- Cow Creek
- Fish Hawk Creek
- Humbug Creek
- Lewis & Clark River
- Little Creek
- Little Walluski River
- Neacoxi Creek
- Necanicum River
- Neawanna Creek
- Nehalem River
- Northrup Creek
- Plymton Creek

Source: Federal Emergency Management Agency (FEMA), Clatsop County Flood Insurance Study

Probability of Future Occurrence

Clatsop County's Hazard Analysis Report (July 2011) ranked Clatsop County's probability for flooding as 'high.'i A 'high' ranking indicates that one incident is likely within a 10 to 35 year period. The Clatsop County Steering Committee agrees with this assessment.

FEMA has mapped the streams listed in Table 1 for 10-, 50-, 100-, and 500- year flood events, with the probability of flooding in a year being 10%, 2%, 1%, and 0.2% respectively. Areas subject to these floods are depicted on FEMA Flood Insurance Rate Maps (FIRMs), and profiled in an accompanying Flood Insurance Study (FIS). Recurrence intervals can differ between reaches of the same stream. For example, certain reaches of the Young's River may experience a 100-year (1%) flood while other sections of the river may be having a 50-year (2%) or perhaps a 500-year (0.2%) flood event.

Ocean storms can be expected every year. El Niño effects, which tend to raise ocean levels, occur about every three to five years (Taylor and Hannan, 1999). V (wave velocity) zones, depicted on FEMA's Flood Insurance Rate Maps, are areas subject to 100-year events (i.e., 1% chance in any given year). The Flood Insurance Rate Maps show areas vulnerable to wave action (V zones), pounding and sheet-flow from waves over-topping dunes (AO and AH zones). Flood Hazard maps are available for viewing on the FEMA or County website or at County offices

Vulnerability Assessment

Clatsop County's Hazard Analysis Report (July 2011) ranked Clatsop County's vulnerability to future flooding events as 'moderate.'ii A 'moderate' vulnerability ranking indicates that 1-10% of the population or regional assets are likely to be affected by a major flooding event. The Clatsop County Steering Committee agrees with this assessment.

Low-lying coastal areas are particularly vulnerable to flood hazards that can be exacerbated by high tides. The northern half of the County is more susceptible to riverine flood damage that that to the south. This is because the northern half of the region is more densely populated and consequently contains much of the region's infrastructure. Physical location also makes a difference. For example, the areas that empty into Young's Bay, Cathlamet Bay and other sections of the Columbia River, have increased risk from riverine flooding on the relatively flat valley floor. In general, structures at-risk (excluding tidal / wind effects) include:

- Pre-FIRM structures (residential and commercial)
- Pre-FIRM structures (state-owned / occupied)
- Repetitive Loss structures
- Manufactured Homes (inside and outside manufactured home parks)
- Critical Facilities At-Risk
- Hospital, Police, Fire, National Guard, Emergency Management (Ingress /Egress)
- Transportation to include highway, rail, and airport
- Sewer and water treatment plants
- Energy facilities
- Communications infrastructure

In general, economic activities at- risk from a 1% flood include:

- Motel / hotel operations
- Highway oriented businesses (especially in Tillamook area)
- Buoyant materials storage (e.g., logs, fuel drums)
- Food outlets (e.g., grocery stores)

Other special considerations to include:

- Special populations (e.g., minority, handicapped, non-English speaking)
- Institutions / incarceration facilities
- Schools / Day-Care
- Hazardous materials sites
- The physical condition of dams
- The physical condition of our levees

Few of Clatsop County's coastal developments are within FEMA- designated Velocity (V) zones. Those that are appear to be constructed according to V-zone standards. A number of coastal developments are protected by primary frontal dunes (as defined in 44 CFR) that are in various stages of accretion or erosion. In some situations, FEMA has allowed accreting dunes to be lowered in order for property owners to retain unobstructed ocean views. The vulnerability of the homes has not been increased. This policy would change, however, should erosion surpass accretion. Many residential structures are located in areas subject to flooding from wave over-topping (e.g., AO and AH zones). However, very few appear to have been flooded, probably because of elevation requirements.

Clatsop County has not inventoried all buildings that are vulnerable to wave action (in V zones); however, some pertinent information is available from the National Flood Insurance Program (NFIP). This data is provided to the state and includes the addresses of buildings insured through the NFIP, flood zones in which they are located, claims, and location of repetitive loss structures.

Table 2: NFIP Coverage, Policies and Claims in Clatsop County

Community Name	Total Coverage	V-Zone[1]	A-Zone[2]	Number of Policies	Total Coverage	Total Claims since 1978	Total Paid Since 1978
Astoria	$27,086	0	19	41	$9,759.500	4	$0
Cannon Beach	$325,581	113	124	487	$120,819,700	13	$157,247
Clatsop County	$364,992	17	331	569	$117,703,600	54	$967,175
Gearhart	$73,726	0	22	151	$38,442,300	4	$3,030
Seaside	$473,336	0	509	1,019	$189,496,000	19	$60,263
Warrenton	$1,352,135	130	1,096	2,447	$515,164,800	96	$1,187,735

Source: Federal Emergency Management Agency - National Flood Insurance Program Report, 2008

1. Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

2. Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone. Mandatory flood insurance purchase requirements apply.

Below is a list of the types and number of repetitive loss properties located in the floodplain.

- Building payments: $145,495.50
- Contents payments: $41,120.04
- Total payments: $186,615.54
- Average payment: $20,735.06
- Losses: 9
- Properties: 3

Source: Dept. of Land Conservation and Development (3/31/08)

Coastal highways are always problematic. In Clatsop County, much of the problem is linked to the local geology. This has been mapped as part of DOGAMI's environmental geology series. Bedrock conditions can and do change abruptly within very short distances. This results in an inconsistent highway foundation; some sections are more susceptible to wave action than others and require continuous maintenance. There is no practical solution outside of relocation of the highway; this option is not financially feasible at this point in time. On the positive side, the State Highway Division and Clatsop County are adept in rerouting traffic. This will continue to be part of the solution.

Risk Analysis

Table 3: Clatsop County residents* at risk for food hazard:

Dwelling Units in Flood Zone "A:	Average RMV of Improvements within flood zone
3,083 (17.88%)	$145,490

*Includes municipal and unincorporated areas based on FEMA Q3 maps.

Community Hazard Issues

What is susceptible to damage during a hazard event?

The extent of the damage and risk to people caused by flood events is primarily dependent on the depth and velocity of floodwaters. Fast moving floodwaters can wash buildings off their foundations and sweep vehicles downstream. Roads, bridges, other infrastructure and lifelines (pipelines, utility, water, sewer, communications systems, etc.) can be seriously damaged when high water combines with flood debris, mud and ice. Extensive flood damage to residences and other structures also results from basement flooding and landslide damage related to soil saturation. Surface water entering into crawlspaces, basements and daylight basements is common during flood events not only in or near flooded areas but also on hillsides and other areas far removed from floodplains. Most damage is caused by water saturating materials susceptible to loss (e.g., wood, insulation, wallboard, fabric, furnishings, floor coverings and appliances).

Homes in frequently flooded areas can also experience blocked sewer lines and damage to septic systems and drain fields. This is particularly the case of residences in rural flood prone areas who commonly utilize private individual sewage treatment systems. Inundation of these systems can result in the leakage of wastewater into surrounding areas creating the risk of serious water pollution and public health threats. This kind damage can render homes unlivable.

As was seen in Oregon's 1996 floods, many housing units that were damaged or lost were mobile homes and trailers. Many older manufactured home parks are located in floodplain areas. Manufactured homes have a lower level of structural stability than "stick-built" (standard wood frame construction) homes. Manufactured homes in floodplain zones must be anchored to provide additional structural stability during flood events. Lack of community enforcement of manufactured home construction and anchoring standards in floodplains can contribute to severe damages from flood events.

Flood events impact businesses by damaging property and interrupting commerce. Flood events can cut off customer access and close businesses for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic viability in the face of flood damage.

Bridges are a major concern during flood events as they provide critical links in road networks by crossing watercourses and other significant natural features. However bridges and the supporting structures can also be obstructions in flood-swollen watercourses and can inhibit the rapid flow of water during flood events.

Existing Hazard Mitigation Activities

Flood Hazard Overlay District

The Clatsop County Land and Water Development & Use Ordinance (LWDUO) contains a Flood Hazard Overlay District. The purpose of the flood hazard overlay district is to identify those areas of the County subject to the hazards of periodic flooding and establish standards and regulations to reduce flood damage or loss of life in those areas. This district shall apply to all areas of special flood hazards within the unincorporated areas of Clatsop County as identified on Flood Insurance Rate Maps (FIRM) and Flood Boundary and Floodway Maps. In advancing these principles and the general purposes of the Clatsop County Comprehensive Plan, the specific objectives of the Flood Overlay District are:

- To promote the general health, welfare and safety of the County;
- To prevent the establishment of certain structures and land uses unsuitable for human habitation because of the danger of flooding, unsanitary conditions or other hazards;
- To minimize the need for rescue and relief efforts associated with flooding;
- To help maintain a stable tax base by providing for sound use and development in flood-prone areas and to minimize prolonged business interruptions;
- To minimize damage to public facilities and utilities located in flood hazard areas;
- To insure that potential home and business buyers are notified that property is in a flood area.

Public Meetings

In order to keep the citizens of Clatsop County informed of proposed changes in FEMA flood maps, the County held a public forum to discuss changes in the County's flood maps as part of FEMA's Map Modernization Project. In addition, County staff has met with individual property owners to discuss changes to specific properties. The proposed changes include the decertification of the County's levees, thus affecting the properties protected by these structures. County staff has also met with representatives of the local Diking Districts and are working in conjunction with the US Army Corps of Engineers and the State of Oregon Division of Land Conservation and Development to disseminate information to the residents of Clatsop County.

Building Codes

Clatsop County Building Codes adhere to the Oregon Structural Specialty Code and FEMA guidelines for new development.

Hazard Mitigation Action Items

- Elevate runway at Port of Astoria airport and improve diking around the airport.
- Complete a risk assessment related to levees in the County and adjacent development.
- Westport Railroad Bridge (71.3) replacement.
- Provide support and assistance to Diking Districts in respect to accreditation of the County's levees.

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[i] Oregon Emergency Management, July 2011, County Hazard Analysis Scores.

Landslide

Causes and Characteristics of the Hazard

Landslides are a major geologic threat in almost every state in the United States. In Oregon, a significant number of locations are at risk from dangerous landslides and debris flows. While not all landslides result in property damage, many landslides do pose serious risk to people and property. Increasing population in Oregon and the resultant growth in home ownership has caused the siting of more development in or near landslide areas. Often these areas are highly desirable owing to their location along the coast, rivers and on hillsides.

Landslides are fairly common, naturally occurring events in various parts of Oregon. In simplest terms, a landslide is any detached mass of soil, rock, or debris that falls, slides or flows down a slope or a stream channel. Landslides are classified according to the type and rate of movement and the types of materials that are transported.

In understanding a landslide, two forces are at work: 1) the driving forces that cause the material to move down slope, and 2) the friction forces and strength of materials that act to retard the movement and stabilize the slope. When the driving forces exceed the resisting forces, a landslide occurs.

Landslides can be grouped as "on-site" and "off-site" hazards. An on- site slide is one that occurs on or near a development site and is slow moving. Slow moving slides cause the most property damage in urban areas. On-site landslide hazards include features called slumps, earthflows and block slides. Off-site slides typically are rapid moving and begin on steep slopes at a distance from homes and development. A 1996 off-site slide in southern Oregon began a long distance away from homes and road, traveled at high velocity, killing five people and injuring a number of others.

Landslides are classified based on causal factors and conditions and exist in three basic categories:

Falls

This type of landslide involves the movement of rock and soil which detaches from a steep slope or cliff and falls through the air and/or bounces or rolls down slope. This type of slide is termed a rock fall and is very common along coastal highways where bedrock in steep canyons has been cut into.

Slides

This kind of landslide exists when the slide material moves in contact with the underlying surface. Here the slide moves along a plane and either slumps by moving along a curved surface (called a rotational slide) or along a flat surface (called a translational slide). While slow moving slides that occur on relatively gentle slopes are less likely to cause serious injuries or fatalities, they can result in significant property damage.

Flows

In this case, the landslide is characterized as plastic or liquid in nature in which the slide material breaks up and flows during movement. This type of landslide occurs when a landslide moves down slope as a semi-fluid mass scouring or partially scouring rock and soils from the slope along its path. A flow landslide is typically rapid moving and tends to increase in volume as it moves down slope and scours out its channel.

Rapidly moving flow landslides are often referred to as a debris flow. Other terms given to debris flows are mudslides, mudflows, or debris avalanches. Debris flows frequently take place during or following an intense rainfall on previously saturated soil. Debris flows usually start on steep hillsides as slumps or slides that liquefy, accelerate to speeds as high as 35 miles per hour or more, and travel down slopes and channels onto gentle sloping or flat ground. Most slopes steeper than 70 percent are at risk for debris flows.

The consistencies of debris flows range from watery mud to thick, rocky, mud-like, wet cement, all of which are dense enough to carry boulders, trees and cars. Separate debris flows from different starting points sometimes combine in canyons and channels where their destructive energy is greatly increased. Debris flows are difficult for people to outrun or escape and present the greatest risk to human life. Debris flows have caused most of their damage in rural areas and were responsible for most landslide-related deaths and injuries during the 1996 storm in Oregon.

Conditions Affecting Landslides

Both natural conditions and human activities can play a role in causing landslides. Certain geologic formations are more susceptible to landslides than others. Locations with steep slopes are at the greatest risk of slides. However, the incidence of landslides and their impact on people and property can be accelerated by community development. Developers who are uninformed about geologic conditions and processes may create conditions that can increase the risk of or even trigger landslides.

There are four principal factors that affect or increase the likelihood of landslides:

- Natural conditions and processes including the geology of the site, rainfall, wave and water action, seismic tremors and earthquakes and volcanic activity;
- Excavation and grading on sloping ground for homes, roads and other structures;
- Drainage and groundwater alterations that are natural or human- caused can trigger landslides. Human activities that may cause slides include broken or leaking water or sewer lines, water retention facilities, irrigation and stream alterations, and ineffective storm water management and excess runoff due to increased impervious surfaces; and
- Change or removal of vegetation on very steep slopes due to timber harvesting, land clearing and wildfire.

History of the Hazard in Your Community

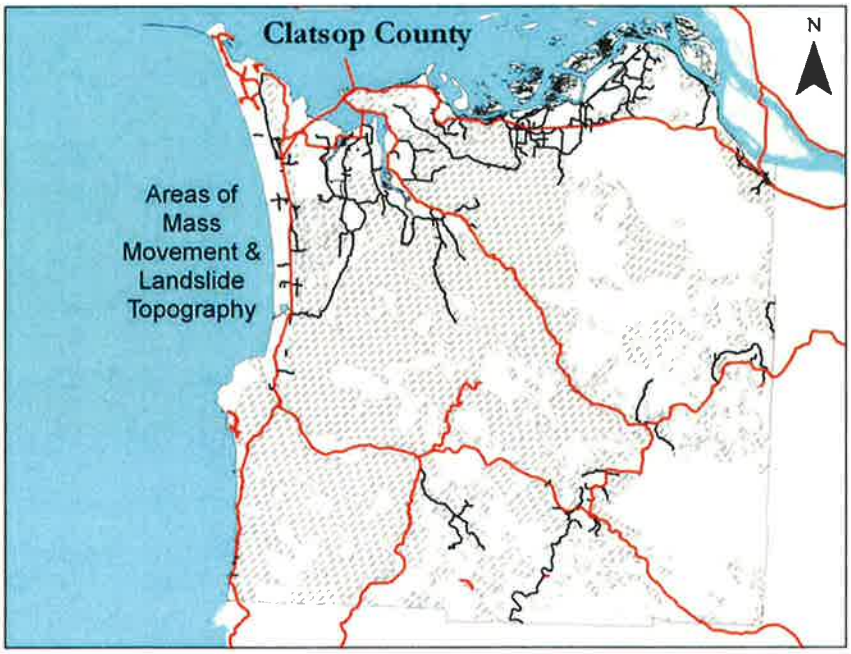
Landslides accompany nearly every major storm system that impacts western Oregon. In recent events, particularly noteworthy landslides accompanied storms in 1964, 1966, 1982, and 1996. Two major landslide producing winter storms occurred in Oregon during November 1996. Intense rainfall on recently and past logged land as well as previously un- logged areas triggered over 9,500 landslides and debris flows that resulted directly or indirectly in eight fatalities throughout the state. Highways were closed and a number of homes were lost. The fatalities and losses resulting from the 1996 landslide events brought about the passage of Oregon Senate Bill 12, which set site development standards, authorized the mapping of areas subject to rapidly moving landslides and the development of model landslide (steep slope) ordinances.

During the December 2007 storm, a landslide occurred near Woodson in neighboring Columbia County – only a few miles from the eastern border of Clatsop County. The slide sent a debris flow through the hamlet of Woodson, across Highway 30, and into Westport Slough, destroying several residential structures and covering the highway with mud and large woody debris.i

Risk Assessment

How Are Hazard Areas Identified?

A large portion of the County is at risk due to Mass Movement or Landslide Topography. County government used Geographic Information Systems (GIS) to identify potential hazard areas. Figure 1 shows areas of mass movement and landslide topography as identified by Clatsop County. Properties in these areas are subject to added requirements to mitigate for landslides. (See Existing Mitigation Activities below for more information).



Source: Clatsop County & DOGAMI

Probability of Future Occurrence

Clatsop County's Hazard Analysis Report (July 2011) ranked Clatsop County's probability for landslides as 'high.'[ii] A 'high' ranking indicates that one incident is likely to occur within a 35-75 year period. The Clatsop County Steering Committee agrees with this assessment.

The probability of rapidly moving landslides occurring depends on a number of factors; these include steepness of slope, slope materials, local geology, vegetative cover, human activity, and water. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows); consequently, the Oregon Department of Forestry tracks storms during the rainy season, monitors rain gages and snow melt, and issues warnings as conditions warrant. Given the correlation between precipitation / snow melt and rapidly moving landslides, it would be feasible to construct a probability curve. The installation of slope indicators or the use of more advanced measuring techniques could provide information on slower moving slides.

Vulnerability Assessment

Rain-induced landslides and debris flows can potentially occur during any winter in Clatsop County. To minimize future landslide impacts to new development, hazards areas must be identified and siting standards applied. Clatsop County's Hazard Analysis Report (July 2011) ranked Clatsop County's vulnerability to landslides as 'moderate.'[iii] A 'moderate' ranking indicates that 1-10% of the population or county assets are likely to be affected by a major landslide emergency or disaster. The Clatsop County Steering Committee agrees with the Hazard Analysis Report ranking.

Risk Analysis

Approximately 4,809 existing dwelling units in the County are within a geological hazard area that is identified as Mass Movement or Landslide Topography.[iv]

Community Hazard Issues

What is susceptible to damage during a hazard event?

Depending upon the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. Landslides can damage or temporarily disrupt utility services, roads and other transportation systems and critical lifeline services such as police, fire, medical, utility and communication systems, and emergency response. In addition to the immediate damage and loss of services, serious disruption of roads, infrastructure and critical facilities and services may also have longer-term impacts on the economy of the community and surrounding area.

Most slopes in Clatsop County steeper than 70% have a risk of rapidly moving landslide activity regardless of geologic unit. Areas directly below these slopes in the paths of potential landslides are at risk as well. The combination of steep slopes and geologic formation (sedimentary rock units) contributes to the increased hazard risk.

Existing Hazard Mitigation Activities

- Geotechnical site evaluations are required for new construction in geological hazard areas as required by the County's Land and Water Development and Use Ordinance. State of Oregon Building Code requirements are also enforced.
- Expansion of Geographic Information Systems has increased availability and accuracy in identifying hazard areas.
- Clustering of development is encouraged to minimize and reduce disruption of soil and thus maintain the integrity of soil composition.
- Lot size for specific zoning designations in Clatsop County are dependent upon the slope of the land. The greater the slope, the larger the lot size must be. This assists in creating smaller footprint on lands that may be prone to erosion or landslides.
- Erosion control plans are required for any development that requires the disturbance of soil. A brochure outlining erosion control techniques and sample plans is made available to those applying for development permits.
- Clatsop County Public Works utilizes retaining walls and slope restoration techniques to stabilize areas prone to landslides. In addition, major excavation areas are hydro seeded and re-vegetated with native species. County roads have been realigned to move them away from slide prone areas.

Hazard Mitigation Action Items

- Build new access road on east side of Astoria from Hwy 30.
- Continue upgrading and enhancing GIS data in order to more efficiently identify areas prone to landslide and mass movement utilizing LIDAR and new techniques.
- Develop alternative transportation routes around slide-prone areas in County.

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[i] GeoScience, Inc,. 2008. Debris Flow Assessment Eilertsen Creek/Woodson.

[ii] Oregon Emergency Management, July 2011, County Hazard Analysis Scores.

[iii] Ibid.

[iv] Citation needed.

Tsunami

Causes and Characteristics of the Hazard

Tsunamis are induced hazards created by events occurring under the ocean. A tsunami, often incorrectly referred to a "tidal wave," is a series of waves that can travel great distances from the earthquake's origin and can cause serious flooding and damage to coastal communities.

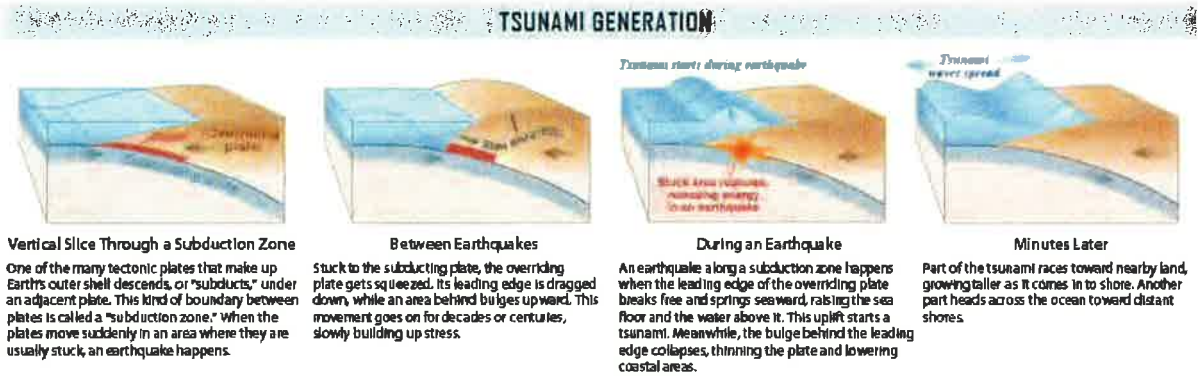
A tsunami usually begins as a single ocean wave but quickly becomes a series of waves, initiated by earthquakes, underwater volcanic eruptions, or landslides (including landslides that begin below the water surface or enter a deep body of water from above the water surface). It is also possible that a tsunami can be generated by a meteoroid, asteroid, or comet impacts that can be catastrophic to an entire ocean basin.

The wavelength of a tsunami may be 100 miles or more in the ocean, with a surface wave height of only a few feet or more. These waves have the potential to travel up to 500 m.p.h. As tsunamis approach shallow water, the speed of the tsunami will slow, but wave heights may increase to as much as 100 feet.

Tsunamis can be divided geographically into two categories: those of distant origin and those locally caused. The distant tsunami is generated by a subduction zone earthquake far out in the Pacific and takes up to 24 hours to reach the coast of Oregon. A local tsunami is generated by a subduction earthquake near the Oregon coastline and would take mere minutes to reach land. In the past, Oregon has experienced both types.[i]

While all types of quakes possess the potential to cause tsunamis, subduction zone earthquakes pose the greatest danger.[ii] The Cascadia Subduction Zone (CSZ) off the Oregon coast is a source for such events. More information on the CSZ can be found in the earthquake hazard annex. More details about the tsunami generation can be seen in Figure 1.

Figure 1: Tsunami Generation



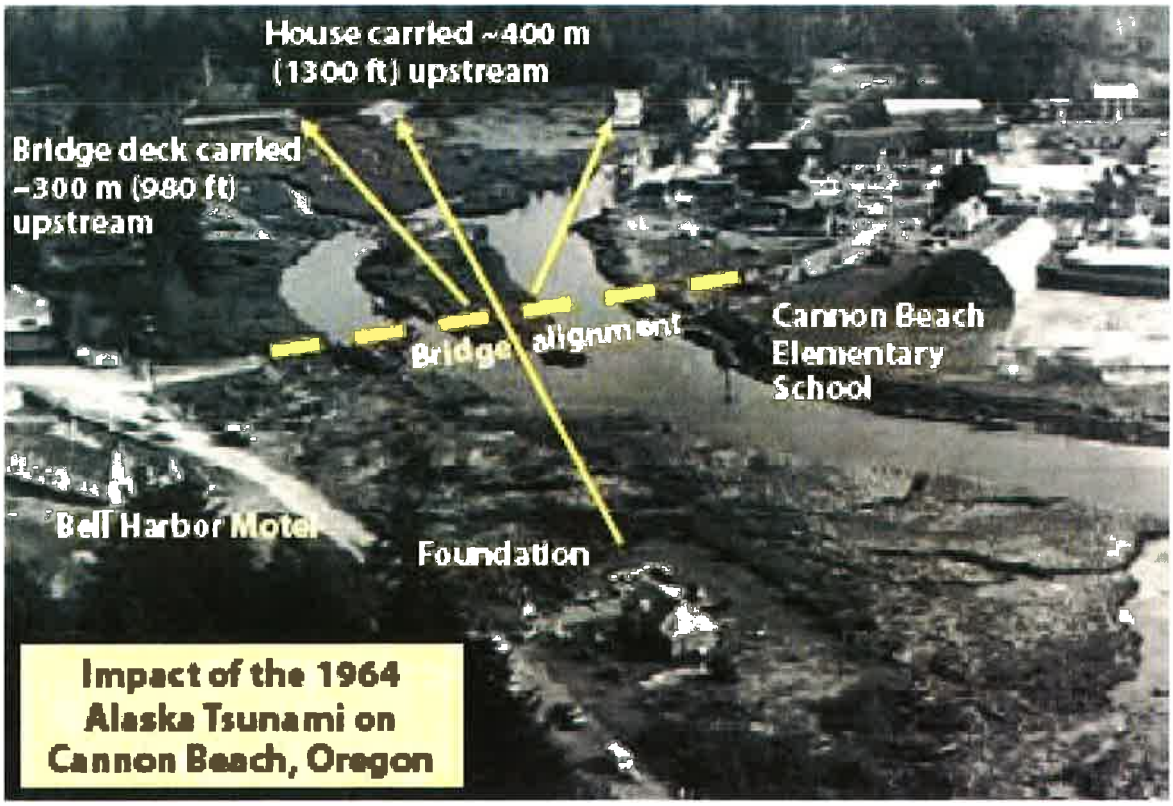
Source: U.S. Geological Survey Circular 1187

History of the Hazard in Your Community

Tsunamis have historically been rare in Oregon. Since 1812, Oregon has experienced about a dozen tsunamis with wave heights greater than 3 feet; some of these were destructive. Ten of these were generated by distant earthquakes near Alaska, Chile or Japan. The worst damage and loss of life resulted from the 1964 Alaskan earthquake.

The tsunami resulting from the 1964 earthquake killed four people (campers on a beach in Newport, OR) and caused around one million dollars in damage to bridges, houses, cars, boats, and sea walls.[iii] The greatest tsunami damage in Oregon occurred in the estuary channels located further inland, not along the coast as expected. The estuary channels amplified the tsunami wave heights and caused extreme flooding. Seaside, which was struck by a 10-foot wave, was the hardest hit city in Oregon due to its level topography and proximity to the ocean. Tsunami wave heights reached 10 to 11.5 feet in the Nehalem River, 10 to 11.5 feet at Depoe Bay, 11.5 feet at Newport, 10 to 11 feet at Florence, 11 feet at Reedsport, 11 feet at Brookings, and 14 feet at Coos Bay.[iv] For reference, the impact of the tsunami in Cannon Beach can be seen in Figure 2.

Figure 2: Impact of the 1964 Alaska Tsunami on Cannon Beach, OR



Source:Hillsboro Argus, March 30, 1964

A tsunami also struck the Oregon coast in 1700 and has been documented by Native American folklore. The 1700 tsunami was the last recorded tsunami triggered by a Cascadia subduction zone earthquake.[v]

Risk Assessment

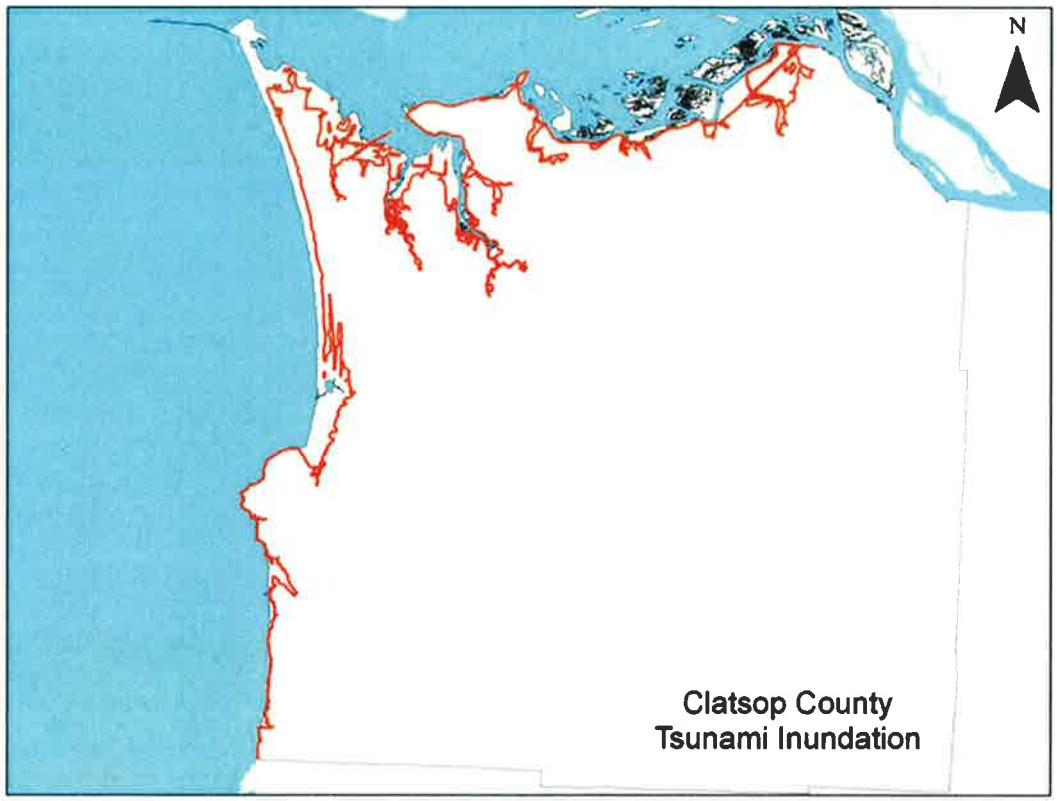
How Are Hazard Areas Identified?

In 2013 the Oregon Department of Geology and Mineral Industries (DOGAMI) released 10 new tsunami inundation maps (TIM) which formed the basis for seven new evacuation brochures covering population centers from Astoria to Arch Cape. The new maps are based on the latest science, new mapping technology and lessons learned from earthquakes and tsunamis around the globe over the last decade.

The maps show tsunami evacuation zones for a local tsunami generated by an earthquake just offshore, along the Cascadia Subduction Zone, which would send tsunami waves onto the coastline 15-20 minutes later. Maps also show danger zone for a *distant* tsunami caused by an earthquake in Alaska, with waves reaching Oregon approximately 4 hours later. Evacuation routes are shown on the maps, directing people to assembly areas on high ground.

The inundation maps and evacuation brochures (shown on were created with local emergency officials to confirm the boundaries' locations are accurate and meet the needs of local governments. DOGAMI works with local building code officials to administer ORS 455.446 and ORS 455.447 which limit construction of critical and essential facilities in designated tsunami inundation zones.

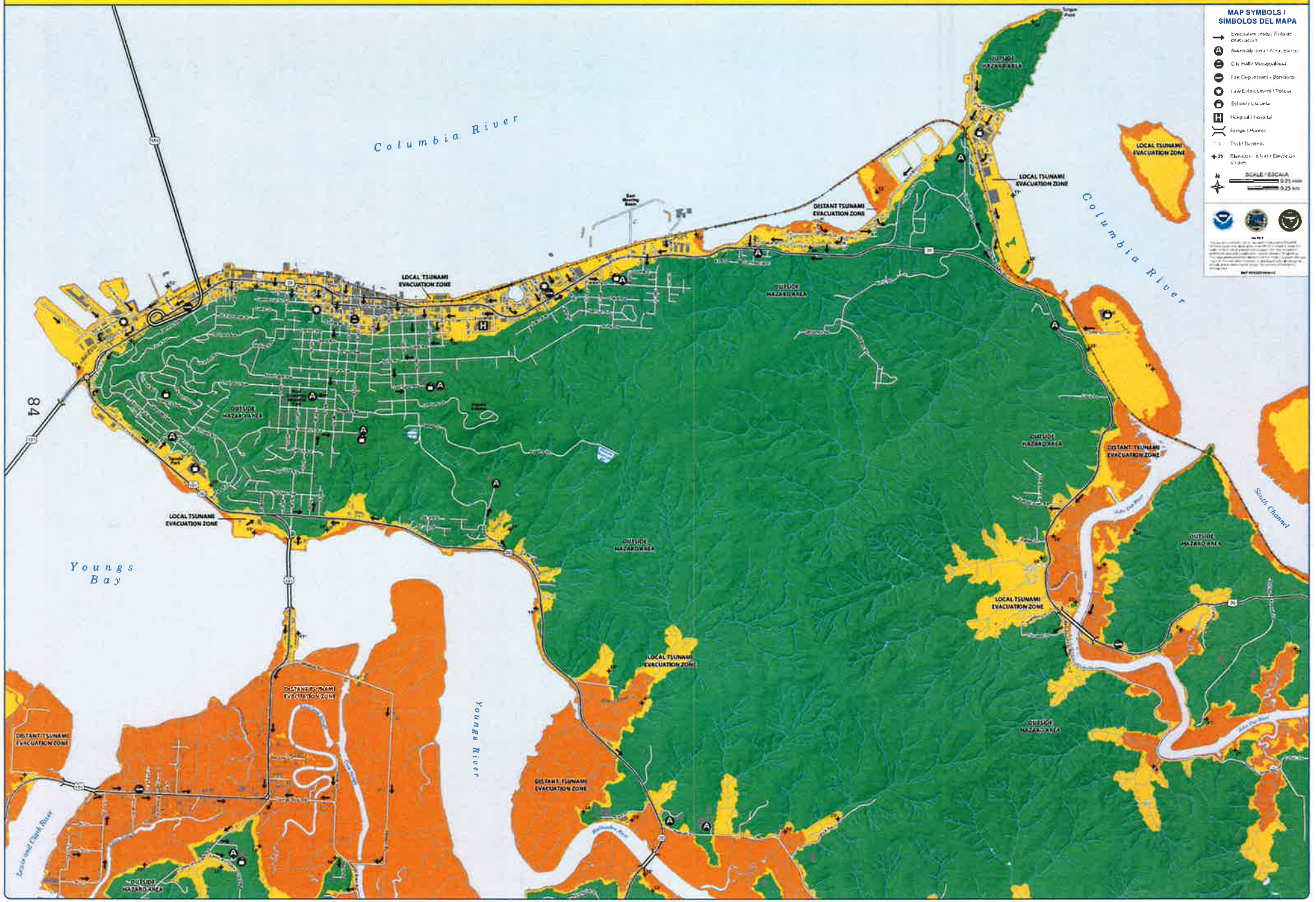
Figure 3: Tsunami Inundation Zone for Clatsop County



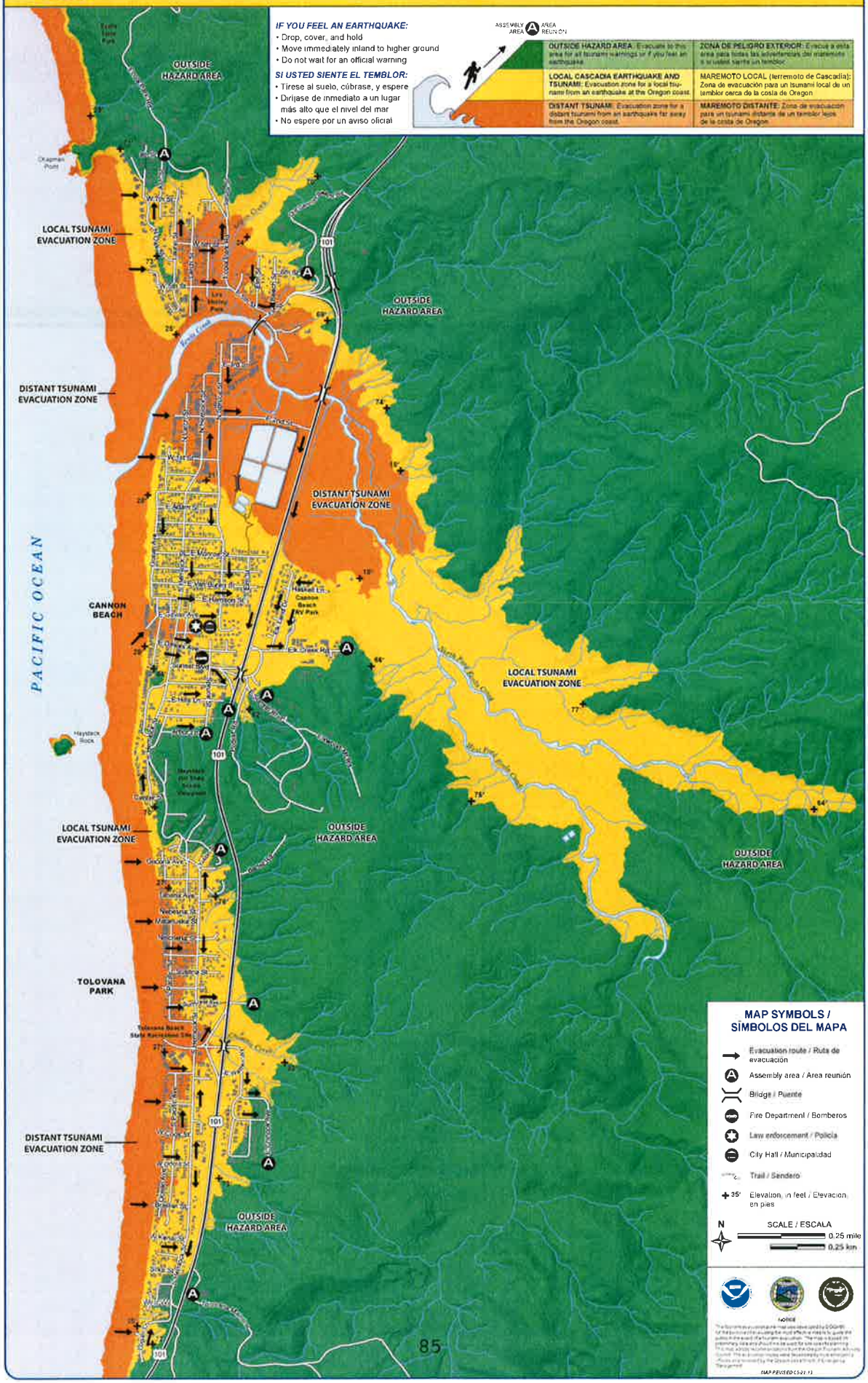
TSUNAMI EVACUATION MAP ARCH CAPE, OREGON

TSUNAMI EVACUATION MAP

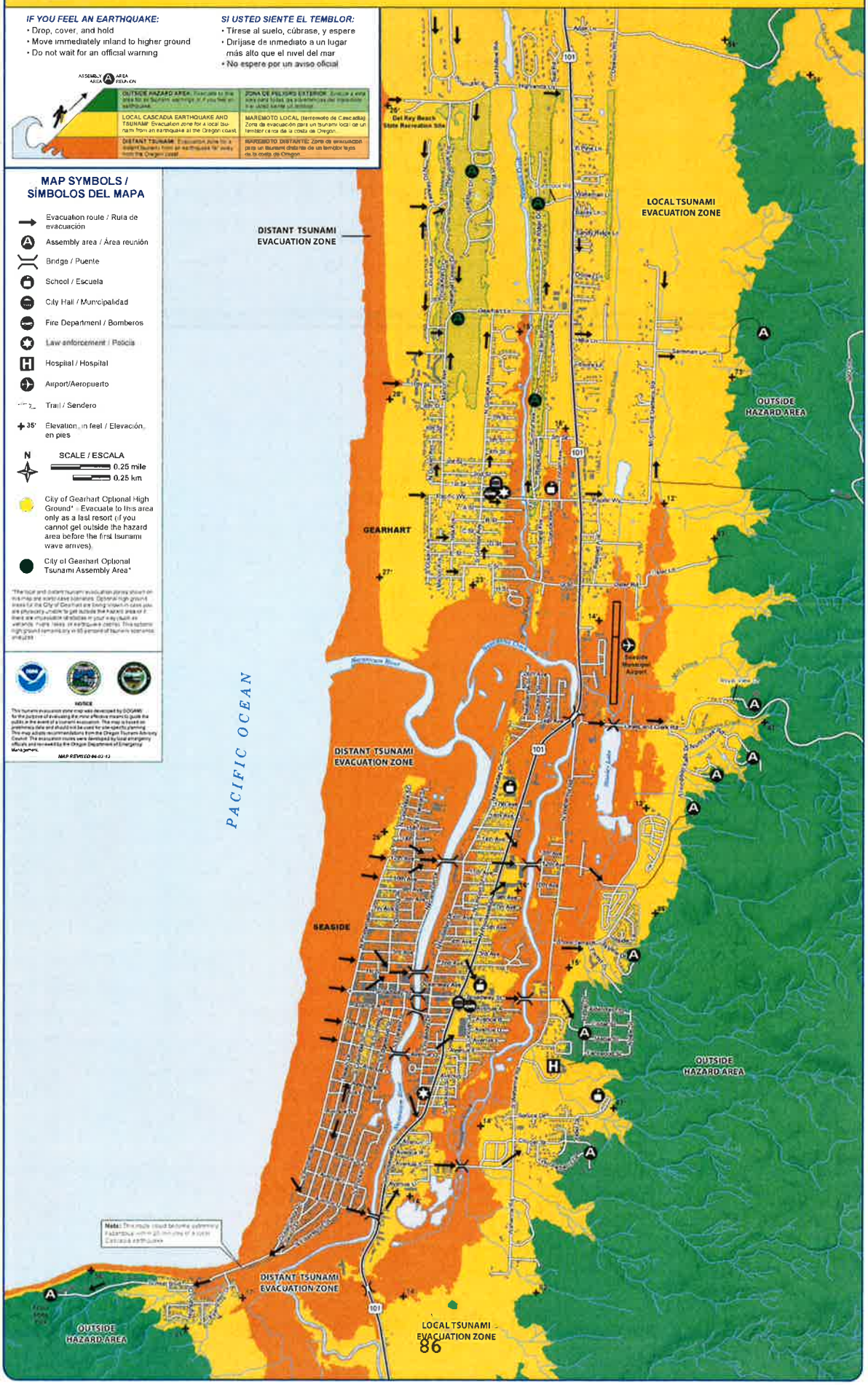
ASTORIA, OREGON



TSUNAMI EVACUATION MAP CANNON BEACH, OREGON

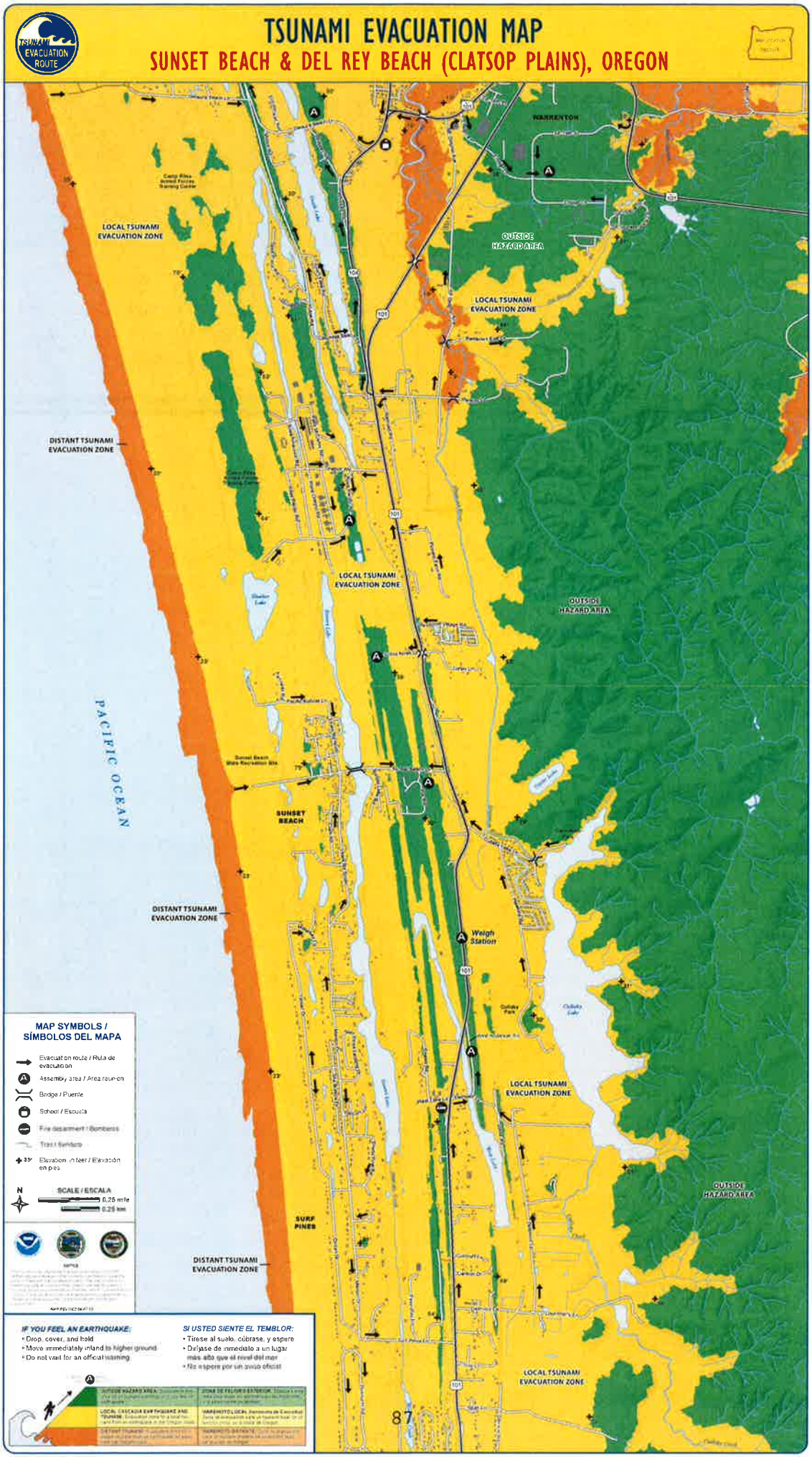


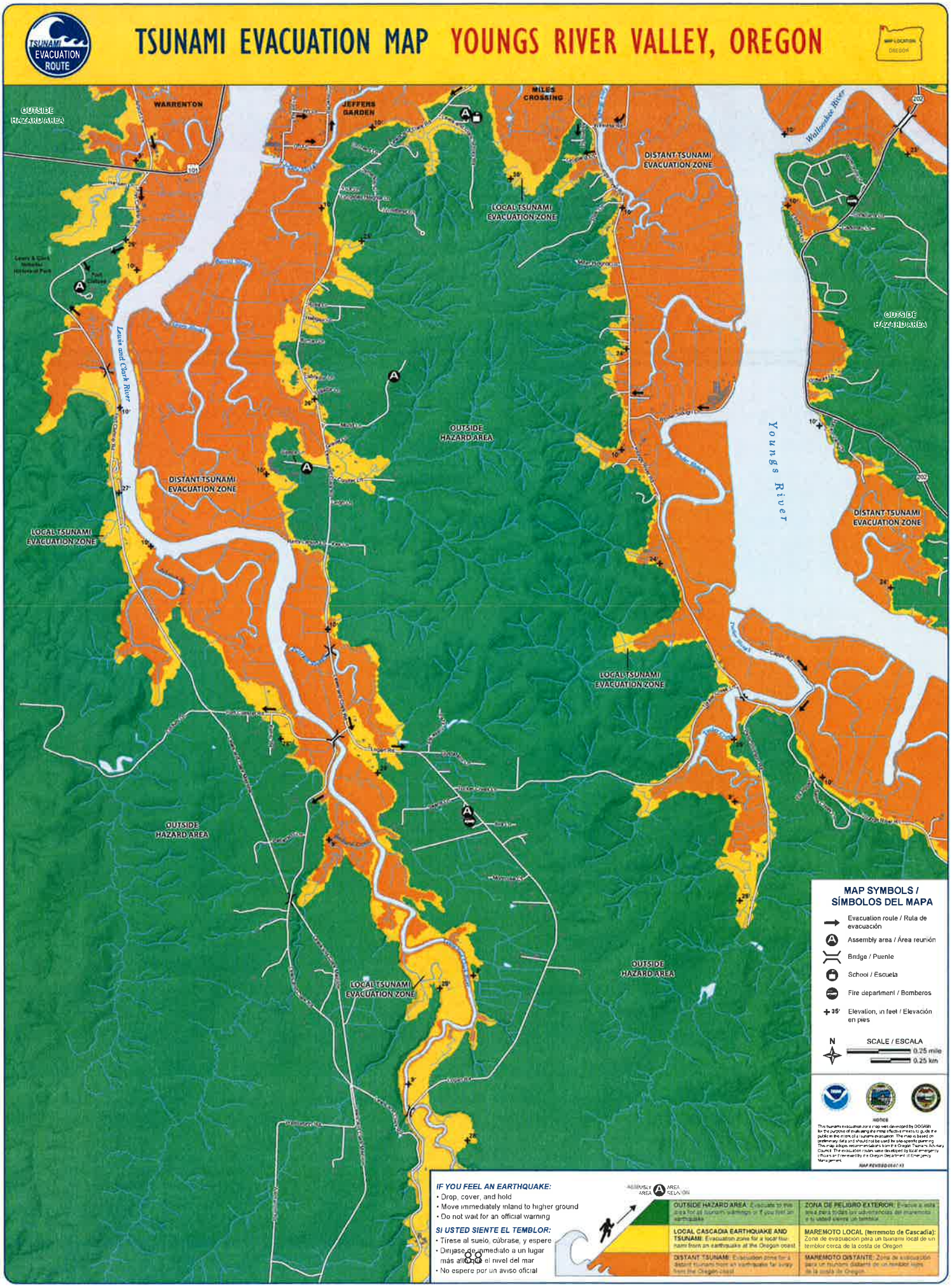
TSUNAMI EVACUATION MAP SEASIDE & GEARHART, OREGON



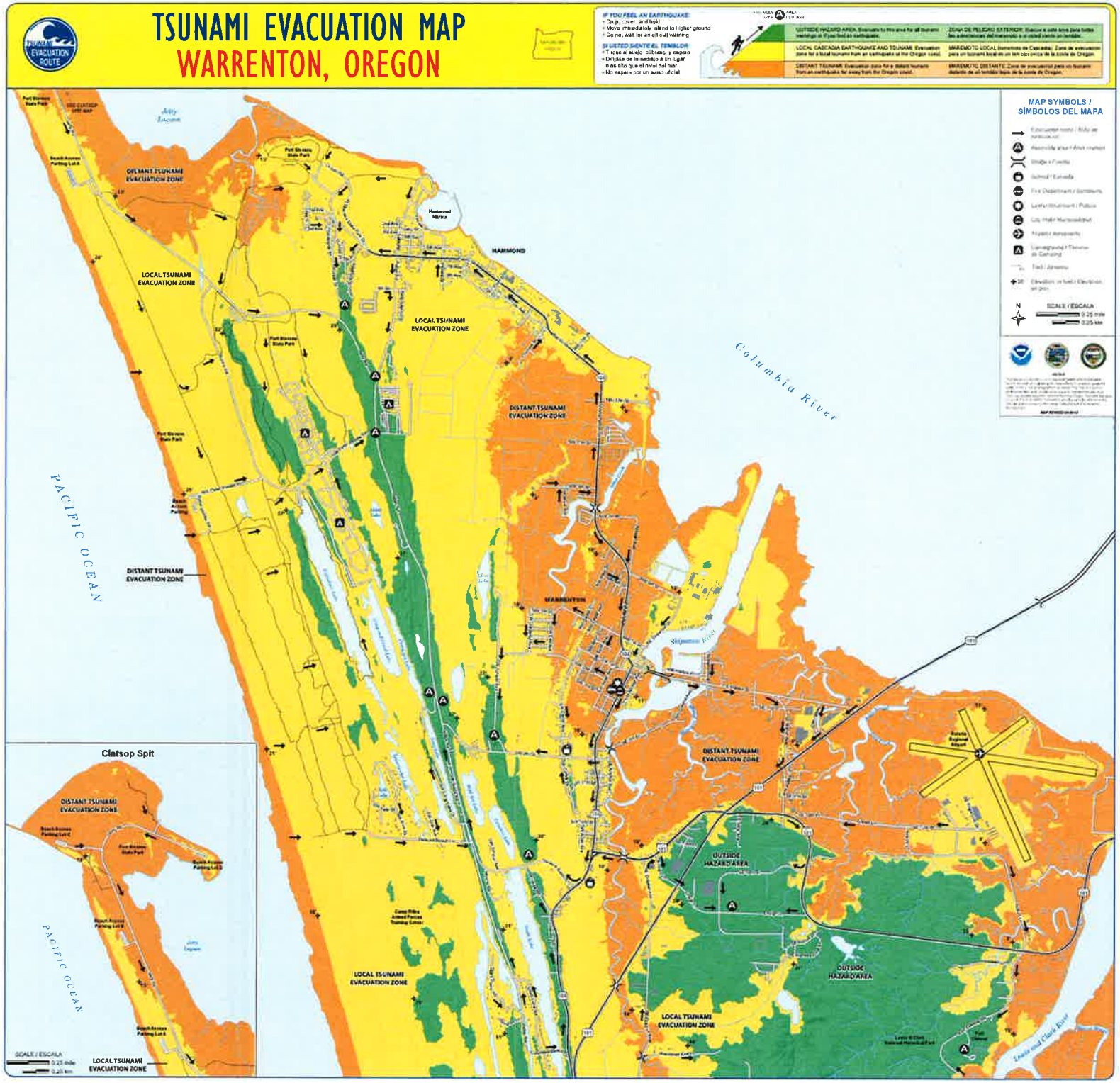
TSUNAMI EVACUATION MAP

SUNSET BEACH & DEL REY BEACH (CLATSOP PLAINS), OREGON




TSUNAMI EVACUATION ROUTE
TSUNAMI EVACUATION MAP YOUNGS RIVER VALLEY, OREGON
MAP LOCATION OREGON
OUTSIDE HAZARD AREA
WARRENTON
JEFFERS GARDEN
MILES CROSSING
Wallooskee River
DISTANT TSUNAMI EVACUATION ZONE
LOCAL TSUNAMI EVACUATION ZONE
Lewis & Clark National Historical Park
Fort Clatsop
Lewis and Clark River
OUTSIDE HAZARD AREA
Youngs River
DISTANT TSUNAMI EVACUATION ZONE
LOCAL TSUNAMI EVACUATION ZONE
OUTSIDE HAZARD AREA
LOCAL TSUNAMI EVACUATION ZONE
OUTSIDE HAZARD AREA
MAP SYMBOLS / SÍMBOLOS DEL MAPA
Evacuation route / Ruta de evacuación
Assembly area / Área reunión
Bridge / Puente
School / Escuela
Fire department / Bomberos
Elevation, in feet / Elevación en pies
N
SCALE / ESCALA
0.25 mile
0.25 km
NOTICE
This tsunami evacuation zone map was developed by OEGMI for the purpose of evaluating the most effective means to guide the public in the event of a tsunami evacuation. The map is based on preliminary data and should not be used for site-specific planning. This map adopts recommendations from the Oregon Tsunami Advisory Council. The evacuation routes were developed by local emergency officials and reviewed by the Oregon Department of Emergency Management.
MAP REVISED 2017
IF YOU FEEL AN EARTHQUAKE:
• Drop, cover, and hold
• Move immediately inland to higher ground
• Do not wait for an official warning
SI USTED SIENTE EL TEMBLOR:
• Tírese al suelo, cúbrase, y espere
• Diríjase de inmediato a un lugar más alto que el nivel del mar
• No espere por un aviso oficial
ASSEMBLY AREA
OUTSIDE HAZARD AREA: Evacuate to this area for all tsunami warnings or if you feel an earthquake.
ZONA DE PELIGRO EXTERIOR: Evacúe a esta área para todas las advertencias del maremoto o si usted siente un temblor.
LOCAL CASCADIA EARTHQUAKE AND TSUNAMI: Evacuation zone for a local tsunami from an earthquake at the Oregon coast.
MAREMOTO LOCAL (terremoto de Cascadia): Zona de evacuación para un tsunami local de un temblor cerca de la costa de Oregon.
DISTANT TSUNAMI: Evacuation zone for a distant tsunami from an earthquake far away from the Oregon coast.
MAREMOTO DISTANTE: Zona de evacuación para un tsunami distante de un temblor lejos de la costa de Oregon.

TSUNAMI EVACUATION MAP
WARRENTON, OREGON



Probability of Future Occurrence

Clatsop County has a "moderate" probability of experiencing a tsunami event. Given the past pattern of tsunami occurrence on the Oregon Coast, geologists predict a 10-14 percent chance that a Cascadia subduction zone earthquake will occur within the next 50 years, causing a tsunami that will affect the Oregon coast. This forecast comes from evidence for large but infrequent earthquakes and tsunamis that have occurred at the Oregon coast, on average, every 500 years.[vii]

Vulnerability Assessment

Clatsop County is "highly" vulnerable to a tsunami event. This score indicates that a minimum of 10% of the population or County assets are likely to be affected by a tsunami emergency or disaster.

Along the Oregon Coast there can be a moderate to high level of vulnerability to tsunamis below 100 feet above mean sea level. The County is vulnerable due the exposure of its population centers (and tourist destinations) to the tsunami hazard. Likewise, County residents' abilities to escape the tsunami inundation zone post-earthquake are highly limited.

Clatsop County is especially vulnerable to tsunamis because of its large amount of coastline along with the fact that much of the development and population is near the coast and in tsunami inundation zones (See DOGAMI inundation zone maps above).

In natural hazard situations, it is important to be aware of high-risk populations living within the hazard zone. Figure 5 shows three categories of high-risk and their presence within the tsunami inundation zone. Renters (including seasonal residents) are the most prevalent high-risk population within the inundation zone in Clatsop County and are a difficult population to address because they can move frequently and might not have community connections for information.

Clatsop County has many dependent population care facilities within the tsunami inundation zone. Figure 6 shows the presence of these facilities; the majority of these facilities are schools and day care facilities.

The City of Seaside is the most vulnerable city due to its low elevation and high number of residents and tourist population within the predicted inundation zone. Although many communities have evacuation maps and evacuation plans, many casualties are expected. The built environment in the inundation zone will be especially hard hit.

Risk Analysis

Approximately 5,475 dwelling units are within the Tsunami Inundation Zone of Clatsop County. According to the Clatsop County Assessor the average Real Market Value of these dwellings is $223,261.

Community Hazard Issues

What is susceptible to damage during a hazard event?

The areas of Clatsop County along the coast and estuaries have the greatest risk of being damaged during a tsunami. An earthquake has the potential to drop low-lying coastal regions several feet below sea level. Tsunami waves could reach 80 ft, which would severely flood coastal communities near beaches, along with bay mouths and low-elevation coastal plains. In Oregon, these areas provide residences for about 40,000 people. This number excludes tourists and transient populations, which could increase the number significantly.[vii]

Tsunamis also have the potential to flood and damage important transportation networks. In Clatsop County, Highway 101 is the main road and is often the only route in and out of cities. Highway 101 runs along the coast and in some cases, is within the tsunami inundation zone. As a result, Highway 101 and connecting arterials have the potential to be damaged by tsunami floods as well as hinder transportation of goods throughout the region.

Existing Hazard Mitigation Activities

- Hazards Outreach Specialist – Oregon State University Clatsop County Extension office has a Hazards Outreach Specialist, Patrick Corcoran, who performs the following duties in the County on tsunami/natural hazards awareness: presentations for public and local officials, radio interviews, local capacity building, establishing partnerships between local officials and outside experts, etc.
- The Cities of Seaside, Warrenton and Cannon beach have hired hazards preparedness coordinators and consultants for a variety of local projects.
- The City of Seaside has worked with OSU on tsunami wave modeling to research vertical evacuation route possibilities.
- USGS Scientist, Nate Wood, published a report on the vulnerability of coastal cities to a tsunami event. Clatsop County ranked as the most vulnerable coastal county based on the city rankings.

Hazard Mitigation Action Items

- Rebuild four Seaside School District schools outside of the tsunami inundation zone.
- Build "tsunami towers" in coastal cities
- Relocate Arch Cape Fire Station out of the tsunami inundation and flood zones.
- Elevate Brownsmead Rural Fire District Station
- Seismic vulnerability assessment/vertical evacuation routes
- Conduct preliminary research on the development of a County
- Land Use Ordinance relating to Tsunami Hazards.

[i] Partnership for Disaster Resilience, State of Oregon Natural Hazard Mitigation Plan (2002), http://www.oregonshowcase.org/downloads/pdf stateplan/OR-SNHMP_tsunami_chapter.pdf

[ii] Oregon Department of Geology and Mineral Industries. Geologic Hazards on the Oregon Coast: Prehistoric and historic tsunamis, http://www.oregongeology.com/sub/earthquakes/Coastal/HistoricTsunamis.htm

[iii] Ibid.

[iv] University of Southern California Tsunami Research Group. 1964 Alaskan Tsunami. http://www.usc.edu/dept/tsunamis/alaska/1964/webpages/index.html.

[v] Oregon Department of Geology and Mineral Industries. Oregon Geology Fact Sheet: Tsunami Hazards in Oregon. http://www.oregongeology.com/sub/publications/tsunami-factsheet_onscreen.pdf

[vi] Oregon Department of Geology and Mineral Industries

[vii]Oregon Department of Geology and Mineral Industries. Oregon Geology Fact Sheet: Tsunami Hazards in Oregon. http://www.oregongeology.com/sub/publications/tsunami- factsheet_onscreen.pdf.

[viii] Ibid.

Volcanic Ash Fall

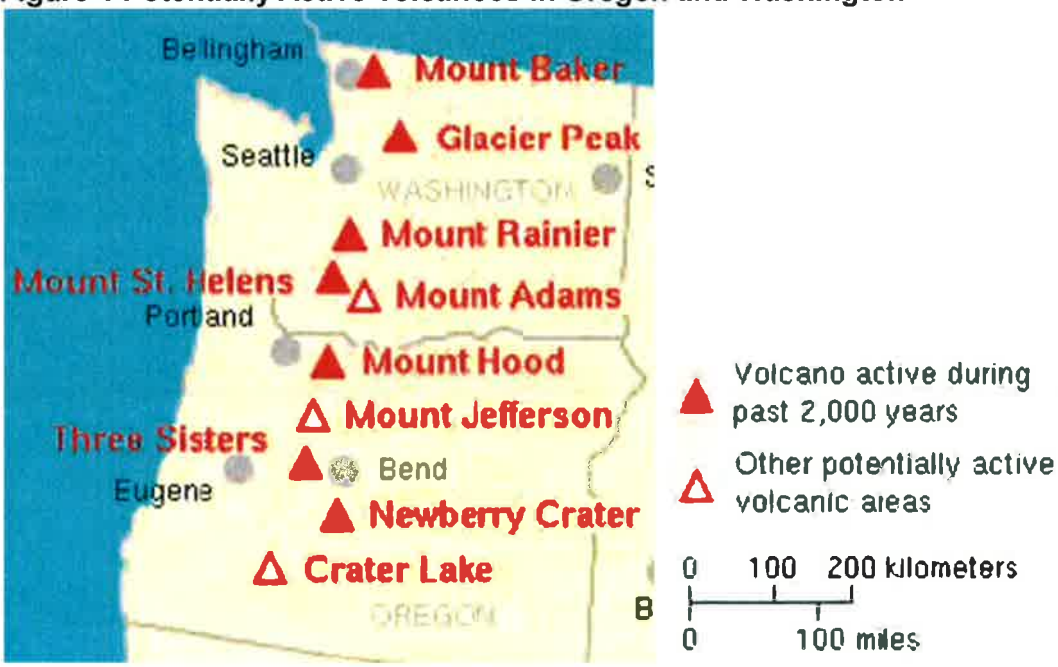
Causes and Characteristics of the Hazard

The Cascade Range of the Pacific Northwest has more than a dozen active volcanoes. These snow-clad peaks are part of a 1,000 mile-long chain of mountains, which extend from southern British Columbia to northern California. Cascade volcanoes tend to erupt explosively, and have occurred at an average rate of 1-2 per century during the last 4,000 years. Future eruptions are certain. Seven Cascade volcanoes have erupted since the first U.S. Independence Day slightly more than 200 years ago. Four of those eruptions would have caused considerable property damage and loss of life had they occurred today without warning. The most recent events were Mt. St. Helens in Washington (1980-86) and Lassen Peak in California (1914-1917). The existence, position and recurrent activity of Cascade volcanoes are generally thought to be related to the convergence of shifting crustal plates. As population increases in the Pacific Northwest, areas near volcanoes are being developed and recreational usage is expanding. As a result more and more people and property are at risk from volcanic activity.

The effects of a major volcanic event can be widespread and devastating. The Cascade Range in Washington, Oregon and northern California is one of the most volcanically active regions in the United States. Volcanoes produce a wide variety of hazards that can destroy property and kill people. Large explosive eruptions can endanger people and property hundreds of miles away and even affect the global climate. Some volcano hazards such as landslides can occur even when a volcano is not erupting.

Although there are no active volcanoes in Clatsop County (the closest volcano is Mt. Hood, Figure 1), it is important for counties to know the potential impacts of nearby volcanoes. While immediate danger area around a volcano is approximately 20 miles, ash fall problems may occur as much as 100 miles or more from a volcano's location; therefore, ash fall may affect Clatsop County. Table 1 displays the distances between Clatsop County and the nearest volcanoes.

Figure 1 Potentially Active Volcanoes in Oregon and Washington



Source: USGS, 1999 <http://vulcan.wr.usgs.gov/Volcanoes/WesternUSA/Maps/map_potentially_active.html>

Table 1 Volcanoes closest to Clatsop County

Volcano	Distance from Clatsop County	Last Event
Mt. Hood	95 mi	1790s
Mt. Jefferson	115 mi	Between 35,000 and 100,000 years ago
Mt. St Helens	60 mi	May 18, 1980
Mt. Adams	90.4	More than 3,500 years ago
Mt. Rainier		1882

Source: USGS

Eruption Columns and Clouds

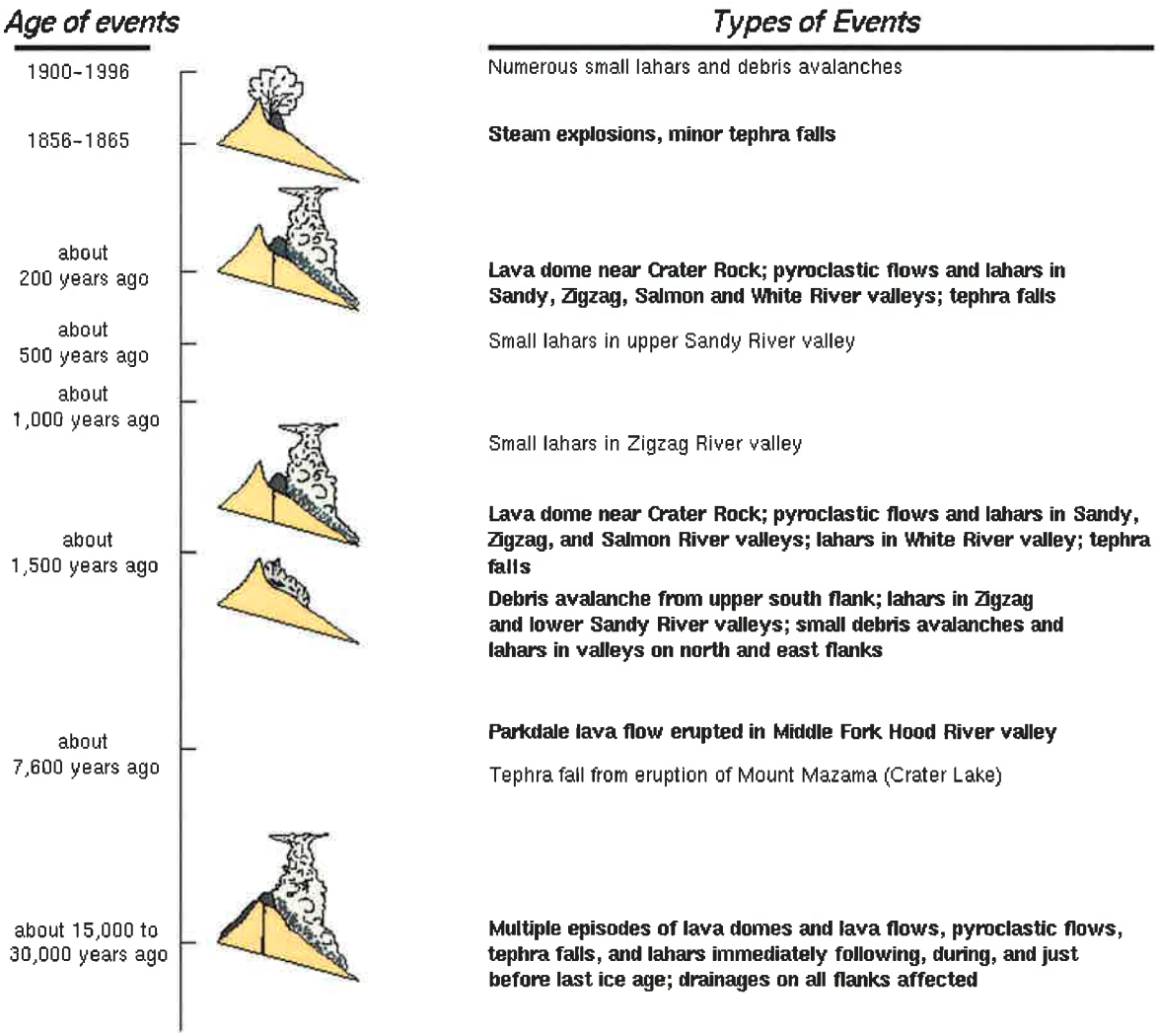
An explosive eruption blasts solid and molten rock fragments called tephra and volcanic gases into the air with tremendous force. The largest rock fragments called 'bombs' usually fall back to the ground within two miles of the event. Small fragments (less than 0.1 inch across) of volcanic glass, mineral and rock (ash) rise high into the air forming a huge, billowing eruption column. Eruption columns creating an eruption cloud can grow rapidly and reach more than 12 miles above a volcano in less than 30 minutes. Volcanic ash clouds can pose serious hazards to aviation. Several commercial jets have nearly crashed because of engine failure from inadvertently flying into ash clouds.

Large eruption clouds can extend hundreds of miles downwind resulting in ash fall over enormous areas. Ash from the May 18, 1980 Mt. St. Helens eruption fell over an area of 22,000 square miles in the western U.S. Heavy ash fall, particularly when mixed with rain, can collapse buildings and even a minor ash fall can damage crops, electronics and machinery. For more information on the volcanic hazard, please visit the State Plan's Volcano chapter.

History of the Hazard in Your Community

According to the Department of Geology and Mineral Industries (DOGAMI), Mt. Hood and Mt. St. Helens are the volcanoes that could impact Clatsop County.[i] Mt. Hood is a volcano approximately 90 miles southeast of the southeastern corner of the County. Given that most of Clatsop County's population in located in the northern and western areas of the County and that volcanic ash would follow eastward wind patterns, it is unlikely that a volcanic event at Mt. Hood would significantly impact Clatsop County.[ii] There have been no recorded effects from eruptions of Mt. Hood. The history of Mt. Hood is detailed in Figure 2.

Figure 2: Key Geological Events in the Mt. Hood Region during the Past 30,000 Years



Source: W.E. Scott et al., 1997, http://vulcan.wr.usgs.gov/Volcanoes/Hood/Hazards/OFR97-89/key_geologic_events_30000yrs.html

Mt. St. Helens is a volcano in Washington State located about 60 miles to the east of Clatsop County. It is the most active volcano in the Cascade Range. Its last major eruption occurred on May 18th, 1980 when a large landslide and powerful explosive eruption created a large crater, and ended 6 years later after more than a dozen extrusions of lava built a dome in the crater.[iii] Larger, longer lasting eruptions have occurred in the volcano's past and are likely to occur in the future. Clatsop County was also impacted from the eruption of Mt St Helens on May 18th, 1980.

Risk Assessment

How Are Hazard Areas Identified?

To identify the areas that are likely to be affected by future events, pre- historic rock deposits are mapped and studied to learn about the types and frequency of past eruptions at each volcano. This information helps scientists to better anticipate future activity at a volcano, and provides a basis for preparing for the effects of future eruptions through emergency planning.

Scientists also use wind direction to predict areas that might be affected by volcanic ash; during an eruption that emits ash, the ashfall deposition is controlled by the prevailing wind direction. The predominant wind pattern over the Cascades is from the west, and previous eruptions seen in the geologic record have resulted in most ashfall drifting to the east of the volcanoes. The potential and geographical extent of volcanic ashfall from Mt. Hood and Mt. St. Helens are depicted in Figures 3 and 4, respectively.

Figure 3: Map showing annual probability of 10 cm (~4 inches) or more tephra accumulation in Oregon and Washington from eruptions throughout the Cascade Range (Clatsop County is circled in red).

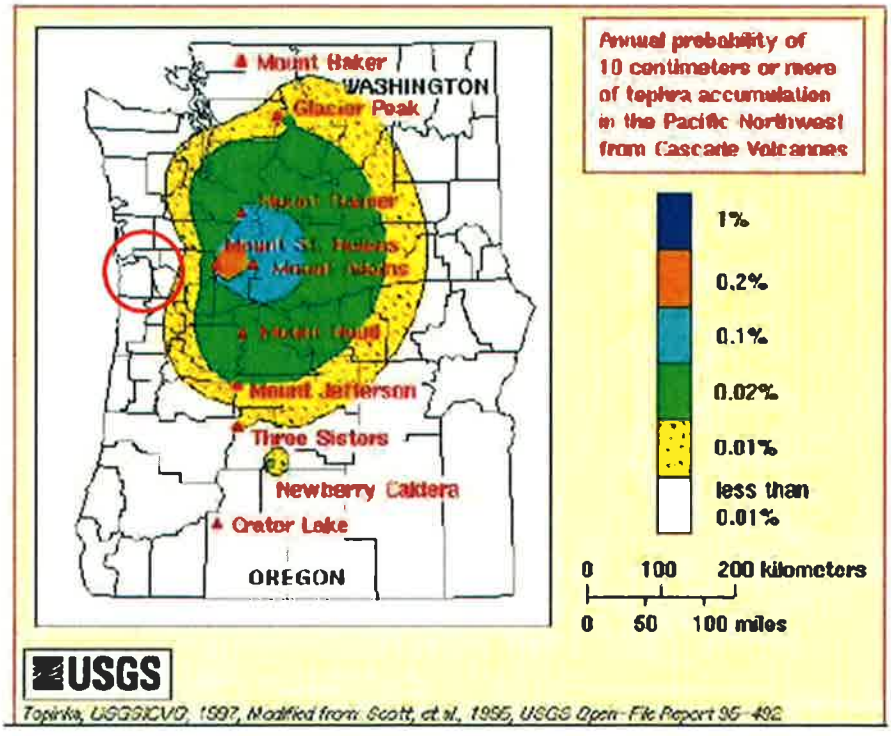
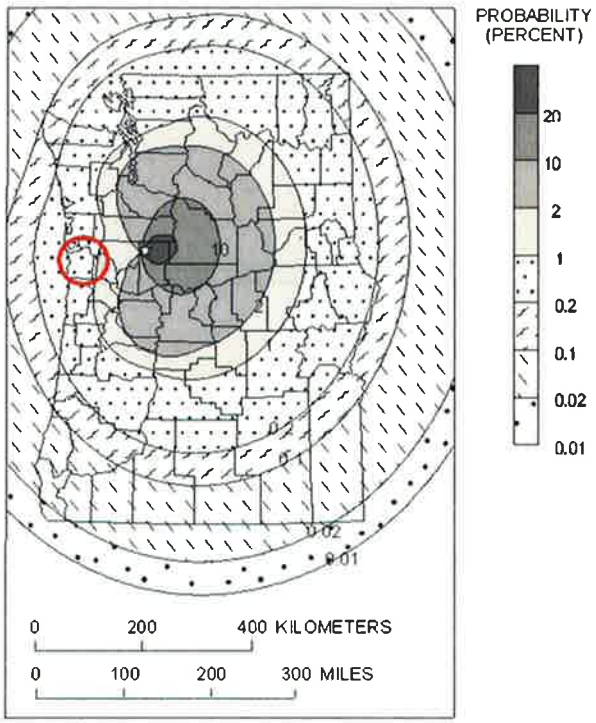


Figure 4: Map of Washington and Oregon showing the percentage probability of accumulation of ten or more centimeters (four or more inches) of tephra from a large eruption of Mount St. Helens



Source: USGS. <http://vulcan.wr.usgs.gov/Imgs/Gif/MSH/OFR95-497/figure2.gif>

Probability of Future Occurrence

Due to the distance from Cascadian volcanoes, there is a 'low' probability that Clatsop County will experience the effects of a volcanic event.[iv] The Clastop County Steering Committee agrees with this probability ranking. A 'low' ranking indicates that one event is not likely to occur more than once in a 75-100 year period.

Vulnerability Assessment

Due to the distance from Cascadian volcanoes the County Steering Committee estimates a 'low' vulnerability to volcanic events. A low ranking indicates that less than 1% of the population or regional assets are likely to be affected by a major event.

Risk Analysis

Because of the distance between Cascadian volcanoes and Clatsop County, there is not a significant volcanic risk. There is a slight chance of volcanic debris falling to the earth in Clatsop County due to a Cascadian volcanic eruption. Estimates of damages and losses resulting from volcanic ash are not available at this time.

Community Hazard Issues

What is susceptible to damage during a hazard event?

Structural damage can result from the weight of volcanic ash, especially if it is wet. Four inches of wet ash may cause buildings to collapse. A half- inch of ash can impede the movement of most vehicles and disrupt transportation, communication, and utility systems, and cause problems for human and animal respiratory systems. It is extremely dangerous for aircraft, particularly jet planes; volcanic ash can damage critical engine components, coat exposed electrical components, and erode exposed structure. Ashfall may severely decrease visibility, and can even cause darkness, which can further disrupt transportation and other systems.

Ashfall can severely degrade air quality, triggering health problems. In areas with considerable ashfall, people with breathing problems might need additional services from doctors or emergency rooms. In severe events, an air quality warning could be issued, similar to those given on poor air quality days during the summer. This would, for example, warn people with breathing problems not to go outside. On roads and streets, ashfall can create serious traffic problems as well as road damage. Vehicles moving over even a thin coating of ash can cause clouds of ash to swell. This results in visibility problems for other drivers, calling for speed restrictions, and often forcing road closures. It also adds to the potential for health problems for residents in the area.

Extremely wet ash creates very slippery and hazardous road conditions. Ash that fills roadside ditches and culverts can prevent proper drainage and cause shoulder erosion and road damage. Blocked drainages can also trigger debris flows or lahars if they cause water to pool on or above susceptible slopes. Conventional snow removal methods do not work on dry ash, as they only stir it up and cause it to resettle on the roadway. When ash is pushed to the side of travel lanes, wind and vehicle movement continue to cause it to billow.

Existing Hazard Mitigation Activities

None exist.

Hazard Mitigation Action Items

- Increase public education and outreach in natural hazards which affect the north coast.

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[i] Personal Communication with Bill Burns, Engineering Geologist. Oregon Department of Geology and Mineral Industries (DOGAMI). Feb 1, 2008.

[ii] U.S. Department of the Interior and U.S. Geological Survey. Volcano Hazards in the Mount Hood Region, Oregon, http://vulcan.wr.usgs.gov/Volcanoes/Hood/Hazards/

[iii] USGS. Mt. St. Helens Volcano. http://vulcan.wr.usgs.gov/Volcanoes/MSH/framework.html.

[iv] Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Wildfire

Causes and Characteristics of the Hazard

Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property particularly in the state's growing rural communities. Wildfires are fires occurring in areas having large areas of flammable vegetation that require a suppression response. Areas of wildfire risk exist throughout the state with areas in central, southwest and northeast Oregon having the highest risk. The Oregon Department of Forestry has estimated that there are about 200,000 homes in areas of serious wildfire risk.

The impact on communities from wildfire can be huge. In 1990, Bend's Awbrey Hall Fire destroyed 21 homes, causing $9 million in damage and costing over $2 million to suppress. The 1996 Skeleton fire in Bend burned over 17,000 acres and damaged or destroyed 30 homes and structures. Statewide that same year, 218,000 acres were burned, 600 homes threatened and 44 homes were lost. The 2002 Biscuit fire in southern Oregon affected over 500,000 acres and cost $150 million to suppress.

Classifications of Wildfires

Wildfire can be divided into three categories: interface, wildland, and firestorms. Although Clatsop County is most susceptible to interface fires, wildland and firestorm events are also possible.

Interface Fires

Essentially an interface fire occurs where wildland and developed areas come together with both vegetation and structural development combining to provide fuel. There are three categories of wildland/urban interface (sometimes called a rural interface in small communities or outlying areas):

- The **classic** wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas.
- The **mixed** wildland/urban interface is more typical of the problems in areas of exurban or rural development: isolated homes, subdivisions, resorts and small communities situated in predominantly wildland settings.
- The **occluded** wildland/urban interface where islands of wildland vegetation exist within a largely urbanized area.

Wildland Fires

A wildland fire's main fuel source is natural vegetation. Often referred to as forest or rangeland fires, these fires occur in national forests and parks, private timberland, and on public and private rangeland. A wildland fire can become an interface fire if it encroaches on developed areas.

Firestorms

Firestorms are events of such extreme intensity that effective suppression is virtually impossible. Firestorms often occur during dry, windy weather and generally burn until conditions change or the available fuel is consumed. The disastrous 1991 East Bay Fire in Oakland, California is an example of an interface fire that developed into a firestorm.

Conditions Contributing to Wildfires

Ignition of a wildfire may occur naturally from lightning or from human causes such as debris burns, arson, careless smoking, and recreational activities or from an industrial accident. Once started, four main conditions affect the fire's behavior: fuel, topography, weather and development.

Fuel is the material that feeds a fire. Fuel is classified by volume and type. As a western state, Oregon is prone to wildfires due to its prevalent conifer, brush and rangeland fuel types.

Topography influences the movement of air and directs a fire's course. Slope and hillsides are key factors in fire behavior. Unfortunately, hillsides with steep topographic characteristics are also desirable areas for residential development.

Weather is the most variable factor affecting wildfire behavior. High risk areas in Oregon share a hot, dry season in late summer and early fall with high temperatures and low humidity.

The increase in residential development in interface areas has resulted in greater wildfire risk. Fire has historically been a natural wildland element and can sweep through vegetation that is adjacent to a combustible home. New residents in remote locations are often surprised to learn that in moving away from built-up urban areas, they have also left behind readily available fire services providing structural protection.

History of the Hazard in Your Community

Clatsop County has not had many significant wildfires in the past. This is mostly due to its wet climate. The only urban recorded wildfire occurred in downtown Astoria in early December, 1922. According to the Oregon Department of Forestry, this fire was most likely a structural fire not related to a wildfire.[i]

In 1939, 207,000 acres burned on Saddle Mountain. That was the largest fire recorded over the past 100 years. In addition, the following table lists the costliest fires in Clatsop County since 1960. This information was collected from the Clatsop County office of the Oregon Department of Forestry.

Table 1: Costliest Fires in Clatsop County since 1960

Fire Year	Fire Name	Size (acres)	Total Cost	Description	Twn	Rng	Sec
1977	77521062	483	$443,101	Debris Burning	05N	08W	02
1988	88521198	45	$237,363	Debris Burning	05N	06W	04
1985	85521140	125	$87,257	Debris Burning	08N	06W	34
1973	73521128	112	$50,814	Smoking	06N	06W	31
1980	80521129	47	$49,354	Debris Burning	04N	10W	25
1989	89521241	64	$48,724	Debris Burning	07N	08W	13
1970	70521470	18	$44,461	Equipment Use	04N	10W	08
1993	Humbug Mtn.	8	$33,586	Debris Burning	05N	08W	08
1977	77521350	18	$30,607	Debris Burning	06N	07W	25
1987	87521063	5	$26,912	Debris Burning	05N	08W	25

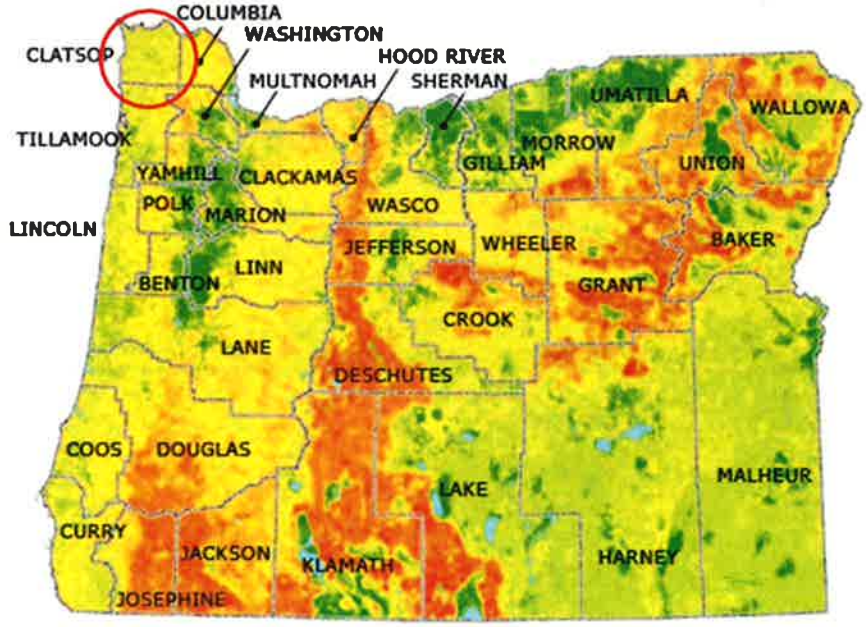
Fire Year	Fire Name	Size (acres)	Total Cost	Description	Twn	Rng	Sec
2003	NAVY HEIGHTS	2.5	$26,566	Miscellaneous	8N	9W	10
1986	86521128	12	$23,234	Debris Burning	06N	06W	29
2002	Elk Mtn	40	$22,989	Debris Burning	06N	07W	4
2005	Watershed Fire	7.2	$21,252	Miscellaneous	8N	8W	34
1989	89521244	25	$18,408	Debris Burning	05N	06W	12
1981	81521180	15	$18,250	Equipment Use	08N	07W	29
2004	South Jetty	6	$17,366	Miscellaneous	9N	11W	26
2006	Indian Beach	0.75	$14,529	Miscellaneous	5N	10W	18
1986	86521129	23	$13,067	Debris Burning	06N	06W	07
1995	West Sager	10	$12,317	Debris Burning	06N	06W	27
1981	81521037	6	$11,778	Smoking	06N	08W	17
1979	79521102	15	$11,768	Debris Burning	07N	07W	22
1982	82521089	10	$11,244	Debris Burning	08N	07W	32
1970	70521363	1	$10,661	Equipment Use	05N	09W	11
1993	HAGLUND ROAD	23	$10,576	Debris Burning	08N	07W	31
1987	87521058	0.7	$10,427	Debris Burning	06N	06W	22
2002	David Douglas	15	$10,242	Debris Burning	5N	8W	29
1989	89521054	80	$10,066	Debris Burning	07N	07W	29

Risk Assessment

How Are Hazard Areas Identified?

In defining wildfire hazards, it is clear that one assessment technique is not universal. However, nearly all assessment models consider risk, hazard, protection capabilities and values protected. In addition, an assessment of the vulnerability of values at risk is needed for a community down to parcel level assessments. Complex assessment worksheets are available through Firewise, National Fire Protection Association (NFPA), Regional Atmospheric Modeling System (RAMS), Western Fire Chiefs Association, and the International Fire Code Institute.[ii] Risk Assessments throughout the state of Oregon are shown in Figure 1; Clatsop County has a low to moderate risk rating.

Figure 1: Wildfire Rating for Oregon



(Green-Low Rating; Yellow-Moderate Rating; Red-High Rating; Blue-Water)

Source: Oregon Department of Forestry.
http://egov.oregon.gov/ODF/FIRE/FirePlans.shtml#Community_Wildfire_Protection_Plans

The Oregon Department of Forestry also determines Fire Weather Hazard Values, which are related to the number of days per season that forest fuels are capable of producing a significant fire. Hazard Values (HV) range from 1 to 12—with 1 being the lowest capacity to sustain a forest fire and 12 being the highest. Clatsop County is divided into Area 1 and Area 2; both these areas have very low hazard rankings, which indicate they are not in a wildfire hazard zone.[iii] HV 1 produces flame lengths up to five feet with little spotting, torching or crowning. HV 2 has flame lengths from 5-8 feet with sporadic spotting, torching or crowning.

Table 1: Fire Weather Hazard Values (OAR 629-44-0230)

COUNTY	HAZARD VALUE
Clatsop, Area 1 - All of Clatsop County except Area 2.	1
Clatsop, Area 2 - That portion of Clatsop County in Township 4 North Range 6 West.	2

Source: http://egov.oregon.gov/OSP/SFM/docs/Comm_Ed/WUI/WHZ.doc

Probability of Future Occurrence

Clatsop County's Hazard Analysis Report (July 2003) ranked Clatsop County's probability for wildfire as 'high.' This score indicates that one incident is likely within a 35 to 75 year period,[iv] and the Clatsop County Steering Committee agrees with this ranking. Wildfires result from natural causes (e.g., lightning strikes), mechanical failures (Oxbow Fire), or human-caused (unattended campfire, debris burning, or arson); Most wildfires can be linked to human carelessness. The severe fire season of 1987 resulted in a record setting mobilization of firefighting resources.

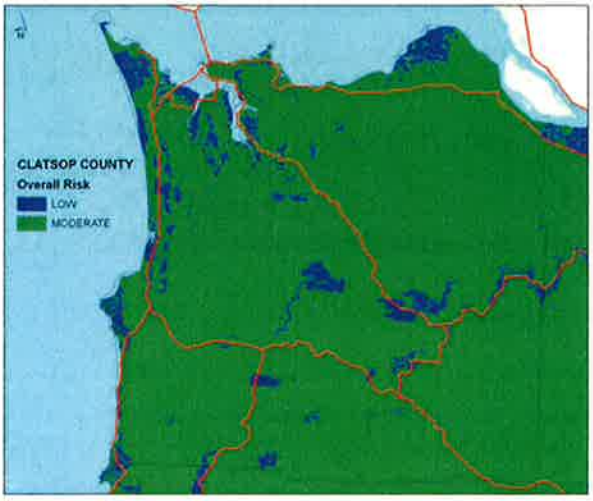
Vulnerability Assessment

Approximately 90% of the land in Clatsop County is forested and susceptible to wildfire. Each year a significant number of people build homes within or on the edge of the forest (urban/wildland interface), thereby increasing wildfire hazards. Clatsop County is no exception to this trend. Because of this, Clatsop County is ranked "moderate" in wildfire vulnerability which indicates that 1-10% of the population or region assets are likely to be affected by a major wildfire emergency or disaster.[iv] These incidents would most likely occur in the interface communities. The following communities within Clatsop County are considered "Interface Communities."[v]

- Arch Cape
- Astoria
- Brownsmead
- Cannon Beach
- Coastal Strip
- Elsie-Vinemaple
- Fern Hill
- Ft. Clatsop
- Hamlet
- Jewell
- Knappa-Svensen
- Lewis & Clark
- Necanicum
- Olney
- Westport

Risk Analysis

Figure 2: Wildfire risk in Clatsop County



Source: Oregon Department of Forestry

Community Hazard Issues

What is susceptible to damage during a hazard event?

The effects of fire on ecosystem resources can include damages, benefits, or some combination of both. Ultimately, a fire's effects depend largely on the characteristics of the fire site, the severity of the fire, its duration and the value of the resources affected by the fire.

The ecosystems of most forests and wildland depend upon fire to maintain various functions. These benefits can include, depending upon location and other circumstances, reduced fuel load, disposal of slash and thinned tree stands, increased forage plant production, and improved wildlife habitats, hydrological processes and aesthetic environments. Despite these potential benefits, fire has historically been suppressed for years because of its effects on timber harvest, loss of scenic and recreational values and the obvious threat to property and human life.

At the same time, the effects of a wildfire on the built environment, particularly in the face of a major wildfire event, can be devastating to people, homes, businesses and communities. As noted above, fuel, topography, weather and the extent of development are the key determinants for wildfires. A number of other factors also have been identified which affect the degree of risk to people and property in identified wildfire interface areas. These include:

- Combustible roofing material (for example cedar shakes)
- Wood construction
- Homes and other structures with no defensible space
- Roads and streets with substandard width, grades, weight-load and connectivity standards making evacuation and fire response more difficult
- Subdivisions and homes surrounded by heavy natural fuel types
- Structures on steep slopes covered with flammable vegetation
- Limited on-site or community water supply
- Locations with normal prevailing winds over 30 miles per hour

For more information on the wildfire hazard, please visit the State Plan's Wildfire chapter or the Oregon Technical Resource Guide.

Existing Hazard Mitigation Activities

- All new forest dwellings must meet specific construction, access, and property maintenance standards. These can be found in S3.512 of the Clatsop County Standards Document – Sitting Requirements for Dwellings and Structure in Forest and Agriculture-Forest Zones.
- Education and Outreach
- Road Standard requirements found in S6.050 – Table 1 – of the Clatsop County Standards Document. These standards were adopted from the Oregon Fire Code.
- Infrastructure Protection
- Emergency Management Division Enhancement

Hazard Mitigation Action Items

- Maintain and update Community Wildfire Protection Plan Exercise Plan

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[i] Brian Ballou, 2002, A Short History of Oregon Wildfires, Oregon Department of Forestry, unpublished; and Oregon Emergency Management, State Natural Hazard Mitigation Plan, 2003, Wildland/Urban Interface chapter.

[ii] Oregon Department of Forestry. 2004. Identifying and assessment of communities at risk in Oregon. http://egov.oregon.gov/ODF/FIRE/docs/WildfireRiskAssessment.pdf

[iii] Oregon Department of Forestry. 1996. Criteria for Determination of Wildfire Hazard Zones Administration Rules. http://egov.oregon.gov/OSP/SFM/docs/Comm_Ed/WUI/WHZ.doc

[iv] Oregon Emergency Management, July 2003, County Hazard Analysis Scores. vi Federal Register: August 17, 2001. V.66, N.160.

[v] Oregon Emergency Management, July 2003, County Hazard Analysis Scores.

Wind & Winter Storms

Causes and Characteristics of the Hazard

Destructive wind and winter storms that produce ice, rain and freezing rain, and high winds have a long history in Clatsop County. Severe storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March.

Ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation that may include freezing rain, sleet and hail. Of these, freezing rain can be the most damaging of ice formations.

Outside of mountainous areas significant snow accumulations are much less likely in western Oregon than on the east side of the Cascades. However, if a cold air mass moves northwest through the Columbia Gorge and collides with a wet Pacific storm, then a larger snow fall may result in Clatsop County.

High winds can be expected throughout Clatsop County. Destructive windstorms are less frequent, and their pattern is fairly well known. They form over the North Pacific during the cool months (October through March), move along the coast and swing inland in a northeasterly direction. Wind speeds vary with the storms. Gusts exceeding 100 miles per hour have been recorded at several coastal locations (Table 20), but lessen as the storm moves inland. These storms can be very destructive as documented in the now infamous Columbus Day Storm of October 1962. Less destructive storms usually topple trees, power lines, and cause building damage. Flooding can be an additional problem. A large percentage of Oregon's annual precipitation comes from these events.[i]

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. Although windstorms can affect the entirety of Clatsop County, they are especially dangerous in areas with significant tree stands, and areas with exposed property, major infrastructure, and above ground utility lines. A windstorm can knock down trees and power lines, damage homes, businesses, public facilities, and create tons of disaster related debris.

Though tornadoes are not common in Oregon, these events do occasionally occur and sometime produce significant property damage and even injury. Tornadoes are the most concentrated and violent storms produced by earth's atmosphere, and can produce winds in excess of 300 mph. They have been reported in most of the counties throughout the state since 1887, but they are most prevalent in the northwest corner of the state, where Clatsop County is located. Most tornadoes are caused by intense local thunderstorms that are common between April and October.

History of the Hazard in Your Community

Clatsop County has had the following winter storms and windstorms during its history. Heavy precipitation aspects associated with storms, which sometimes lead to flooding, are covered in the flood chapter of this plan. This data can be found in the Clatsop County Hazard Analysis updated every 5 years.

Table 1: Recorded Wind and Winter Storms in Clatsop County

Date	Location	Type	Comments
December 1-3, 2007	Clatsop County	Wind / Rain	Hurricane Force Winds, Rain, and Mudslides
December 14-15, 2006	Clatsop County	Wind / Rain	
November 5-8, 2006	Clatsop County	Wind / Rain	Severe Storms, Flooding, Landslides, and Mudslides
March 20, 2006	Clatsop County	Wind / Rain	
February 19, 2004	Clatsop County	Wind / Rain	
January 23, 1997		Wind / Rain	
December 23, 1996		Wind / Rain	
March 19, 1996		Wind / Rain	
February 9, 1996		Wind / Rain	
February, 1994	Near Warrenton	Tornado	Damage in local park
January 24, 1990		Wind / Rain	
January 1993	North Coast Range	Wind Storm	Inauguration Day Storm resulted in a major disaster declaration in Washington State
November 1981	Oregon Coast N. Willamette Valley	Windstorm	Back-to-back storms on the 13th and15th of November
January 25, 1974		Wind / Rain	
January 21, 1972		Wind / Rain	
February 13, 1971		Wind / Rain	
October 1966	Seaside	Tornado	Windows broken, telephone lines down, outdoor signs destroyed
October	Near Astoria airport	Tornado	Began over ocean and moved inland. Several homes and commercial buildings damaged
December 24, 1964		Wind / Rain	Western Oregon and some locations east of Cascades
October 1962		Windstorm	Oregon's most famous and most destructive windstorm, the Columbus Day Storm, produced a barometric pressure low of 960 mb (*)
November 1958	NW and N Oregon	Windstorm	Also produced damaging gusts across Idaho, Montana, Wyoming
March 1, 1957		Wind / Rain	
December 29, 1955		Wind / Rain	
December 1951	Statewide		Barometric pressure low of 968.5 mb near Astoria (*)

Date	Location	Type	Comments
January 1921	Oregon coast Lower Columbia	Windstorm	Winds 113 mph at mouth of Columbia. Gusts at Astoria, 130mph. Widespread damage.
January 1880	Western Oregon	Windstorm	Very high winds. 65-80 mph near Portland. Flying debris; fallen trees

(*) For the sake of comparison, surface barometric pressures associated with Atlantic hurricanes are often in the range of 910 to 960mb. The all-time record low sea level barometric pressure recorded was associated with Typhoon Tip in the Northwest Pacific Ocean on October 12, 1979 at 870mb.

Sources: FEMA < http://www.fema.gov/news/disasters_state.fema?id=41>, Taylor and Hatton, 1999, The Oregon Weather Book, pp. 130-137

Risk Assessment

How Are Hazard Areas Identified?

Virtually every area of the County is susceptible to storm damage, especially the coastal and headland areas. A risk assessment using the FEMA methodology is contained in our Hazard Analysis.

Probability of Future Occurrence

Snowstorms need two ingredients: cold air and moisture. Rarely do the two ingredients occur at the same time over western Oregon, except in the higher elevations of the Coast Range and especially in the Cascades.

High windstorms occur yearly. More destructive storms occur once or twice per decade. High wind events on the order of the 1962 Columbus Day storm are thought to have a 100-year recurrence interval. Clatsop County's Hazard Analysis Report (July 2003) ranked Clatsop County's probability for windstorms as 'high,' which indicates that at least one major emergency or disaster because of a windstorm is likely within a 10 to 35 year period. The Clatsop County Steering Committee agrees with this assessment.

Vulnerability Assessment

Many buildings, utilities, and transportation systems in Clatsop County are vulnerable to wind damage. This is especially true in open areas, such as along the Oregon Coast (towns such as Seaside, Gearhart, and Cannon Beach), natural grasslands, or farmland. It also is true in forested areas, along tree-lined roads and electrical transmission lines, and on residential parcels - where trees have been planted or left for aesthetic purposes.

Structures most vulnerable to high winds in Clatsop County include insufficiently-anchored manufactured homes and older buildings in need of roof repair. Manufactured and other non-permanent homes make up 9% of Clatsop County's housing and would require anchoring. In addition, according to the 2000 US Census, a majority (73.2%) of Clatsop County's permanent housing structures was built before 1980 and would need to replace their original roofs if not already completed.

Division 530 of the Oregon Building Code identifies high wind areas in Clatsop County and sets anchoring standards for manufactured homes located in those areas. It is essential that coastal counties ensure that the standards are enforced. The Oregon Department of Administrative Service's inventory of state-owned and operated buildings includes an assessment of roof conditions as well as the overall condition of the structure. Oregon Emergency Management has arranged this information by county.

Fallen trees are especially troublesome. They can block roads and rails for long periods, which can affect emergency operations. In addition, uprooted or shattered trees can down power and/or utility lines, effectively bringing local economic activity and other essential activities to a standstill. Much of the problem may be attributed to a shallow or weakened root system in saturated ground. Many roofs have been damaged or destroyed by uprooted ancient trees growing next to a house. In some situations, strategic pruning may be the answer. Clatsop County works with utility companies in identifying problem areas and establishing a tree maintenance / removal program.

Tree-lined coastal roads and highways present a special problem in Clatsop County, especially along Highways 30 and 101. This is because much of the traveling public enjoys the beauty of forested corridors and most certainly would be concerned with any sort of tree removal program. In short, any "safety" program involving tree removal must be convincing, minimal, and involve a variety of stakeholders.

Wind-driven waves are common along the Oregon coast and are responsible for road and highway wash-outs and the erosion of beaches and headlands. These problems are addressed under Flood Hazards (i.e., Ocean flooding and wave action). Bridges spanning bays or the lower Columbia River would be closed during high wind periods.

Clatsop County's Hazard Analysis Report (July 2003) ranked Clatsop County's vulnerability to windstorms as 'high.' This indicates that more than 10% percent of the population or regional assets are likely to be affected by a major windstorm emergency or disaster. The Clatsop County Steering Committee agrees with this assessment.

Risk Analysis

Damages and lost estimates related to wind and winter storms are not available at this time. Post-disaster damage estimates can be found following presidentially-declared disasters. Damages from the December 2007 storm, for example, were estimated at $12,353,136 in the rural County (excludes cities).

Community Hazard Issues

What is susceptible to damage during a hazard event?

The damaging effects of windstorms may extend for distances of 100 to 300 miles from the center of storm activity. Isolated wind phenomena in the mountainous regions have more localized effects. Near-surface winds and associated pressure effects exert loads on walls, doors, windows, and roofs, sometimes causing structural components to fail.

Positive wind pressure is a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Negative pressure also affects the sides and roof of a building: passing currents create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact and remove the building protective envelope (doors, windows, and walls), internal pressures rise and result in roof or leeward building component failures and considerable structural damage. Debris carried along by extreme winds can directly contribute to loss of life and indirectly to the failure of protective building envelope components. Upon impact, wind-driven debris can rupture a building, allowing more significant positive and internal pressures. When severe windstorms strike a community, downed trees, power lines, and damaged property are major hindrances to response and recovery.

Severe winter weather can be a deceptive killer. Winter storms that bring snow, ice and high winds can cause significant impacts on life and property. Many severe winter storm deaths occur as a result of traffic accidents on icy roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to the cold. The temporary loss of home heating can be particularly hard on the elderly, young children and other vulnerable individuals.

Property is at risk due to flooding and landslides that may result if there is a heavy snowmelt. Additionally, ice, wind and snow can affect the stability of trees, power and telephone lines and TV and radio antennas. Downed trees and limbs can become major hazards for houses, cars, utilities and other property. Such damage in turn can become major obstacles to providing critical emergency response, police, fire and other disaster recovery services.

Severe winter weather also can cause the temporary closure of key roads and highways, air and train operations, businesses, schools, government offices and other important community services. Below freezing temperatures can also lead to breaks in un-insulated water lines serving schools, businesses, and industry and individual homes. All of these effects if lasting more than several days can create significant economic impacts for the communities affected. In the rural areas of Clatsop County, severe winter storms can isolate small communities, farms and ranches.

Both winter storms and windstorms are particularly damaging to mobile homes and other non-permanent housing structures, which account for 9% of the housing in Clatsop County. Special attention should be given to securing these types of structures.[ii] Winter and windstorms are also disrupting for road and air travel in Clatsop County. Flights face the potential for cancellation from storms. Airports have strict guidelines regarding when conditions are safe for flight.

Existing Hazard Mitigation Activities

- Clatsop County Building Codes adhere to the Oregon Structural Specialty Code guidelines for new development.
- Clatsop County Public Works conducts yearly inspections along county owned roads to identify and remove danger trees that may block transportation routes.
- Utilities in all new subdivision developments are required to be installed underground. This assists in the prevention of damaged power and communication lines during an event.

Hazard Mitigation Action Items

- Develop and implement hazard tree program.
- Promote tree planting projects on private and public properties.
- Have one to three ISA-certified arborists in each community that know how to properly prune storm damaged trees.
- Heightened awareness by First Responders and appropriate staff of the factors contributing to tree stability.
- Educate homeowners about methods to tie down metal roofs and metal sheds.
- Bury water lines in Big South Fork and Little South Fork watersheds (City of Warrenton Watershed within Clatsop County land).
- Identify major transportation routes that are at risk during a major winter storm event.
- Update Clatsop County Hazard Analysis, to ensure all identified hazards are addressed.
- See mitigation alternatives for expanding possible additional mitigation activities, in next section of the plan.

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[i] Taylor and Hatton, 1999, The Oregon Weather Book, p. 139; and FEMA-1405-DR- OR, Reducing Windstorm Damage to Property and Electrical Utilities.

[ii] US Census Bureau. 2000 Census Summary File 3, census.gov

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III: City Addendums

This section includes the City Addendums to the Clatsop County Natural Hazard Mitigation Plan for the following municipalities:

- City of Astoria
- City of Cannon Beach
- City of Gearhart
- City of Seaside
- City of Warrenton

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City of Astoria

Natural Hazards Mitigation Plan Addendum

APRIL 2015

City of Astoria
1095 Duane Street
Astoria, OR 97103

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Volume III: City Addendum
City of Astoria

Amended 6-17-2013

Overview

The City of Astoria developed this addendum to the Clatsop County Multi-jurisdictional Natural Hazards Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Astoria, Oregon, which include: Coastal Erosion, Drought, Earthquake, Flood, Landslide, Tsunami, Volcano, Wildfire, Windstorm, and Winter Storm. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the City. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

The addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use or watershed management programs. The actions described in the addendum are intended to be implemented through existing plans and programs within the City.

The addendum is comprised of the following sections: 1) How was the Addendum Developed? 2) Community Overview; 3) Risk Assessment; 4) Action Items; 5) Supporting Documents.

How was the Addendum Developed?

In Fall 2006, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center partnered with Oregon Emergency Management (OEM) and Clatsop and Lincoln Counties to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined The Partnership by signing (through their County Commissions) a Memorandum of Understanding for this project. FEMA awarded the Oregon Coast Region a grant to support the development of multi-jurisdictional natural hazard mitigation plans for the two counties and the cities therein.

The Columbia River Estuary Studies Taskforce (CREST) was hired by Clatsop County to lead the development of the County's Multi-Jurisdictional plan. A graduate student with OPDR assisted CREST with data collection and plan writing to support the development of the

County's Community Overview and Risk Assessment as well as similar components for the City addendums.

The City of Astoria's Community Development Director served on the Countywide Steering Committee which helped guide the development of the County's plan. A work session was held with City of Astoria staff on February 13, 2008 to develop this City-specific addendum. OPDR facilitated this work session to gather information for the City's risk assessment. The following City departments were represented during this work session:

- Astoria Community Development Department;
- Astoria Public Works Department; and
- Astoria Fire Department.

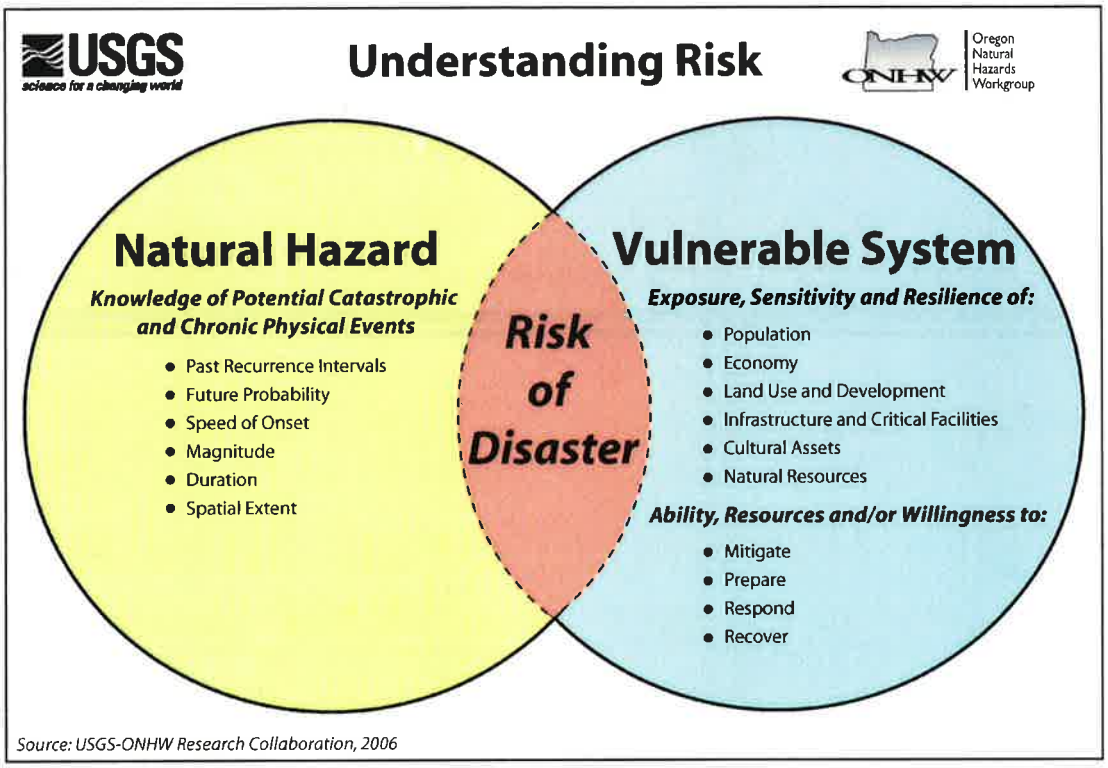
Clatsop Community College also participated in the Countywide Steering Committee and attended the Astoria work sessions. Potential mitigation projects for the Community College will be included in this addendum.

The City of Astoria adopted the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan via resolution on October 20, 2008. The first amendment to the Plan was adopted via Resolution No. 13-19 on June 17, 2013.

Community Overview

The following section describes the City of Astoria 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 in this section represents a snapshot in time of the current sensitivity and resilience factors in the City when the plan was developed. The information documented below, along with the hazard assessments located in the Hazard Summary, should be used as the local level rationale for the City's risk reduction actions. The identification of actions that reduce the City's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 1 below.

Figure 1 Understanding Risk



Source: USGS - Partnership for Disaster Resilience Research Collaborative, 2006.

Geography & Climate

Located at the mouth of the Columbia River, Astoria is located in the northwestern corner of Clatsop County. The climate in the City of Astoria is moderate. The monthly average temperatures range from highs around 69 degrees and lows around 60 degrees in July and August, to highs around 48 degrees and lows around 36 degrees in December and January. The City receives approximately 66 inches of rain annually. Monthly precipitation averages range from 10 inches during the wetter months of November through January, to around 1 inch during the drier summer months of June through August.[i]

Population & Demographics

Astoria is the oldest American settlement west of the Rockies, dating from the fur trading post set up by John Jacob Astor's men in 1811. From 1813 to 1818, the British owned Astoria and it was known as Fort George. In 1818, a treaty with England established joint occupation of the Oregon Country, as it was called then. The boundary was set at the 49th Parallel. The British did not completely abandon Astoria until 1846. A hundred years ago,

Astoria was the second largest City in Oregon with a population of 8,975. The population now is just over 10,000.[ii]

In 2000, the City was home to 9,813 permanent residents, which makes up approximately 28% of Clatsop County's total population.[iii] The City population has remained steady for most of its history, hovering around 10,000. Table 1 shows the City's population since 1980.

Table 1 Population Growth, City of Astoria, 1980-2000

Census	Population	Percent Change
1980	9,998	---
1990	10,069	0.70%
2000	9,813	-2.50%
2010	9,477	-3.42%

Source: US Census

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. In Astoria, more than 8% of the City's population speaks a language other than English as their primary language. In 2000, 15.9% of all individuals and 11.6% of families in the Astoria were living below the federal poverty level.[vi] More information on special needs populations is shown in Tables 2 through 4.

Table 2 Population by Age, City of Astoria, 2000

Age	Percent
Under 5 years	6.4 %
5 to 9 years	6.1 %
10 to 14 years	7.2 %
15 to 19 years	7.1 %
20 to 24 years	6.3 %
25 to 34 years	12.3 %
35 to 44 years	14.1 %
45 to 54 years	15.7 %
55 to 59 years	5 %
60 to 64 years	3.7 %
65 to 74 years	7.4 %
75 to 84 years	6 %
85 years and over	2.5 %

Source: US Census, 2000

Table 3: Poverty Distribution by Age Group, City of Astoria, 2000

Age	Percent Below Poverty Level
Under 5 years	1.9%
5 years	0.5%
6 to 11 years	1.8%
12 to 17 years	1.2%
18 to 64 years	9.1%
65 to 74 years	0.6%
75 years and over	0.9%

Source: US Census, 2000

Table 4: Disabled Population, City of Astoria, 2000

Age	Percentage
5-20 years	6%
21-64 years	17.8%
65 years and over	48.6%

Source: US Census, 2000

Employment & Economics

Historically, the economy of Astoria has been largely based on fishing, fish processing, and lumber. Both the fish processing (canneries) and timber industries have declined in the last few decades. Though these areas continue to contribute to the City's economy, tourism and government services are the main economic activities. The Port of Astoria also serves as a docking site for cruise ships with 19 dockings scheduled for 2008. [iv]

Table 5 Employment by Industry, City of Astoria, 2000

INDUSTRY	Percent
Educational, health and social services	22.0
Retail trade	15.4
Arts, entertainment, recreation, accommodation and food services	14.1
Manufacturing	7.8
Public administration	6.5
Construction	6.3
Finance, insurance, real estate, and rental and leasing	4.8
Other services (except public administration)	4.8
Professional, scientific, management, administrative, and waste management services	4.4
Transportation and warehousing, and utilities	4.2
Wholesale trade	3.3
Agriculture, forestry, fishing and hunting, and mining	3.3
Information	3.1

Source: US Census, 2000

Median income can be used as an indicator of the strength of the region's economic stability. In 1999, the median household income in Astoria was $33,011.[v] This is almost $9,000 below the 1999 national median household income of $41,994, and around $3,000 below the $36,301 median household income for Clatsop County.[vi] Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

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 homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

In 2000, Astoria had 4,860 housing units. Of those, 45% (2,187) were owner occupied, 42.2% (2,055) were renter occupied, and 12.8% were vacant.[x] Nearly 90% of the City's housing stock was built prior to 1980, before

stronger seismic building codes were put into place. Other housing characteristics for Astoria are provided in Tables 6 and 7.

Table 6: Housing Type, City of Astoria, 2000 Housing

Housing Type	Percentage
Single-Family	60.1 %
Multi-Family	18.1 %
Mobile home	1.2 %
Boat, RV, van, (	0.4 %

Source: US Census, 2000

Table 7: Housing Structure Age, City of Astoria, 2000

Year Built	Percent of Structures
1980-2000	10.9%
1960-1980	14.7%
Before 1960	74.4%

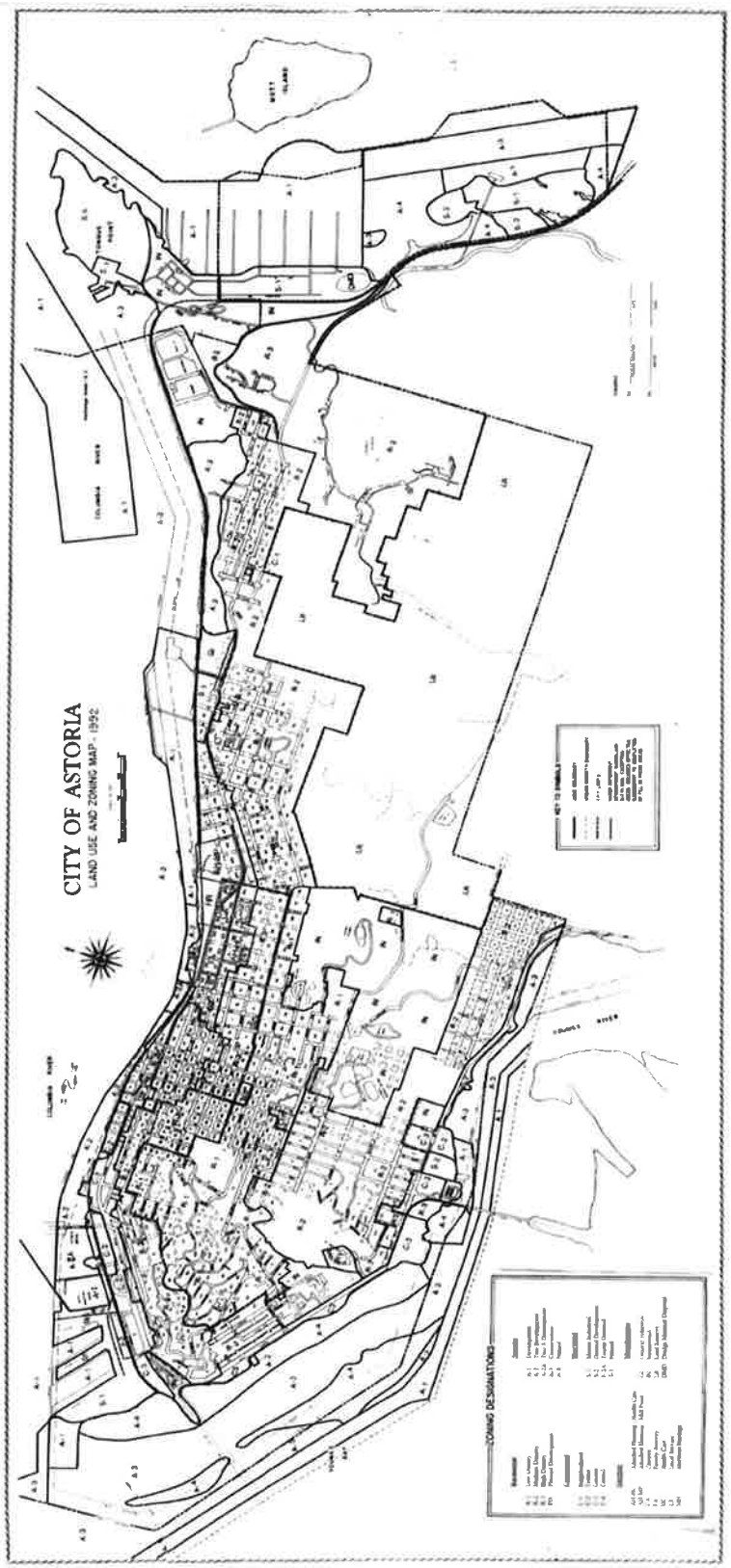
Source: US Census, 2000

Land Use & Development

Development in Astoria spreads mostly to the east and west along the Columbia River from the downtown area. The downtown area has itself seen much revitalization and new construction in recent years. Residential development is also located south of downtown; additional growth is limited by water bodies and designated 'land reserve.[vii]' The City's Comprehensive Plan identifies land use needs within the City and the Urban Growth Boundary.

The City of Astoria is in the process of conducting a buildable lands inventory.

Figure 2 City of Astoria Zoning Map (1992)



Source: City of Astoria (http://www.astoria.or.us)

Transportation

Two major transportation routes run through Astoria, Federal Highways 30 and 101. Highway 30 runs east to west and Highway 101 runs north and south over bridges leading into and out of Astoria over the Columbia River to the north and Young's Bay to the south. State Highway 202 runs along the southern edge of the City.

Transportation is an important consideration when planning for emergency service provisions. Growth within the City will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles. Figures 5 and 6 are the Oregon Department of Transportation maps for Astoria.

Figure 5. Astoria Transportation Map – East, 2006

Source: Oregon Department of Transportation

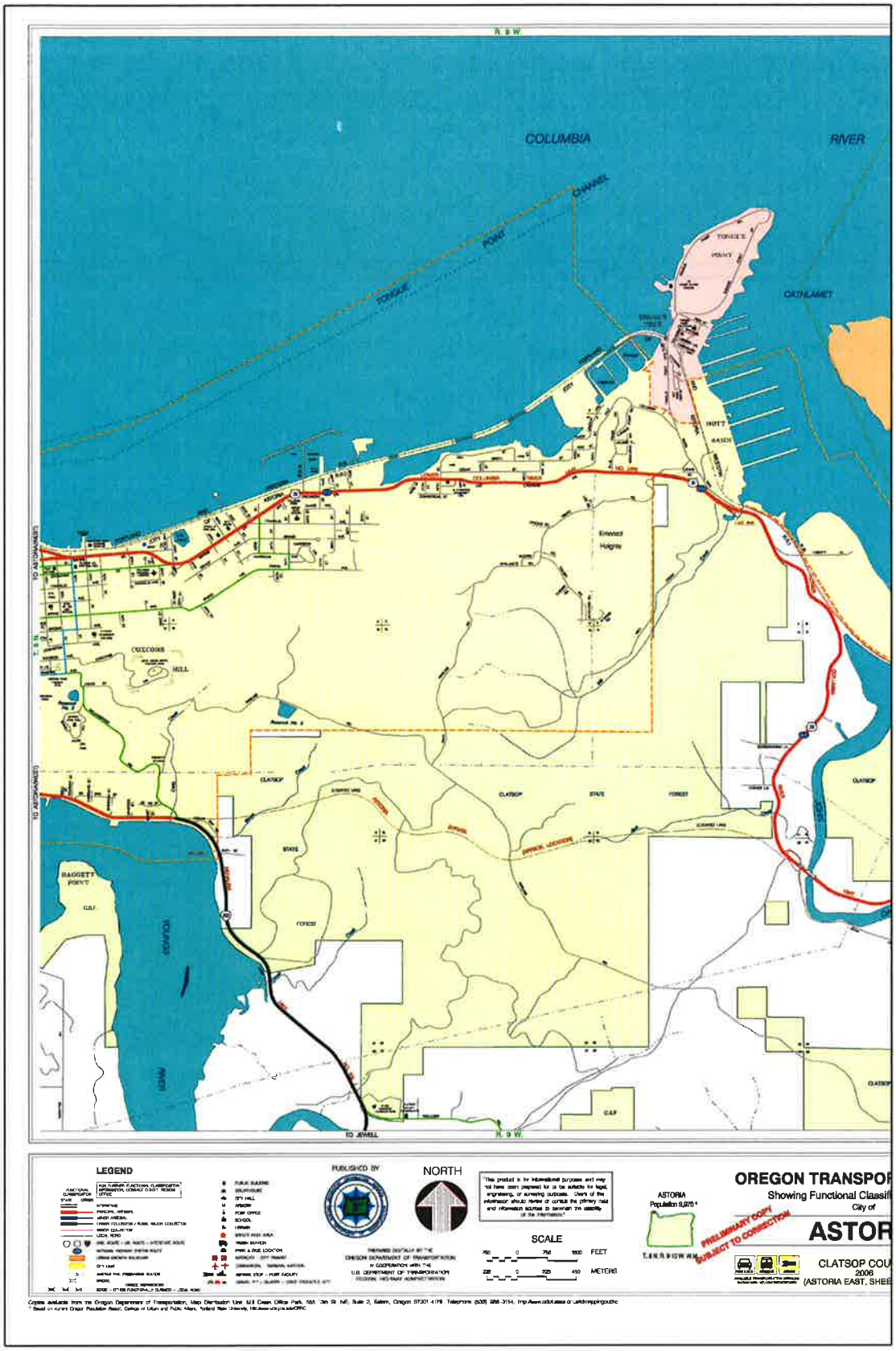


Figure 6. Astoria Transportation Map – West, 2006

Source: Oregon Department of Transportation

Critical Facilities & Infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. Individual communities should inventory their critical facilities to include locally designated shelters and other essential assets, such as fire stations, public works shops, and water and waste water treatment facilities. Astoria has 2 fire stations, 1 hospital, 2 private pre-schools, 2 public elementary schools, 1 middle school, 1 high school, 1 alternative school, 1 community college, and 1 Job Corps training center.

Historic & 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. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

The City's Historic Inventory, dated October 2012, includes the following historic resources:

- 5 Museums;
- 40 places on the National Register of Historic Places;
- 2 National landmarks (Fort Astoria site & Lightship Columbia);
- 3 National Register Historic Districts (Uniontown-Alameda, Downtown, and Shively McClure).
- 6 Historic Sites (Taylor School; Shively Park; Tidal Rock (Local Landmark in DNRHD); First US Post Office West of the Rocky Mountains (Local Landmark in SMNRHD); Fort Astoria (also noted as National Landmark, DNRHD); 14th Street Ferry Landing (Local Landmark);
- 1 Historic Reconstruction (First US Customhouse West of the Rocky Mountains) and
- Local Historic Register including 102 individual designations plus 745 historic designated properties both local and National for a total of 847 historic properties.

Government Structure

The City Council is the policy making body for the City of Astoria. Members of the Council serve as Council representatives on many boards and commissions of the City, other local governments, agencies, and the State. The Mayor appoints all City Boards and Commissions. The Mayor and Councilors appoint the City Manager, City Attorney, and Municipal Judge. The City Manager appoints all other City employees.

The City of Astoria currently has the following departments[viii]:

City Manager's Office: The City Manager is responsible for overall City administration and the supervision of seven department heads including: Finance, Community Development, Parks and Community Services, Library, Fire, Police and Public Works/Engineering. The City Manager is responsible to the City Council. The staff consists of the City Manager, an Executive Secretary, and a Human Resources Administrator.

Community Development Department: The Community Development Department is responsible for economic development, land use planning, zoning administration, building inspection, and historic preservation. The Department provides staff support to the Planning Commission (APC), the Historic Landmarks Commission (HLC), the Design Review Committee (DRC), and the Traffic Safety Advisory Committee (TSC). The Department administers both the City Comprehensive Plan and the Development Code. The Department also administers the City's Building Inspection Program.

Public Works Department: The Public Works Department is the largest department within the City of Astoria. Major areas of responsibility include: water treatment and distribution; waste water collection and treatment; street maintenance; engineering services; sanitation/recycling services; fleet maintenance for all City vehicles; forestry management; City facility maintenance; railroad maintenance; and mapping with Geographic Information Systems (GIS).

Finance Department: The Finance Department offers a wide variety of services to the general public and to other departments of the City. The major activities include: utility billing, cashiering, accounts receivable, payroll, purchasing, accounts payable, data processing, financial planning, budget preparation, cash management, parking control, and maintenance of official City records.

Fire Department: The Astoria Fire Department is responsible for fire suppression and emergency medical response, which is coordinated with the local ambulance service (Medix). The department also contracts with the Tongue Point Job Corps Center, Coast Guard property at Tongue Point along with USCG cutters Alert and Steadfast to offer fire suppression and emergency medical services.

Police Department: The Astoria Police Department provides law enforcement services for the City's residents and visitors 24 hours every day and places particular emphasis on responding to the community's calls for service, investigating crimes and traffic enforcement. In addition, the Police Department also includes 911 and dispatch services.

Parks and Community Services Department: The Parks and Community Services Department oversees parks and recreation activities for the City. The City has six historic sites, one caretaker home, three community halls,

one maritime memorial park, six general use parks, one senior center, one indoor aquatic center, two recreation centers, five public restroom buildings, three tennis courts, eight playgrounds, ten ball fields, four basketball courts, one boat launch ramp/fishing dock, River Trail, and seven miscellaneous locations including urban forest trails, all of which are maintained by this department.

Astoria Public Library: The Astoria Public Library collects, preserves, and administers organized collections of books and related materials, promotes their efficient use, provides a public meeting place for discussion and reading, and extends the cultural life of the community. The Library Advisory Board, appointed by the Mayor, assists with the development of library policies. The City Council approves these policies and the library staff implements them.

Existing Plans, Policies and Community Organizations

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.[ix]

The City of Astoria'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 county's existing plans and policies. Linking existing plans and policies to the Natural Hazards Mitigation Plan helps identify what resources already exist that can be used to implement the action items identified in the Plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the City's resources.

The following table documents the plans and policies already in place in Astoria.

Table 8 Existing Plans, City of Astoria

Name	Date of Last Revision	Author/ Owner	Description	Relation to Natural Hazard Mitigation
City of Astoria Development Code/Zoning Ordinances	Feb-07	City of Astoria	The purpose of the Development Code is to promote orderly city growth, conserve and stabilize property value, encourage appropriate land use and establish standards for population density. It provides for adequate open space, fire and police protection, avoidance of traffic congestion; it also promotes and protects public health, safety, convenience and general welfare.	Article 2 The Flood Hazard Overlay Zone regulates the use of those areas subject to periodic flooding, to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions. Article 3 Erosion Control and Stormwater Managment - The purpose of this ordinance is to : 1) minimize impacts associated with excavation and grading, 2) minimize the erosion of land during clearing, excavation, grading, construction and post-construction activities, 3) prevent the transport of sediment and other soil borne pollutants into the Columbia River estuary and its tribuataries, wetlands and riparian areas, 4) prevent the transport of sediment onto adjacent property and into City rights of way and storm systems, 5) prevent unnecessary clearing, excavation, and stripping of land, and 6) to reduce the amount of soil exposure during construction. Article 4 Columbia River Estuary and Shoreland Regional Standards - The purpose of this article is to establish use and activity standards for developments in Columbia River estuary aquatic areas and shorelands. Article 5 establishes impact assessment and resource capability standards.
Astoria Transportation Systems Plan	Jul-99	City of Astoria	The TSP has been completed to help provide direction for transportation systems in the Astoria urban area over the next 20 years, as well as to meet federal, state and local transporation planning requirements. Transportation refinement plans were developed for the following areas of the City: Astoria Gateway TGM 7/99, East Gateway TSP 2/07, and Port/Uniontown TRP 2/07.	Mitigation principles and strategies can be incorporated into Transportation Systems Plan to protect key transportation infrastructure from natural hazards.
City of Astoria Comprehensive Plan		City of Astoria	To anticipate and plan for future land use within the City of Astoria.	Section CP.390 - .400, "Geologic and Flood Hazards" outlines limitations and regulations abided by in regard to flooding, landslides, erosion, storm water, and development on steep slopes." The identification and prioritization of specific areas subject to each hazard can help in crafting action items.
Water Supply Master Plan		City of Astoria	The water supply master plan insures that future water supplies are adequate for the expected growth of the City of Astoria.	A water supply master plan can be used to implement mitigation activities realted to vulnerable water infrastructure.
Water Distribution Master Plan		City of Astoria	The water distribution master plan evaluates existing systems and assists in planning for future expansion and growth.	A water distribution master plan can be used to implement mitigation activities realted to vulnerable water infrastructure.
Wastewater Treatment Master Plan		City of Astoria	The purpose of this study is to provide a long range planning of the wastewater system improvement needs to meet the growing demand for sewer services.	A wastewater treatment master plan can be used to implement mitigation activities realted to vulnerable wastewater infrastructure.
Bear Creek Dam Emergency Action Plan	Dec 2012	City of Astoria	The purpose of this EAP is to establish procedures to reduce the risk to human life and minimize damage to property in the event of an unusual or emergency situation at Bear Creek Dam.	The EAP establishes procedures in the event of an emergency situation at the Dam to help people with limited emergency experience to act decisively.

The following are excerpts from the City's Comprehensive Plan that describe actions related to natural hazard vulnerability and risk.

- CP.400 Geologic and Flood Hazard Policies

1. The City will take reasonable precautions to protect life and property from natural hazards or disasters, through the use of the City Flood Hazards Ordinance (Ord.78-06), the Uniform Building Code, and the policies for the management of geologic hazard areas.

2. Where it appears a landslide, or other earth movement hazard may be present, the approval of the City Engineer and/or Planning Commission may require a site investigation and report by a City approved licensed engineering geologist or soils engineer in such cases.

3. Land divisions in areas of steep slopes, unstable soils, weak foundation soils, or landslide potential will be permitted only after a favorable site investigation report has been completed.

4. Detailed drainage plans showing the location of proposed storm water disposal will be a part of building permit or land division applications.

5. Clustering of development on steep or less steep portions of sites is encouraged in order to maintain steeper slopes in their natural condition.

6. General development policies for areas of steep slopes will be as follows:

7. Construction excavation will be held to a minimum necessary to build footings efficiently

8. Removal of vegetation will be kept to the minimum necessary for the placement of roads, utilities, and structures. Erosion control measures as required by the City Engineer will be employed during and after construction.

9. Access roads and driveways will be constructed with a minimum amount of grading.

10. No development will be allowed to block stream drainages in any area or divert storm water across adjacent property.

11. Where necessary, the City Engineer may require certification by a professional engineer or architect to accompany building plans.

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 County-wide Community Organizations and Programs table can be found in Section 2: Community Overview of the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan. The table highlights organizations that are active within the County and may be potential partners for implementing mitigation actions.

Existing Mitigation Activities

Existing mitigation activities include current mitigation programs and activities that are being implemented by the community in an effort to reduce the community's overall risk to natural hazards. Documenting these efforts can assist participating jurisdictions better understand risk and can assist in documenting successes.

- MULTI-HAZARD – Astoria Builders Supply Co. designed their new building (1777 Marine Drive) to be resistant to both flood and windstorms by elevating the building and utilizing hurricane building design concepts.
- MULTI-HAZARD - Current Oregon Codes / International Codes adopted for seismic and wind resistance requirements.
- MULTI-HAZARD - Public awareness and education efforts.
- MULTI-HAZARD - Community Emergency Response Team training for neighborhood disaster readiness and personal/home structural and non-structural mitigation efforts.
- MULTI-HAZARD – Columbia Memorial Hospital has placed a trailer on-site at the Middle School for storage of non-invasive medical supplies. In addition, the hospital purchased two generators. These generators would provide minimum emergency power if needed.
- EARTHQUAKE – Clatsop Community College's Jerome Avenue campus has completed renovations to the Student Services Center and subject to grant funding. Towler Hall was renovated in 2012 to bring the buildings to current seismic codes.
- EARTHQUAKE – Lewis and Clark Elementary School was built in 2002 and conformed to seismic building codes in place at that time. Projects at the high school included construction of a new gymnasium and student commons built to current seismic codes.

Astor Elementary and Gray Elementary were renovated to bring the buildings into compliance with current building codes.

- EARTHQUAKE - The City received a State Office of Emergency Management grant to upgrade the Public Safety Building that houses police, fire, EOC, and the 911 dispatch center. That project was completed in 2013 bringing the facility to immediate occupancy seismic standards.

- FLOOD - Special Design Consideration of storm drains to minimize blockage. Public Works proactively checks storm basins and keeps them clean of debris to help minimize urban flooding. In addition, they've installed stormwater drains with cow catcher shaped grills that help divert debris out of the way.

Figure 5. Stormwater drains – Astoria, Oregon

Source: City of Astoria Public Works

- FLOOD – The City of Astoria has adopted a Flood Hazard Overlay Zone that regulates the use of those areas subject to periodic flooding, to promote public health, safety and general welfare and to minimize public and private losses due to flood conditions. The Code was updated in 2009.

- FLOOD - Many residential structures in low areas of town built to be flood resistant with unoccupied/unfinished first floors and main living area on 2nd and 3rd floor.

- FLOOD - Requirements for down-spouts/rain water to be directed to streets and storm drains to help control ground saturation.

- LANDSLIDE – The City has drafted a Geologic Hazard and Hillside Development Ordinance which will guide development related to earthquakes and landslides. The ordinance has yet to be adopted. The City also has requirements for comprehensive geo-

technical reports prior to construction. The City has also purchased lands associated with historic landslides and is using them as parks and open space. A map showing past slides can be found within City records as well.

- WINDSTORM - New roofs were placed on Astor Elementary, Gray Elementary and the high school. The new roofs were rated for 100 mph winds and have a 20 year life.
- WILDFIRE - Significant upgrades were made to the electrical and lighting systems at the Middle School. Lewis and Clark Elementary and Gray Elementary were completely sprinkled while upgrades to the fire alarm systems were made at other schools.
- WILDFIRE - The City is participating in the development of a county-wide Community Wildfire Protection Plan to address the risks posed by wildfire.

Risk Assessment

The following hazards have been addressed in the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan. The City of Astoria reviewed the County's plan during a work session on February 12, 2008 and assessed how Astoria's risks vary from the risks facing the entire planning area.

Coastal Erosion

Astoria's location on Young's Bay makes it susceptible to coastal erosion. City of Astoria staff indicated that the **extent** of the coastal erosion hazard is limited to those lands directly adjacent to Young's Bay on the south side of town. These **locations** are highlighted in Figure 6 below.

Little data exists for **previous occurrences** of coastal erosion in Astoria. Significant erosion events took place along the Oregon coast during: El Nino events in 1982-1983 and 1997-1998 and winter storm events in 1998-1999. These events have been cited as the most significant examples of coastal retreat in the last three decades. [x] The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan did not rank the **vulnerability** or **probability** of coastal erosion.

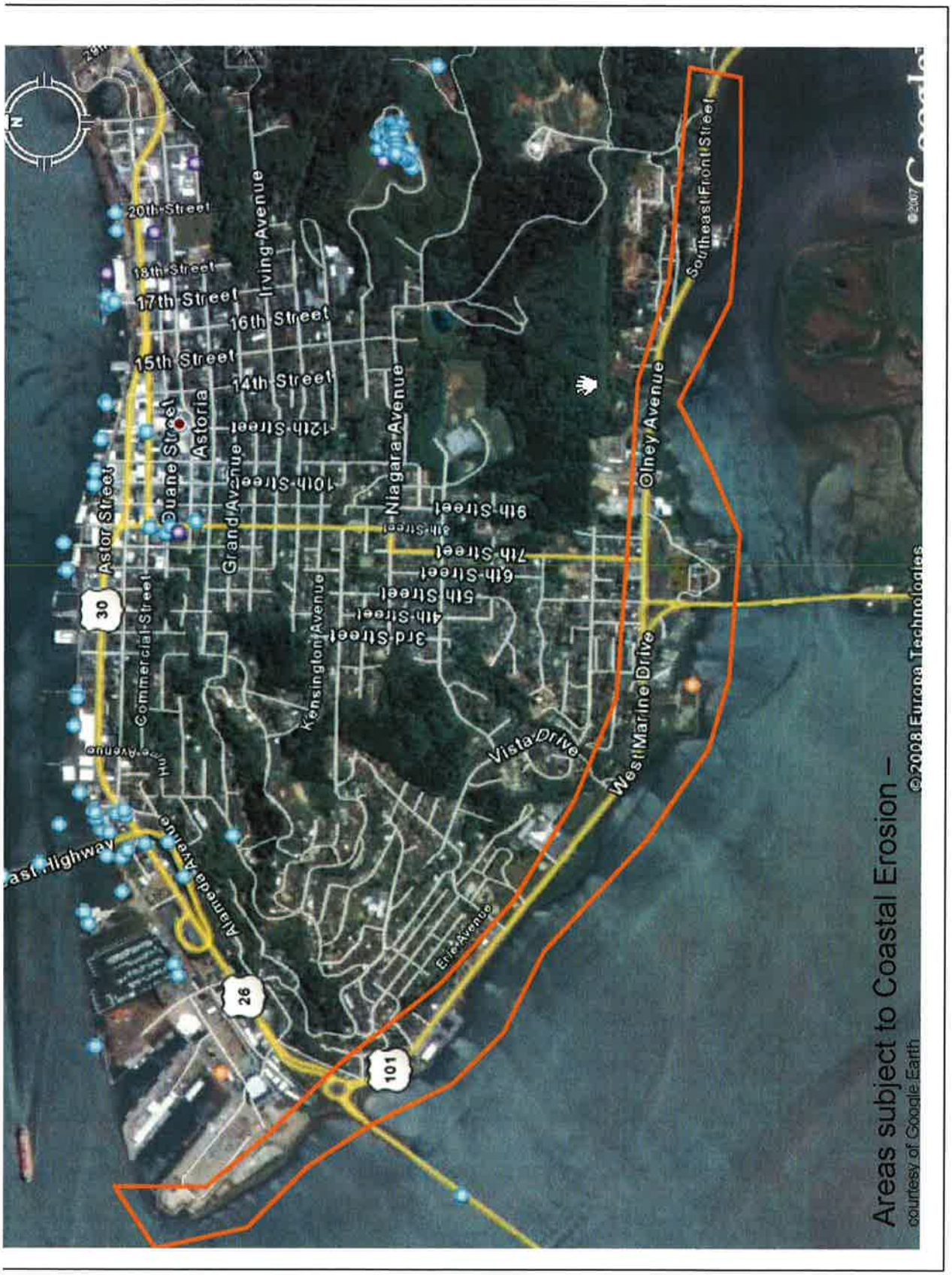
According to a brochure developed by CREST, erosion can have the following **community impacts**:

- Loss of property;
- Threatens near shore buildings and other structures;
- Degrades aquatic and riparian habitats;
- Reduces water clarity, light penetration and plant productivity;

- Causes warming of the stream/river;
- Releases nutrients which could stimulate undesirable plant and algae growth;
- Affects fish feeding, spawning, and gill function; and
- Changes bottom substrate, reduces channel capacities, increases flooding.

Figure 6. Areas subject to Coastal Erosion

Source: Astoria Staff – February 13, 2008 Work Session



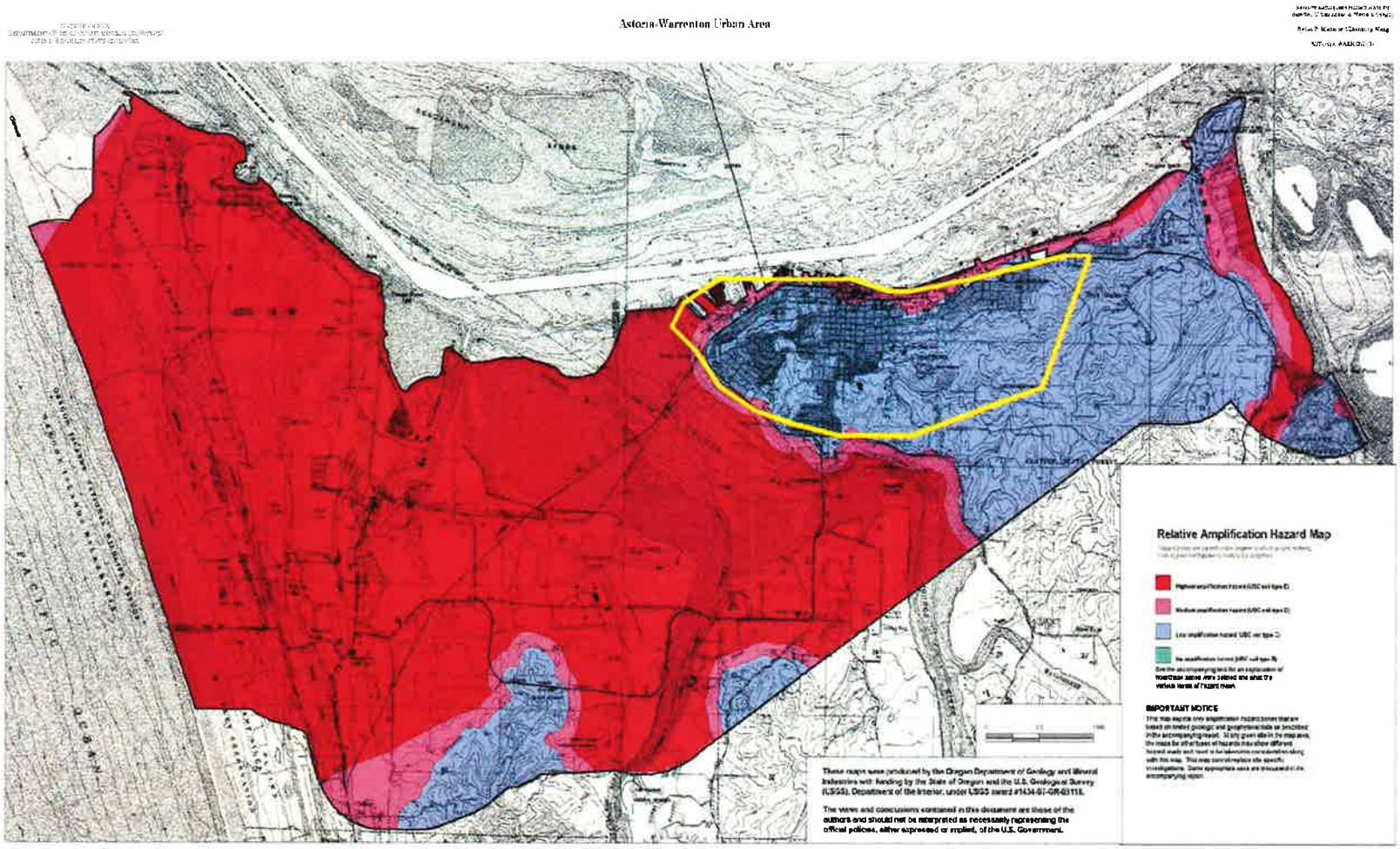
Drought

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan adequately addresses the drought hazard for the City of Astoria. The **location, extent, previous occurrences, vulnerability**, and **probability** for drought in Astoria are the same as the County. City staff did indicate that the most significant **community issue** would be a lack of water, but that the City does have adequate storage capabilities. Staff also indicated that in the 1980's a drought prompted the City to implement voluntary water restrictions. In addition, drought conditions can also increase the probability of wildfires.

Earthquake

Astoria's location along the Oregon Coast makes it susceptible to earthquakes, especially a Cascadia Subduction Zone earthquake. The **extent** of the earthquake hazard includes the entire community of Astoria, although damage from an earthquake may be more severe in the downtown area where buildings are old and sit on fill that has liquefaction potential.

The following earthquake hazard maps were developed by the Department of Geology and Mineral Industries. The figures illustrate the **location** of the amplification, liquefaction, earthquake induced landslide, and relative earthquake hazards in both Astoria and Warrenton.



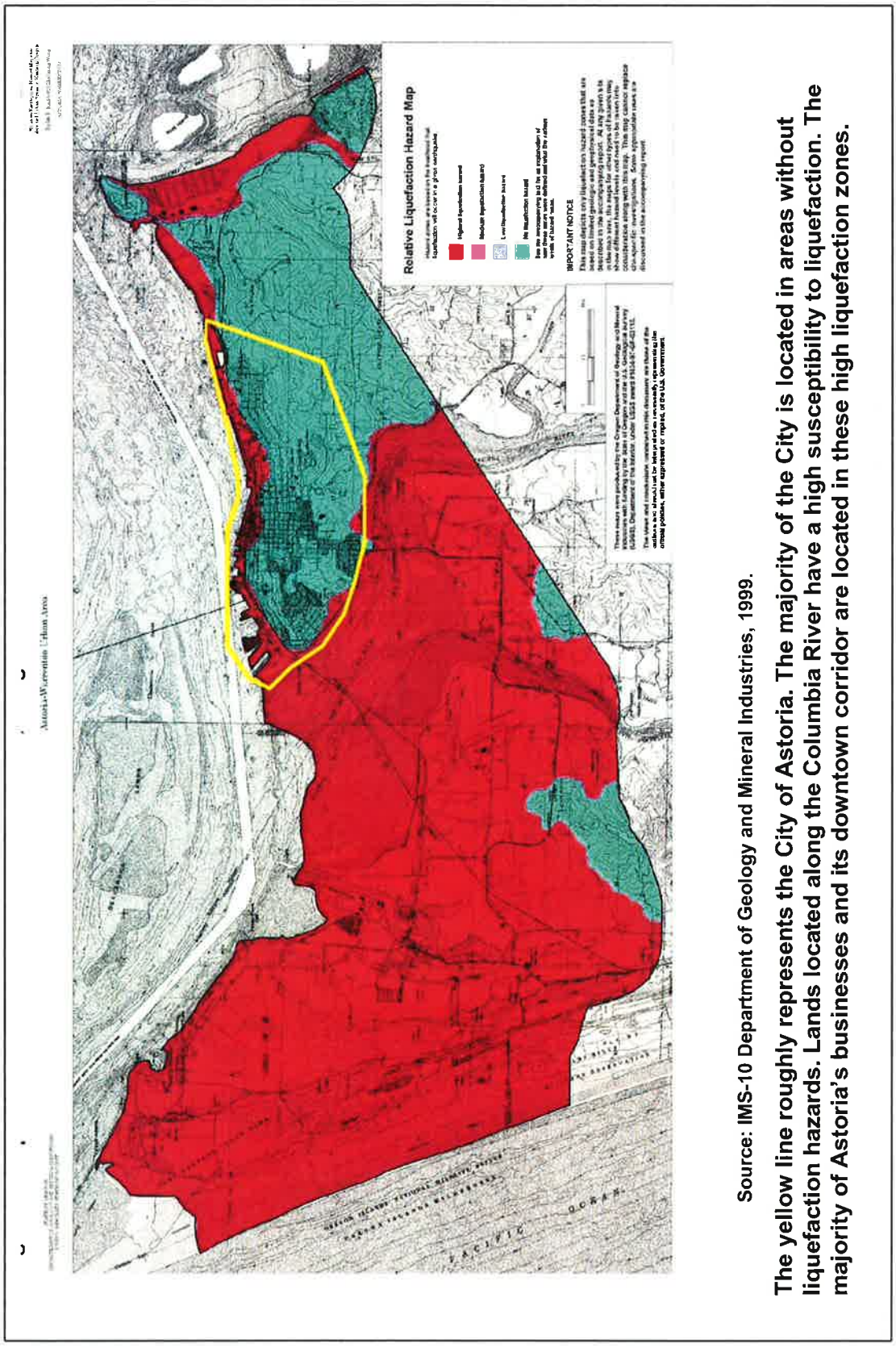
Source: IMS-10 Department of Geology and Mineral Industries, 1999.

The yellow line roughly represents the City of Astoria. The majority of the city is located in areas of low amplification hazards. Lands located immediately adjacent to the Columbia River and Young's Bay have a moderate or high risk of amplification.

Figure 7. Amplification hazard – Astoria-Warrenton, Oregon

Figure 8. Liquefaction hazard – Astoria-Warrenton, Oregon

Source: IMS-10 Department of Geology and Mineral Industries, 1999.



Source: IMS-10 Department of Geology and Mineral Industries, 1999.

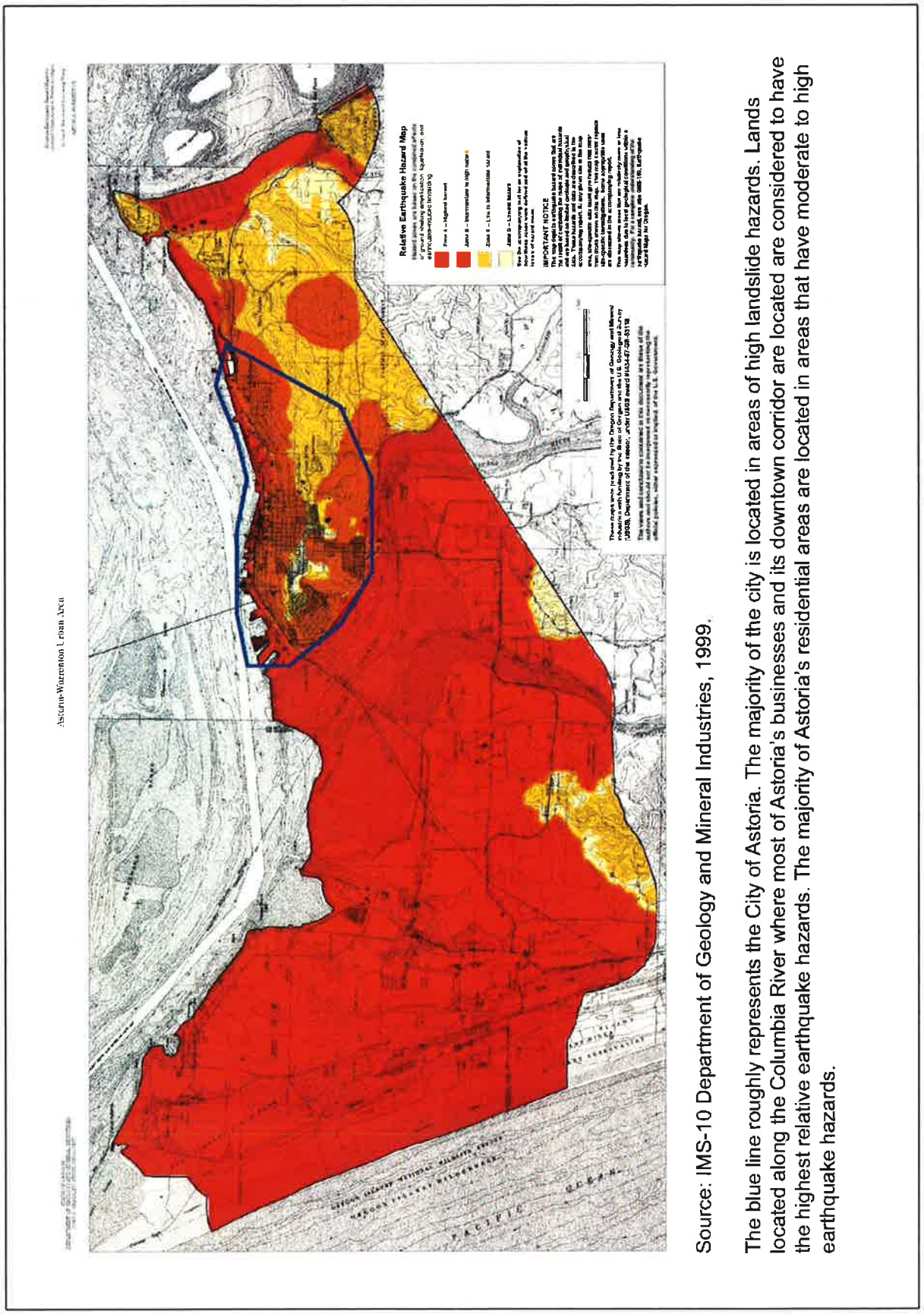
The yellow line roughly represents the City of Astoria. The majority of the City is located in areas without liquefaction hazards. Lands located along the Columbia River have a high susceptibility to liquefaction. The majority of Astoria's businesses and its downtown corridor are located in these high liquefaction zones.

Figure 9. Earthquake Induced Landslide hazard – Astoria-Warrenton, Oregon

Source: IMS-10 Department of Geology and Mineral Industries, 1999.

The yellow line roughly represents the City of Astoria. The majority of the city is located in areas of high landslide hazards. Lands located along the Columbia River where most of Astoria's businesses and its downtown corridor are located are in medium and low landslide hazards.

Figure 10. Relative Earthquake hazard – Astoria-Warrenton, Oregon



Source: IMS-10 Department of Geology and Mineral Industries, 1999.

The blue line roughly represents the City of Astoria. The majority of the city is located in areas of high landslide hazards. Lands located along the Columbia River where most of Astoria's businesses and its downtown corridor are located are considered to have the highest relative earthquake hazards. The majority of Astoria's residential areas are located in areas that have moderate to high earthquake hazards.

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan adequately identifies the **previous occurrences** of earthquakes for the City of Astoria. The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the **vulnerability** of earthquakes as high. The County plan also indicates that the **probability** of earthquakes is high. These scores would be representative of Astoria as well.

City staff identified the following potential **community impacts** or concerns about the earthquake hazard:

- City's reservoirs are water sources for both drinking water and fire suppression and are likely at risk due to age. City staff also identified the importance of Bear Creek Dam as a critical facility.
- Staff had concerns about the City's water distribution system pipe infrastructure which is comprised of mostly older materials - cast iron for water and vitrified clay and terra cotta for sanitary and storm sewer and the potential for loss of fire suppression water.
- The downtown area of Astoria was rebuilt following a catastrophic fire in 1922. The fire destroyed 32 blocks, 40 acres and 33 buildings. Reconstruction efforts involved chair-wall construction which created concrete tunnels for water and gas lines. The area around the chair walls was filled in with dredge sands during reconstruction.[xi] The majority of downtown is located on areas of high liquefaction risk. A large earthquake will have significant impacts on Astoria's economy.
- Only the newest buildings in the City have been built to earthquake standards. The majority of buildings, especially those located downtown, were built prior to the implementation of stricter building codes.
- Downtown's reconstruction using chair walls results in poor access to utilities located underground.
- Staff identified the vulnerability of the Tongue Point area specifically its location in areas of high liquefaction potential.
- The hospital is located on a site filled with dredge materials.
- Staff has concerns about the wastewater system and lift stations around town being damaged and leading to public health emergencies following an earthquake. In addition, the water distribution system would likely be heavily damaged, preventing the delivery of water for fire suppression and domestic use.
- The Astoria Column is an important historic and cultural resource and would like suffer damage from a large earthquake.

- The City owns three bridges in town that are likely at risk – however, the City replaced the Franklin Avenue Bridge in 2012 and will be replacing the Irving Avenue/19th Street Bridge in 2013-2015. The loss of bridges may cut off certain areas of the community.
- Chair-wall construction downtown creating common spaces over large area that can complicate flooding impact and problems due to the ease of travel for natural gas, smoke, fire, etc. between buildings and over a large area.
- Vulnerability and wide ranging hazards from gas and electric utility infrastructure.
- Effect on most road surfaces that will complicate access, evacuation, and emergency response.
- DOGAMI, in consultation with project partners developed a Statewide seismic needs assessment that includes seismic safety surveys of K-12 public school buildings. According to this assessment the following school buildings in Astoria were rated with a high collapse potential and should receive further evaluation:
    - Astor Elementary School
    - Astoria Senior High School
    - Gray Elementary School
- Clatsop Community College's MERTS campus is built to earthquake standard 3, but is subject to liquefaction and has only one way in and out.
- Clatsop Community College's Jerome Avenue campus has completed renovations and seismic upgrades to the Student Services Center. The College addressed life safety issues at Towler Hall. Towler Hall had severe seismic deficiencies, has very high seismic risk, and was a high priority to the community requiring mitigation. The College completed construction of a new building, that replaced Patriot and Fertig Halls. The Library and Art Building were rated fair for seismic performance by a structural engineer and there are no anticipated renovations expected to these buildings.

Flood

Astoria is at risk of flooding from three main sources: the Columbia River, Young's Bay, and urban flooding from storm water coming off the slopes of the City's hillsides. Because of the prevalence of urban flooding, the **extent** of the flood hazard includes most of the City, with the exception of those residences located at the top of the hill in town. The City's Flood

Insurance Rate Maps highlights the **location** of the flood hazard in Astoria. The City's current effective date for the Flood Insurance Rate Map is September 17, 2010.

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan adequately identifies the **previous occurrences** of floods for the City of Astoria. The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the **vulnerability** of floods as moderate. The County plan also indicates that the **probability** of floods is high. These scores would be representative of Astoria's risk as well.

The City of Astoria is a participant in the National Flood Insurance Program. The City has a total of 41 policies under the NFIP, only 20 of which are located in A zones. The total coverage for the City under the NFIP is $9,759,500. There have only been four claims since 1978, with nothing paid on those claims. The last Community Assistance Visit (CAV) was conducted on April 21, 2000.

Using the existing FEMA Flood map and a visual review of aerial photographs of the City dated 2002, the Community Development Department estimates the following number of structures in the floodplain:

- Commercial/Industrial - 24 plus 2 mooring basins
- Residential - 50 plus several vessels at mooring basins
- Infrastructure - 16 facilities plus sewer outfalls.
    - Trolley trestles in Uniontown - 2
    - 7th Street trestle
    - 9th Street trestle
    - 6th Street trestle
    - 6th Street River Park
    - Transient moorage at 17th
    - City sewer outfalls
    - 14th Street RiverPark
    - Trolley trestles in Alderbrook - 2
    - City sewer pump station 1
    - City sewer lagoon
    - Maritime Memorial Park
    - Mill Pond weir and trestle
    - 10th & 11th Street extensions

- Alderbrook ball field
- East extension of River Trail in Alderbrook Lagoon area
- Port of Astoria - Pier 3 extension of River Trail
- West End Mooring Basin extension of River Trail
- Net Pen trestle at Yacht Club, 1555 W Marine Drive

City staff identified the following potential **community impacts** or concerns about the flood hazard:

- City Staff indicated that the Alderbrook neighborhood, located on Highway 30 on the east end of town, often has flooding issues. Many homes have had water in their basements and some have bridges to their front doors. This neighborhood is only 11 feet above sea level. This neighborhood is particularly vulnerable when high tide on the Columbia coincides with high levels of runoff from the hillsides. The neighborhood has one privately owned dike that is approximately 3-4 feet high.
- City staff also mentioned the need for a shelter located inside City limits should roads or bridges be damaged or become impassable.

Figure 11. Location of Historic High Water – Astoria, Oregon

Source: Google Images and City of Astoria Areas of High Water and Past Slides Map.

- The Aquatic Center and Oregon State University Seafood Labs, located on the south side of Highway 30 are also vulnerable to flood waters.
- Businesses downtown (along Commercial, Marine, Duane, and Exchange Streets) are also vulnerable as they are located between one and four blocks from the Columbia River. This is the site of the majority of the businesses in Astoria.
- Houses located adjacent to streams are also vulnerable to frequent flooding. Public Works indicates that several times a year homes are pumping water out of their basements.
- The embankment along the River, which is located adjacent to the Columbia River, could be considered a flood protection device.
- There are flooding issues on Highway 202 on Young's Bay on the south west side of town as well.
- Clatsop Community College's MERTS campus is vulnerable to floods during dike breaches, high tides, or extensive rainfall. This location has only one evacuation route.

- Clatsop Community College leases a facility in the South County on Highway 101 that could be vulnerable to floods during high tides and storms.

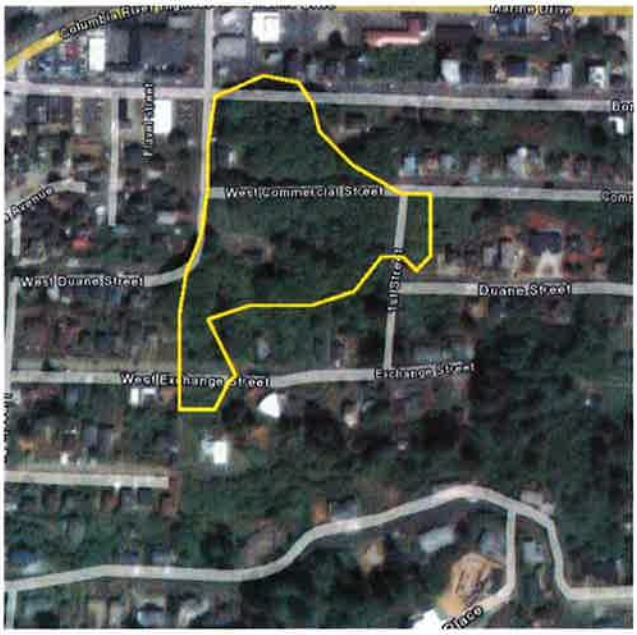
Landslide

Astoria is at risk of landslides because of its location on the hillside above the Columbia River and Young's Bay. The **extent** of the landslide hazard includes most of the residential portions of the City. The City is in the process of completing a LiDAR study with the Department of Geology and Mineral Industries that will identify the **location** of potential landslide hazards in Astoria.

The City of Astoria *Areas of High Water and Past Slides* map originally developed in 1974 and updated as recently as 2008 identifies the **previous occurrences, location** and **extent** of earth movement in the City of Astoria. Those previous occurrences are summarized below. Note that landslide events are summarized by corresponding map sections A-K:

- Map Section A – a total of 7 slide areas
- Map Section B – a total of 9 small slide areas – the most recent in 1998
- Map Section C – 6 small to medium slides and two large slides.
- One of the large slides, known as the Bond Street slide occurred originally in 1954, and was triggered again in January 2007. This slide continued to move during the development of the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan. Mitigation of the landslide area and infrastructure is a top priority of the City. See Figure 12.

Figure 12. Bond Street Landslide Impact Area – Astoria, Oregon



Approximate location of the 1954 Bond Street slide, which reactivated in January 2007.

Source: Google Images and City of Astoria Areas of High Water and Past Slides Map.

- A second and larger slide is approximately bounded by 4th Street on the west, Exchange Avenue on the north, 10th Street on the east, and Irving Avenue on the south. This slide originally occurred in 1905 and continued to creep. In 1991, 1992, and 2006 additional portions slid.
- An area at 5th / 6th and Duane Streets slid in 1991, 1992, 2006, and again in 2012-2013.
- Map Section D – a total of four small slides
- Map Section E – a total of three slides. One large slide located bounded approximately by: Franklin Avenue to the north, 20th-24th Street to the east, north of Jerome Avenue to the south, and 20th Street to the west. The toe of this slide is located just south of the hospital. See Figure 13 below.

Figure 13. Historic Landslide Impact Area – Astoria, Oregon

Source: Google Images and City of Astoria Areas of High Water and Past Slides Map.

- Map Section F – a total of four slides.
- Map Section G – a total of six slides including the Uppertown earth movement dated May 2004 on the map. This slide is approximately bounded by: Lief Erikson Drive to the north, 34th Street to the east, Harrison Avenue to the south, and 31st Street to the west.
- Map Section H – a total of three small slides
- Map Section I – no slides indicated
- Map Section J – one slide located at the intersection of Highway 30 and 53rd Street.

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the **vulnerability** of landslides as moderate. The City of Astoria's vulnerability to landslides, however, is high due to location of critical facilities and residential development within landslide prone areas. The County plan also indicates that the **probability** of landslides is high. This probability score would be representative of Astoria as well.

City staff identified the following potential **community impacts** or concerns about the landslide hazard:

- City staff was concerned about water and transportation infrastructure related to the landslide hazard. The re-activation of the Bond Street slide disrupted water infrastructure. The water distribution system is the only water supply for fire protection. Many streets are located along the sides of hills within the City. These streets function as major arteries and also house water and sewer lines. This creates potential risk that could result in the inability to provide effective emergency services.
- As is illustrated in Figure 13 above, Columbia Memorial Hospital is located at the foot of a historic slide.
- Public Works also indicated that areas near the intersection of 38th Street and Franklin Avenue are somewhat unstable.
- Staff indicated that when the City receives multiple days of heavy rain that the excess precipitation can lead to earth movement.
- Stabilization measures have been undertaken along Highway 30 around Tongue Point to help reduce the vulnerability of a slide cutting off Highway 30, which is the major east-west connection between Astoria and Portland.
- Clatsop Community College and City staff indicated that the eastern portions of the Community College may be at risk from landslides.
- Astoria Middle School may also be at risk to landslides.
- City staff suggested a potential mitigation action to improve the storm drainage system in the forested areas on the ridge in Astoria.
- The following issues have been identified in the City's proposed Geologic Hazard and Hillside Development Ordinance:

    1. Since 1950, it is estimated that sixty to seventy homes have been seriously damaged by earth movement. The resulting cost to the various owners is estimated to be between $500,000 and $1,000,000. Cost of street and utility repairs is estimated to be over $2,000,000.
    2. Geological information indicates that the bedding planes under Astoria generally dip toward the south, and that the landslide potential on the south slope (which is mostly undeveloped at present) could be considerable as development increases. Great care should be taken to insure

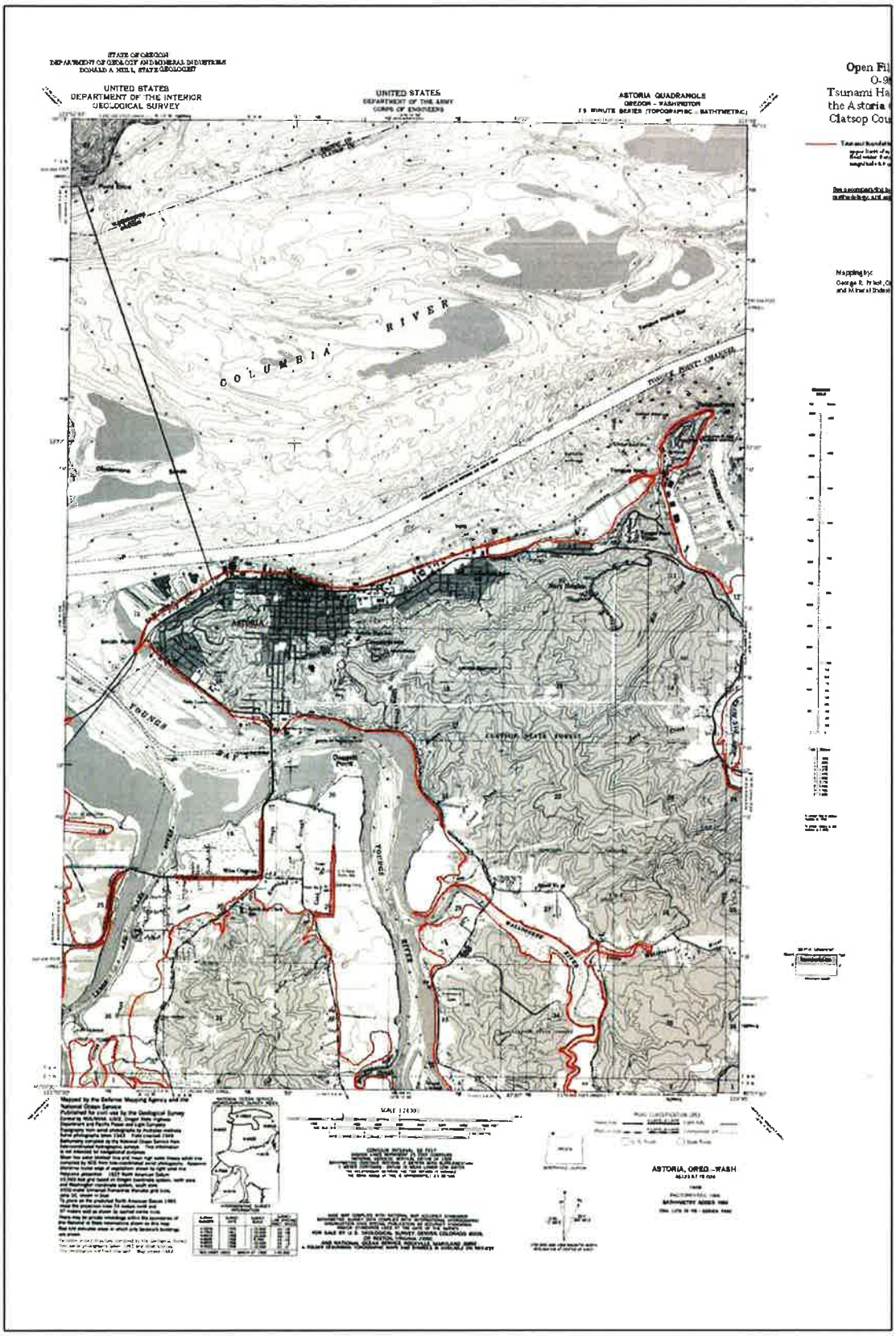
this area does not experience the same problems encountered on the north slope of the City.

Tsunami

Astoria's location along the Oregon Coast makes it susceptible to tsunamis from both near shore (following a Cascadia Subduction Zone earthquake) and distant tsunamis. The **extent** of the tsunami hazard is limited to those areas adjacent to either the Columbia River or Young's Bay.

The following tsunami inundation map illustrates the **location** of the tsunami hazard. This map was developed by the Department of Geology and Mineral Industries in 1995. In 2012-2013, DOGAMI began updating the tsunami hazard mapping for coastal communities. Those maps are nearing completion and should be adopted sometime in 2014-2015. These new maps project a greater area within the City that would be impacted by a tsunami.

Figure 14. Tsunami Inundation Zone – Astoria, Oregon



The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the **vulnerability** of tsunami as high. The County plan indicates that the **probability** of tsunami is moderate. These scores would be representative of Astoria's risk as well.

City staff identified the following potential **community impacts** or concerns about the tsunami hazard:

- City staff had concerns about community assets (including Police, Fire and Public Works facilities) located to the north of Marine Drive. Tsunami inundation maps indicate that this area is vulnerable to tsunami impact.
- The Fire Department indicated that further studies were needed to better assess the tsunami inundation zone given new technology and wave height modeling software now available.
- The City's tourist based economy and population density are significant issues related to the tsunami hazard.
- Clatsop Community College's South County Center is located in the tsunami inundation zone.

Volcano

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan does an adequate job of describing the **location, extent, history, probability, vulnerability,** and **community impacts** of volcanoes in Astoria. The City of Astoria experienced ashfall and debris in the Columbia River as a result of the Mt. St. Helens eruption in 1980. Please refer to the County's plan for additional information on the volcano hazard.

Wildfire

The City of Astoria has urban forests. The urban forest is adjacent to State, County, and private forest that extends for miles east of the City limits. This creates the potential for wildland-urban interface and makes the City vulnerable to wildfire. Also at risk is the City's watershed which is made up of 3,700 acres (Wickiup Mountain) that serves as the City's water source. Clatsop County is currently in the process of developing a Community Wildfire Protection Plan (CWPP) that will further delineate the **location, extent, previous occurrences, probability, vulnerability,** and **community impacts** of wildfires in Astoria.

Based on the best available data, the **location** of the wildfire hazard in Astoria is the large urban forest located within the City and extending beyond the City limits to the east. The City of Astoria was listed as a Community at Risk during the State Wildfire Assessment. The **extent** of the wildfire hazard is likely limited to the interface areas along Irving Avenue to the north and following the crest of the hillside around to 9th Street on

the western side of town. A wildfire could travel from the urban forest into the neighborhoods on the hillsides.

Since June 2005, Astoria Fire has responded to 36 wildfires: 14 natural vegetation fires, 12 brush fires, 5 files in cultivated vegetation, 4 forest or wooded fires, and one grass fire.

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the **vulnerability** of wildfire as moderate. The County plan indicates that the **probability** of wildfire is high. For the City of Astoria, the **vulnerability** of wildfire is high and the **probability** is moderate.

City staff identified the following potential **community impacts** or concerns about the wildfire hazard:

- City staff had concerns about a wildfire impacting the 3,700 acre watershed that is home to the City's water supply and located 12 miles east.
- The east end of the City is a large urban forest that creates the potential for interface fires.
- During August, September, and January, east winds can blow fires into the City.
- The urban interface has not yet been delineated, but will be completed s the County develops its CWPP.
- Clatsop Community College's MERTS campus is located in a heavily forested area and has a single evacuation route. Buildings at this campus have been sprinkled.
- Clatsop Community College's Jerome Avenue campus is located in a forested area and new and renovated buildings will be sprinkled.

Wind and Winter Storms

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan addresses wind and winter storms together.

Windstorm

Astoria's location at the mouth of the Columbia River, and close to the Oregon Coast, makes it susceptible to windstorms. The County's plan accurately describes the **location**, **extent**, and **previous occurrences** of windstorms in Astoria. The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the **vulnerability** of windstorm as high. The County plan indicates that the **probability** of windstorm is high. These scores accurately reflect the vulnerability and probability of windstorms in the City of Astoria.

City staff identified the following potential **community impacts** or concerns about the windstorm hazard:

- City staff indicated that the south slope of the City is more vulnerable than other areas to high winds.
- The urban forest located to the east of the City is also vulnerable to wind damage.
- Pharmacies are an underrated asset following windstorms. Many of the residents of the December 2007 wind storm needed medications and may not have been able to get to the pharmacy.
- Staff raised concerns about emergency power for critical facilities such as shelters, schools, and the community college.
- The City frequently loses power several times each winter. Staff is also concerned about the resiliency of the City's power infrastructure to windstorms and suggested placing portions of the infrastructure underground as a potential mitigation action.
- Emergency notification and communication are always an issue when communication systems are down and the power is out. Lack of redundancy created a lack of communication during the December 2007 wind event.
- Downed trees can block transportation routes and impede the provision of emergency services and can also damage public and private property.
- New construction is being built according to model national building codes. A wind screen at the Hotel Elliot downtown survived the December 2007 windstorm as did new awnings recently installed at the Sears downtown.
- Clatsop Community College's MERTS campus may be vulnerable during a windstorm due to tree blow down across the single evacuation route.

  Clatsop Community College's Jerome Avenue campus may be impacted by downed trees. Proposed plans include minimal emergency back-up systems and replacing overhead utilities with underground utilities.

Winter Storm

Astoria's location on both the Oregon Coast makes it susceptible to winter storms. The County's plan accurately describes the **location, extent**, and **previous occurrences** of winter storms in Astoria. The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan did not rank the **vulnerability** or **probability** of winter storm. City of Astoria staff indicated that the **probability** and **vulnerability** for winter storms is high.

City staff identified the following potential **community impacts** or concerns about the winter storm hazard:

- Travel along the City's steep streets becomes difficult during ice storms.
- Elderly residents may be more directly impacted than other residents during winter storms because of their inability to travel safely to get medications.
- During extended freeze situations, water service lines connected to individual homes can freeze because they are not laid very deep in the ground.
- Staff indicated that there is a need for heated emergency shelters that are available during extended cold weather events.
- Staff is also concerned about the resiliency of the City's power infrastructure to windstorms and suggested placing portions of the infrastructure underground as a potential mitigation action.
- Clatsop Community College's MERTS campus is vulnerable due to its single evacuation route.
- Clatsop Community College's Jerome Avenue campus is replacing aggregate sidewalks with heavily brushed surfaces to reduce the likelihood of slipping.

Action Items

Multi-hazard Requirement §201.6(c)(3)(iv): *For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.*

If the City's risk to a hazard (or hazards) is greater than the County's, then the City must create at least one action item to mitigate that hazard's effects.

The following action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk. See full action item forms for more information. The starred(***) action items below are the City's top priorities for mitigation actions.

- Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.
- Address repetitive flood loss properties not covered by the National Flood Insurance Program
- Determine feasibility of becoming a participant in the NFIP's Community Ratings System

- Evaluate flood hazards in the Alderbrook Neighborhood
- Conduct a seismic and flood vulnerability assessment of all critical facilities and infrastructure in the City. Continue efforts to replace aged bridges with newer structures. The Irving Avenue/19th Street Bridge is scheduled for replacement in 2014-2015.
- Re-map the tsunami inundation hazard for the City of Astoria. DOGAMI has developed new maps which are proposed for adoption in 2014-2015.
- Determine needs and issues related to tsunami warning systems.
- Implement an all-hazards education and outreach campaign
- Identify areas where undergrounding utilities may be appropriate
- ***Complete LiDAR study to further delineate landslide hazards in Astoria. The LiDAR study was completed in 2011. Implementation of the data results into a geologic hazard ordinance has been in progress.
- Improve drainage in forested areas in higher elevations above the City to help reduce the potential for landslides
- Evaluate the vulnerabilities of the water system (including the transmission main, water pipes and dam) and mitigate to ensure disaster resiliency. Maintain and enhance efforts around Community Emergency Response Teams (CERT).
- Identify shelter locations and adequate equipment and supplies in town.
- Conduct fuel reduction in the City's watershed and urban forest.
- Minimize risk in the City's wildland-urban interface.
- Reduce erosion on along Columbia River near the Aquatic Center and Seafood Center. A Shoreline Stabilization Plan was drafted in 2013 and is pending finalization.
- Strengthen the high risk seismic deficiencies at Clatsop Community College's Towler Hall. (Completed) Assess seismic vulnerability to hazardous materials sites
- Relocate Public Work's Facilities
- Improve public communication infrastructure so that it is less vulnerable.
- Acquire a Fire Boat
- Relocate Astoria Fire Department

See Action Item Appendix for detailed action item forms.

Action Items Completed

- Conduct a seismic and flood vulnerability assessment of all critical facilities and infrastructure in the City. The City Public Safety Building that houses police, fire, EOC, and the 911 dispatch center was brought up to immediate occupancy seismic standards in 2013.
- Continue efforts to replace aged bridges with newer structures. The Franklin Avenue Bridge was replaced in 2012.
- Evaluate the vulnerabilities of the water system (including the transmission main, water pipes and dam) and mitigate to ensure disaster resiliency. The Bear Creek Dam Emergency Action Plan was adopted in December 2012. Bear Creek Dam water lines were removed from the face of the dam and relocated below ground to reduce the vulnerability for failure.
- Conduct fuel reduction in the City's watershed and urban forest. City completed a timber harvesting project in 2012.
- Strengthen the high risk seismic deficiencies at Clatsop Community College's Towler Hall. Upgrades were completed in 2012.

Items Completed But Not on Action Item List

The following items were not included in the Action Items in the 2008 adopted Plan but are projects that have been completed to help reduce risks:

- City installed floating reservoir covers on Water Reservoirs 2 & 3 in 2011.
- The City installed a backup SCADA facility at 6th Street and Lexington Avenue in 2013. The existing building was seismically upgraded.

Plan Implementation & Maintenance

The City will utilize the same prioritization process as the County [See Section 4: Plan Implementation and Maintenance of the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan and Appendix D: Economic Analysis of Natural Hazard Mitigation Projects].

The City of Astoria Community Development Department will serve as the convener for the City of Astoria Natural Hazard Mitigation Plan Addendum. The Community Development Department will be responsible for convening the plan committee on a yearly basis to identify new risk assessment data, review status of mitigation actions, identify new actions, and seek funding to implement mitigation actions. The City of Astoria Natural Hazard Mitigation Plan Addendum will be updated every five years.

Plan adopted on October 29, 2008, Resolution No. 08-23.

1st Amendment adopted on June 17, 2013, Resolution No. 13-19.

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[i] National Weather Service Forecast Office. 2007. < http://www.wrh.noaa.gov/pqr/climate/ast_clisummary.php>

[ii] City of Astoria. http://www.astoria.or.us/History/AstoriaHistory/tabid/4009/Default.aspx and Portland State University Population Projections.

iii United States Census Bureau. 2000. Fact Sheet: Astoria, Oregon. <www.census.gov>

iv Port of Astoria. 2007. <http://www.portofastoria.com/portfacilities/cruise/cruiseinformation/cruiseschedule.html>

v United States Census Bureau. 2000. Fact Sheet: Astoria, Oregon. <www.census.gov>.

vi United States Census Bureau. 2000. Fact Sheet: Clatsop County, Oregon. <www.census.gov>.

[vii] City of Astoria. 1992. Land Use and Zoning Map. <http://www.astoria.or.us/LinkClick.aspx?fileticket=2CTb0n2N43o%3d&tabid=4040&mid=9832>

[viii] City of Astoria. *Departments / Contacts* < http://www.astoria.or.us>

[x] Allan, J. et al. 2005. Dynamic Revetments for Coastal Erosion in Oregon. http://www.oregon.gov/ODOT/TD/TP_RES/docs/Reports/DynamicRevetments.pdf

[xi] Astoria's history along the tracks - http://homepage.mac.com/cearl/trolley/ahistory.html

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Appendix A:
Action Item Proposal Forms

Natural Hazard Action Item Proposal Form

Proposed Action Item:	**Alignment with County Goals:**
Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	***Minimize damage to public and private buildings and infrastructure***

Rationale for Proposed Action Item:

- The National Flood Insurance Program provides communities federally backed flood insurance to homeowners, renters, and business owners, provided that communities develop and enforce adequate floodplain management ordinances. The benefits of adopting NFIP standards for communities are a reduced level of flood damage in the community and stronger buildings that can withstand floods. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will help reduce the level of flood damage to new and existing buildings in communities while providing homeowners, renters and business owners additional flood insurance protection.
- The CAV is a scheduled visit to a community participating in the NFIP for the purpose of: 1) Conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered.

Ideas for Implementation:

- Actively participate with DLCD and FEMA during Community Assistance Visits.
- Conduct an assessment of the floodplain ordinances to ensure they reflect current flood hazards and situations, and meet NFIP requirements.
- Coordinate with the County to ensure that floodplain ordinances and NFIP regulations are maintained and enforced.

Coordinating Organization:	**Community Development**

Internal Partners:	**External Partners:**
Public Works	**Department of Land Conservation and Development, Federal Emergency Management Agency**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
On-going		

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Address repetitive flood loss properties not covered by the National Flood Insurance Program	***Minimize damage to public and private buildings and infrastructure***

Rationale for Proposed Action Item:

- Often times, communities have repetitive flood loss properties that are not covered by the NFIP. Working with homeowners and business owners to identify mitigation actions, such as building elevation or property acquisition, can reduce the impact and damage from of floods on repetitive loss properties.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing mitigation actions for repetitive flood loss properties can significantly diminish the impact and damage from flooding on these properties.

Ideas for Implementation:

- Develop a database of repetitive flood loss properties not covered by the NFIP to track flood damage and to use when identifying mitigation actions.
- County public works and the cities should coordinate to identify properties not covered by the NFIP and teach homeowners and businesses about mitigation actions they can implement.
- Work with homeowners to identify potential mitigation measures to be funded through either Pre-Disaster Mitigation or Flood Mitigation Assistance.
- Develop countywide stormwater management strategies to address repetitive loss properties.

Coordinating Organization:	Community Development

Internal Partners:		**External Partners:**
Public Works		Department of Land Conservation and Development
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Determine feasibility of becoming a participant in the NFIP's Community Ratings System	***Minimize damage to public and private buildings and infrastructure Reduce economic loss***

Rationale for Proposed Action Item:

- The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements.
- Participation in the CRS can reduce homeowner's flood insurance premiums.

Ideas for Implementation:

- Review requirements of the CRS and determine whether participation is feasible.

Coordinating Organization:	Community Development

Internal Partners:	**External Partners:**
Public Works	DLCD, FEMA

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
X		

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Evaluate flood hazards in the Alderbrook Neighborhood	***Minimize damage to public and private buildings and infrastructure*** ***Reduce economic loss***

Rationale for Proposed Action Item:

- City Staff indicated that the Alderbrook neighborhood, located on Highway 30 on the east end of town, often has flooding issues. Many homes have had water in their basements and some have bridges to their front doors. This neighborhood is only 11 feet above sea level. This neighborhood is particularly vulnerable when high tide on the Columbia coincides with high levels of runoff from the hillsides. The neighborhood has one privately owned dike that is approximately 3-4 feet high.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing flood mitigation strategies for a part of town that is flood prone can help reduce the number of flood insurance claims and property damage.

Ideas for Implementation:

- Determine which residents are located in the flood hazard area
- Incorporate flood preparedness and mitigation information in existing Fire Department and CERT outreach efforts.
- Develop outreach materials on flood preparedness.
- Determine if any home owners are interested in flood mitigation activities (e.g., elevation or acquisition).
- Work with County and State on developing specific funding packages for flood mitigation activities on private property.

Coordinating Organization:	Public Works/Community Development

Internal Partners:	**External Partners:**
	Clatsop County

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Conduct a seismic and flood vulnerability assessment of all critical facilities and infrastructure in the City	***Protect life*** ***Minimize damage to public and private buildings and infrastructure*** ***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to earthquakes and flooding. Portions of the city were built on fill, which makes any critical facilities and infrastructure located there particularly vulnerable.
- Staff has concerns about the wastewater system and lift stations around town being damaged and leading to public health emergencies following an earthquake. In addition, the water distribution system would likely be heavily damaged, preventing the delivery of water for fire suppression and domestic use.
- Only the newest buildings in the City have been built to earthquake standards. The majority of buildings, especially those located downtown, were built prior to the implementation of stricter building codes.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Having a better understanding of the risks that critical facilities and infrastructure face can help the city identify the most cost-effective mitigation strategies.

Ideas for Implementation:

- Identify the critical facilities and infrastructure needing to be assessed.
- Take a multi-hazard approach and assess both seismic and flood hazard issues.
- Utilize the statewide seismic vulnerability study completed by DOGAMI to determine whether or not K-12 education, community college and critical facilities require additional assessments
- Assess flood risk for Columbia Memorial Hospital
- Prioritize mitigation efforts for those facilities and infrastructure with poor assessments
- Identify funding sources for implementing those mitigation projects.
- Identify potential secondary hazard issues related to the earthquake hazard.

Coordinating Organization:	Public Works/Engineering

Internal Partners:	**External Partners:**
Community Development	Clatsop County, Clatsop County Community College, DOGAMI, School Districts, Hospital

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Continue efforts to replace aged bridges with newer structures.	***Minimize damage to public and private buildings and infrastructure Decrease disruption to critical services***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to earthquakes. Damage to bridges would impact transportation within the City. The City has taken efforts to replace aged bridges.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing mitigation actions for bridges can help ensure that vital transportation networks will be available for emergency services following a disaster.
- The City owns three bridges in town that are likely at risk – however, the City will be replacing one of them (Franklin Bridge) in the next 3-4 years. The loss of bridges may cut off certain areas of the community.
- Astoria is slated to replace the Franklin bridge in 2009 and the 19th and Irving bridge in 2013.

Ideas for Implementation:

- Continue bridge replacement efforts through Capital Improvements and other funding opportunities.
- Seek grant funding for local match.
- Explore opportunities for historic preservation funding for historic bridges
-

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Community Development	Clatsop County, Federal Highway Administration, Oregon Department of Transportation, State Historic Preservation Office.

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
On-going		

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Re-map the tsunami inundation hazard for the City of Astoria	***Increase education and awareness of the risks and hazards in Clatsop County***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to tsunamis from both near and distance sources. The existing tsunami inundation map was developed by DOGAMI in 1995.
- The Fire Department indicated that further studies were needed to better assess the tsunami inundation zone given new technology and wave height modeling software now available.
- The City's tourist based economy and population density are significant issues related to the tsunami hazard.
- City staff had concerns about community assets (including Police, Fire and Public Works facilities) located to the north of Marine Drive. Tsunami inundation maps indicate that this area is vulnerable to tsunami impact.
- Having a better understanding of where thee tsunami hazard is can help the city identify appropriate evacuation routes and education and outreach material.

Ideas for Implementation:

- Partner with DOGAMI to seek funding to update the 1995 map utilizing new modeling that has become available following the Indian Ocean tsunami in 2004.

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Community Development, Public Works	Clatsop County, DOGAMI

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	Alignment with County Goals:
Determine needs and issues related to tsunami warning systems.	***Protect Life***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to tsunamis from both near and distance sources. The existing tsunami inundation map was developed by DOGAMI in 1995. Relatively little has been done to develop, maintain and update tsunami warning systems within the City.
- Warning systems can help save lives during an incident.

Ideas for Implementation:

- Evaluate needs and issues related to tsunami warnings.
- Develop education and outreach to residents about what the tsunami warning system means and how they should respond.
- Improve reverse 911 capability
- Assess communication technology needs related to the warning system.
- Coordinate with Clatsop County to seek funding opportunities to implement a tsunami warning system.
- Consider an all-hazard approach to warning
- Improve reverse 911 capability

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Community Development, Police	Clatsop County, Oregon Emergency Management

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Implement an all-hazards education and outreach campaign	***Increase education and awareness of the risks and hazards in Clatsop County***

Rationale for Proposed Action Item:

- Astoria is at risk to a number of hazards that have the potential to impact people and property. Conducting education and outreach can help reduce the impact of these events on residents.
- On average, the City of Astoria loses power at least once a winter. Power outages can impact residents especially the elderly, who rely on electricity for heat and to power medical equipment.
- The Disaster Mitigation Act of 2000 requires communities to identify a comprehensive range of mitigation actions. Education and outreach can be an effective mitigation strategy.

Ideas for Implementation:

- Continue to use CERT to inform the public about natural hazards
- Provide literature through Community Development when residents pull building permits
- Utilize existing community events to disseminate information – Community Safety Fairs, Home & Garden Shows, etc.

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Community Development	Clatsop County, Oregon Emergency Management

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Identify areas where undergrounding utilities may be appropriate	***Decrease disruption to critical services*** ***Reduce economic loss***

Rationale for Proposed Action Item:

- On average, the City of Astoria loses power at least once a winter. Power outages can impact residents especially the elderly, who rely on electricity for heat and to power medical equipment.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing mitigation actions for utilities can significantly diminish the impact and damage from natural hazards.

Ideas for Implementation:

- Identify areas with the most storm related failure points
- Determine feasibility of requiring undergrounding of utilities at those failure points
- Underground the line to the reservoir

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
	Clatsop County, Pacific Power

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Complete LiDAR study to further delineate landslide hazards in Astoria	***Protect life*** ***Minimize damage to public and private buildings and infrastructure*** ***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- The City of Astoria has both a high probability and vulnerability to landslides.
- The Bond Street slide in 2006 damaged public infrastructure.
- Completing additional risk assessments on this hazard will allow the City to better understand the risk and direct development away from these areas.
- Since 1950, it is estimated that sixty to seventy homes have been seriously damaged by earth movement. The resulting cost to the various owners is estimated to be between $500,000 and $1,000,000. Cost of street and utility repairs is estimated to be over $2,000,000.
- City staff was concerned about water and transportation infrastructure related to the landslide hazard. The re-activation of the Bond Street slide disrupted water infrastructure. The water distribution system is the only water supply for fire protection. Many streets are located along the sides of hills within the city. These streets function as major arteries and also house water and sewer lines. This creates potential risk that could result in the inability to provide effective emergency services.
-

Ideas for Implementation:

- Complete DOGAMI LiDAR study
- Incorporate study information into the city's mitigation risk assessment
- Adopt revised development ordinance based on new study
- Conduct public education and outreach related to the study's findings.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Community Development	Clatsop County, DOGAMI

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Improve drainage in forested areas in higher elevations above the city to help reduce the potential for landslides	***Minimize damage to public and private buildings and infrastructure Decrease disruption to critical services***

Rationale for Proposed Action Item:

- The City of Astoria has both a high probability and vulnerability to landslides.
- Forested areas located at the top of the hill in Astoria may contribute to the risk of landslides. Improving drainage in these upper elevations will help alleviate the potential for landslides.
- Since 1950, it is estimated that sixty to seventy homes have been seriously damaged by earth movement. The resulting cost to the various owners is estimated to be between $500,000 and $1,000,000. Cost of street and utility repairs is estimated to be over $2,000,000.
- City staff was concerned about water and transportation infrastructure related to the landslide hazard. The re-activation of the Bond Street slide disrupted water infrastructure. The water distribution system is the only water supply for fire protection. Many streets are located along the sides of hills within the city. These streets function as major arteries and also house water and sewer lines. This creates potential risk that could result in the inability to provide effective emergency services.
-

Ideas for Implementation:

- Determine where it makes the most sense to implement drainage improvements
- Seek funding to implement drainage improvements
- Document lessons learned and successes of project.
- Work with FEMA to identify appropriate strategies and funding opportunities.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
	Clatsop County, FEMA

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	Alignment with County Goals:
Evaluate vulnerabilities of the water system (including the water pipes and dam) and mitigate to ensure disaster resiliency	***Minimize damage to public and private buildings and infrastructure Decrease disruption to critical services***

Rationale for Proposed Action Item:

- The City of Astoria has both a high probability and vulnerability to landslides.
- Current pipe system is vulnerable to failure following ground movement. In the last 10 years pipe material has become more resistant.
- Staff had concerns about the city's water distribution system pipe infrastructure which is comprised of mostly older materials - cast iron for water and vitrified clay and terra cotta for sanitary and storm sewer and the potential for loss of fire suppression water.
-

Ideas for Implementation:

- Identify critical locations for retrofits, based on either rate of failure or age.
- Evaluate best materials for given locations.
- Determine cost of upgrade
- Seek funding for pipe upgrades
- Document lessons learned and successes

Coordinating Organization:	Public Works

Internal Partners:	External Partners:
	Clatsop County, FEMA

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	Alignment with County Goals:
Maintain and enhance efforts around Community Emergency Response Teams (CERT).	***Protect life*** ***Increase education and awareness of the risks and hazards in Clatsop County***

Rationale for Proposed Action Item:

- The City of Astoria has an active CERT program.
- CERT can be an important resource before, during and after an incident.
- During the December 2007 storm, CERT was instrumental in getting out into the community to do damage reports. They also put a face to the City.

Ideas for Implementation:

- Increase CERT class offerings
- Increase recruitment of team members
- Seek funding to expand the program
- Target school and college staff to participate

Coordinating Organization:	Fire

Internal Partners:	External Partners:
	Clatsop County, Community College

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Identify shelter locations and adequate equipment and supplies in town.	***Protect life***

Rationale for Proposed Action Item:

- The City of Astoria does not have an emergency shelter located in town.
- The Middle School has been used, but it is also a back-up for the Hospital.
- Camp Rilea is the closest shelter, but requires Astoria residents to cross several bridges, which may not be useable.
- Staff raised concerns about emergency power for critical facilities such as shelters, schools, and the community college.
- Staff indicated that there is a need for heated emergency shelters that are available during extended cold weather events.
-

Ideas for Implementation:

- Partner with the American Red Cross to identify potential shelter locations.
- Talk with churches to gauge their interest in serving as a community shelter.
- Seek funding for backup power sources (also include costs for maintenance)
- Identify necessary shelter resources – back-up power, food, supplies, kitchen facilities, etc.
- Conduct education and outreach with the public to make them aware of shelter options in town.
- Develop a plan to distribute food

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Community Development	Clatsop County, Red Cross, Clatsop Community Action Team, Oregon Emergency Management, Public Schools, Churches

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Conduct fuel reduction in the City's watershed and urban forest	***Minimize damage to public and private buildings and infrastructure Protect natural and cultural resources***

Rationale for Proposed Action Item:

- The City of Astoria is at risk from wildfires, specifically in the City's forested watershed.
- Completing fuel reduction will help reduce the potential for large scale fires to impact the City and will also reduce the negative impacts wildfire can have on a watershed.
- City staff had concerns about a wildfire impacting the 3,700 acre watershed that is home to the city's water supply and located 12 miles east.
- The east end of the City is a large urban forest that creates the potential for interface fires.
- During August, September, and January, east winds can blow fires into the city.
- The urban interface has not yet been delineated, but will be completed s the County develops its CWPP.
-

Ideas for Implementation:

- Coordinate with the development of the County's Community Wildfire Protection Plan to ensure this action is also included in that plan.
- Identify high risk locations that would benefit from fuel reduction.
- Work with County and Oregon Department of Forestry to identify potential funding sources
- Conduct education and outreach about the effort.
- The City's Urban Forester would be responsible for determining and drawing up contracts for fuel reduction efforts

Coordinating Organization:	Fire/Public Works

Internal Partners:	**External Partners:**
	Clatsop County, Oregon Department of Forestry, Fire Defense Board, Office of State Fire Marshall

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Minimize risk in the City's wildland-urban interface.	***Minimize damage to public and private buildings and infrastructure Protect natural and cultural resources***

Rationale for Proposed Action Item:

- The City of Astoria is at risk from wildfires, specifically in the City's forested watershed.
- City staff had concerns about a wildfire impacting the 3,700 acre watershed that is home to the city's water supply and located 12 miles east.
- The east end of the City is a large urban forest that creates the potential for interface fires.
- During August, September, and January, east winds can blow fires into the city.
- The urban interface has not yet been delineated, but will be completed s the County develops its CWPP.

Ideas for Implementation:

- Coordinate with the development of the County's Community Wildfire Protection Plan to ensure this action is also included in that plan.
- Identify wildland urban interface locations within and adjacent to the city limits.
- Conduct education and outreach about the effort.
- Work with homeowners to encourage fire resistant building practices.

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Public Works, Community Development	Clatsop County, Oregon Department of Forestry, Fire Defense Board, Office of State Fire Marshall

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Reduce erosion on along Columbia River near the Aquatic Center and Seafood Center	***Minimize damage to public and private buildings and infrastructure*** ***Reduce economic loss***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to flooding. Portions of the city were built on fill, which makes any critical facilities and infrastructure located there particularly vulnerable.
- The Aquatic Center and Oregon State University Seafood Labs, located on the south side of Highway 30 are also vulnerable to flood waters.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing mitigation actions for flood hazards can significantly diminish the impact and damage from flooding on these properties.

Ideas for Implementation:

- Continue Public Work's annual maintenance of rip rap along seawall.

Coordinating Organization:	Public Works/Engineering

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Strengthen the high risk seismic deficiencies at Clatsop Community College's Towler Hall.	***Protect life*** ***Minimize damage to public and private buildings and infrastructure*** ***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- Towler Hall is critical to the campus history, operations and the community.
- Towler Hall has severe seismic deficiencies, has very high seismic risk, and is a high priority to the community and requires mitigation.
- Towler Hall is a 41,433 gross square foot building centrally located within the City of Astoria at an elevation of 271 feet.
- The building could serve as a coordinating point for services in the event of a disaster given its central location and elevation above sea level.

Ideas for Implementation:

- Plans include a complete renovation of this facility. Specific seismic strengthening would include new shear walls with foundations, floors and roof tied to exterior walls, drag struts at floors and roof to transfer seismic forces from the diaphragms to shear walls and addition of plywood sheathing to strengthen roof diaphragm and attic below.
- Exterior access to the building will be improved.

Coordinating Organization:	Clatsop Community College

Internal Partners:		**External Partners:**
		City of Astoria (Community Development, Emergency Services, Public Works), Clatsop County, Oregon Emergency Management, Federal Emergency Management Agency, DOGAMI
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
0-1.5 years, expected start date 2010		

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Assess seismic vulnerability to hazardous materials sites	***Minimize damage to public and private buildings and infrastructure Decrease disruption to critical services***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to earthquakes. Portions of the city were built on fill, which makes hazardous materials storage facilities vulnerable for secondary hazards following an earthquake.
- Within the city, 8 private properties have hazardous materials on-site.
- Public Works has three sites
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Addressing hazardous materials locations can help minimize secondary hazards following a disaster.

Ideas for Implementation:

- Complete seismic vulnerability assessments on hazardous materials storage sites to identify potential mitigation strategies.
-

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Public Works	Office of State Fire Marshall

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Relocate Public Work's Facilities	***Minimize damage to public and private buildings and infrastructure Decrease disruption to critical services***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to earthquakes. The current Public Works facility is vulnerable to earthquakes and is located on fill and is therefore, also vulnerable to liquefaction. The Public Works facility is located on Highway 30 across from the Fire Station at 30th.
- City staff had concerns about community assets (including Police, Fire and Public Works facilities) located to the north of Marine Drive. Tsunami inundation maps indicate that this area is vulnerable to tsunami impact.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Relocating critical facilities out of hazard areas will help ensure that essential city functions can continue following a disaster.

Ideas for Implementation:

- Identify alternative sites to relocate Public Works outside of hazard areas
- Seek funding to relocate facility

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
	Oregon Emergency Management

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Improve public communication infrastructure so that it is less vulnerable	***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- During the December 2007 windstorm, communications were problematic
- Communication is vulnerable during earthquakes, tsunamis and wind and winter storms.

Ideas for Implementation:

- Partner with the County on communication projects
- Combine 911 dispatch with the County
- Support efforts to harden the Wikiup repeater

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Police	Clatsop County, Oregon Emergency Management, Other County Fire and Police

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Acquire a Fire Boat	***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- During an earthquake or tsunami, Astoria Fire may not be able to access all fire vehicles. Having a fire boat would allow the City to provide fire protection from the river.
- A fire boat would also allow for adequate water pressure if water pipes are damaged.
- The Coast Guard has very limited capacity in this area and they can't fight fires on boats.

Ideas for Implementation:

- Explore funding sources – Assistance to Firefighters Grant through FEMA
-

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

Proposed Action Item:	**Alignment with County Goals:**
Relocate Astoria Fire Department	***Minimize damage to public and private buildings and infrastructure Decrease disruption to critical services***

Rationale for Proposed Action Item:

- Astoria's location on the Oregon Coast makes it susceptible to earthquakes. The Fire Department is currently a shared facility with Police. The building is vulnerable to both earthquake and tsunami and would be limited following an event due to bridge access. The facility is built on pilings.
- The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address existing buildings and infrastructure [201.6(c)(3)(ii)]. Relocating critical facilities out of hazard areas will help ensure that essential city functions can continue following a disaster.
- City staff had concerns about community assets (including Police, Fire and Public Works facilities) located to the north of Marine Drive. Tsunami inundation maps indicate that this area is vulnerable to tsunami impact.
-

Ideas for Implementation:

- Identify suitable locations closer to the city center and outside of the tsunami inundation zone.
- Seek funding to pay for the relocation
-

Coordinating Organization:	Fire

Internal Partners:	**External Partners:**
Community Development	

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	

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City of Cannon Beach

Natural Hazards Mitigation Plan Addendum

APRIL 2015

City of Cannon Beach
163 E. Gower
Cannon Beach, OR 97110

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Volume 3: City Addendum
City of Cannon Beach

Overview

The City of Cannon Beach developed this addendum to the Clatsop County multi-jurisdictional Natural Hazards Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Cannon Beach, Oregon, which include: coastal erosion, drought, earthquake, flood, landslide, tsunami, volcano, wildfire, windstorms and winter storms. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the City. With careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

This report provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, development of partnerships, and the implementation of preventative activities such as land use or watershed management programs, hardening community facilities and infrastructure, pre-deployed emergency supplies and evacuation sites. The actions described in the addendum are intended to be implemented through existing plans and programs within the City.

The addendum is comprised of the following sections:

1. How the addendum as developed page 1

2. Community Profile page 8

3. Risk Assessment page 20

4. Action Items page 34

2013 Plan Update

Historical Report Development Process

2006-2007 Planning Process

In Fall 2006, the Oregon Partnership for Disaster Resilience (OPDR/The Partnership) at the University of Oregon's Community Service Center partnered with Oregon Emergency Management (OEM) and Clatsop and Lincoln counties to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined The Partnership by signing (through their County Commissions) a

Memorandum of Understanding for this project. FEMA awarded the Oregon Coast Region a grant to support the development of the natural hazard mitigation plans for the two counties and the cities therein. The Partnership, OEM, and the participating communities were awarded the grant in the Fall of 2006 and local planning efforts in this region began in the Fall of 2007.

The Columbia River Estuary Studies Taskforce (CREST) was hired by Clatsop County to lead the development of the County's Multi-Jurisdictional Plan. A graduate student with OPDR assisted CREST with data collection and plan writing to support the development of the County's Community Overview and Risk Assessment as well as similar components for the city addenda. Two representatives from Cannon Beach served on the Countywide Steering Committee that helped guide the development of the County's Plan. Representatives included Rich Mays, City Manager, and Cleve Rooper, Fire Chief of the Cannon Beach Rural Fire Protection District (RFPD). Cannon Beach's City Planner (Rainmar Bartl) and Public Works Director (Mark See) assisted in drafting the Cannon Beach Addendum. City specific work sessions with Rich Mays and Cleve Rooper facilitated the Addendum's development.

Cannon Beach has conducted annual forums at the Coaster Theater to both educate the public to the tsunami threat and to gather public input. These take place in April or May each year. In early 2006, many civic and community leaders met to discuss long-term disaster recovery planning under the guidance of the Oregon Partnership for Disaster Resilience. The Cannon Beach Emergency Preparedness Committee meets monthly, in public, to discuss disaster preparedness. This committee also held neighborhood-specific meetings in 2001 to detail evacuation routes and procedures for each area of the city. Following the windstorm of December 2007, a public meeting was held at the Coaster Theater to gather feedback from the public regarding the local response to the incident.

Historical Report Development Process

All of the below listed processes and outcomes have provided input used to prepare this report for inclusion in the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan.

2008 Planning Process

1. Cannon Beach has conducted annual forums at the Coaster Theater to both educate the public to the earthquake / tsunami threat and to gather public input. These forums or outreach efforts take place at least twice a year.
2. The Cannon Beach Emergency Preparedness Committee meets monthly, in public, to discuss disaster preparedness.
3. As a result of the 2007 public meeting held at the Coaster Theater to gather feedback regarding local response and community preparation for natural hazards a Post Emergency Recovery Committee (PERC)

was formed. The PERC Committee membership included:
   a. Rich Mays (Cannon Beach City Manager),
   b. Cleve Rooper (Fire Chief of the Cannon Beach Rural Fire Protection District (RFPD)
   c. Gene Halliburton (Cannon Beach Chief of Police)
   d. Les Wierson (Cannon Beach EPREP Committee)
   e. Mark See (Cannon Beach Public Works Director)
   f. Mark Brien (Cannon Beach Building Inspector)
4. Committee natural hazard mitigation projects for City Council review are introduced to the to the council by the City Manager. The City Council considers the project and either approves or send the project back to committee for further development.

2008 Mitigation Activities Completed

1. Completed the first phase automatic (dual fuel) emergency generator install. These two generators service City Hall and the Police Department.
2. Purchased two portable HAM radios and three public works staff were certified as HAM radio operators.
3. Shelter Committee completed the following emergency management projects:
   a. Volunteer training,
   b. Installed additional emergency stock shelving,
   c. Replaced existing food stocks and increased stocks through donations and increased purchasing.
   d. Purchased and installed and emergency generator (15 KVW) for lighting and kitchen electrical needs.
4. Consolidated 911 operations from a stand-alone to an integrated system with Seaside 911.
5. Completed initial "S" stabilization work to reduce risk of landslides that could interfere with utility lines in the Hemlock Street right-of-way. (Note: This mitigation project requires ongoing maintenance)

2009 Planning Process

1. Cannon Beach has conducted annual forums at the Coaster Theater to both educate the public to the tsunami threat and to gather public input. These take place in April or May each year.
2. The Cannon Beach Emergency Preparedness Committee meets monthly, in public, to discuss disaster preparedness.
3. The PERC Committee meets on a monthly basis.
4. The City Council meets at least once a month.

2009 Mitigation Activities Completed

1. Constructed and outfitted the Old Cannon Beach Road (north city) emergency cache site with water and protein bars.
2. Completed the City Center waste-water lagoon pedestrian path

connecting Monroe Street and 2nd Street for to facilitate city evacuation.
3. Pacific Power and Public Works cleared and widened the main electrical power corridor between the City and Highway 26 of trees that could interfere with power lines within the power corridor.
4. Basic Spanish was offered to interested city staff and seven employees were trained in Spanish for emergency translation or direction purposes.
5. Purchased and installed a portable diesel emergency generator (30 KVA) for the waste water plant.

2010 Planning Process

1. Cannon Beach has conducted annual forums at the Coaster Theater to both educate the public to the tsunami threat and to gather public input. These take place in April or May each year.
2. The Cannon Beach Emergency Preparedness Committee meets monthly, in public, to discuss disaster preparedness.
3. The PERC Committee meets on a monthly basis.
4. The City Council meets at least once a month.

2010 Mitigation Activities Completed

1. Cannon Beach commissioned a Tsunami Inundation and Evacuation Study that began in 2010 and was completed in late 2011. Tappister developed a comprehensive tsunami evacuation simulator for Cannon Beach. Several simulations were run for a tsunami event originating from the Cascadia Subduction Zone. Results showed the following:
    a. 11% reduction in fatalities if a tsunami evacuation building (TEB) at the present City Hall.
    b. Proper construction of a earthquake hardened bridge across Ecola Creek at the site of the current roadway bridge could reduce fatalities by 55%; however it was found the bridge must be constructed with sufficiently high elevation.
    c. A TEB at an alternate location near the intersection of Washington and Spruce St. is more effective that at City Hall: such a TEB could reduce fatalities by 65%.
2. A geological technical study was commissioned to study the feasibility of locating a TEB at the City Hall location. It was determined the maximum supporting infrastructure required was cost prohibitive.
3. The Radar Road connection project was completed. This project allowed those who live north of Ecola Creek an exit to US 101.
4. Constructed and outfitted the Tolovana (south city) emergency cache site with water and protein bars.
5. Added two excess property emergency generators (100 KVW & 60 KVW) to power Ecola Lift Station.

2011 Planning Process

1. Cannon Beach has conducted annual forums at the Coaster Theater to

both educate the public to the tsunami threat and to gather public input. These take place in April or May each year.
2. The Cannon Beach Emergency Preparedness Committee meets monthly, in public, to discuss disaster preparedness.
3. The PERC Committee meets on a monthly basis.
4. The City Council meets at least once a month.

2011 Mitigation Activities Completed

1. Tsunami evacuation routes posted and completed.
2. OBEC Study for the feasibility of a footbridge across Ecola Creek.
3. Hired Emergency Management consultant
    a. Evaluate and update Emergency Operation Plan
    b. Train City employees, volunteers and citizens
        i. ICS 100
        ii. ICS 200
        iii. EOC
        iv. Tabletop exercises (4)
            1. Wind
            2. Flood
            3. Earthquake/Tsunami (2)
4. Upgraded the Ash Street water boost pump station generator.
5. The City of Cannon Beach held a Community Forum: Cascadia Event Preparedness, at the Surf Sand Ballroom to discuss eight (8) potential alternatives for Cannon Beach to facilitate the City in emergency preparedness.
6. An outcome of the Cascadia Preparedness Community Forum and the tabletop exercises the City began a Pre-Deployed Cache Container Project.
7. Completed tide gate upgrade protecting city businesses from tidal flooding and storm water runoff.

2012 Planning Process

1. Cannon Beach has conducted annual forums at the Coaster Theater to both educate the public to the tsunami threat and to gather public input. These take place in April or May each year.
2. The Cannon Beach Emergency Preparedness Committee meets monthly, in public, to discuss disaster preparedness.
3. The PERC Committee meets on a monthly basis.
4. As a result of the Pre-Deployed Container Program a sub-committee to PERC was formed. The PreCon sub-committee membership included:
    Rich Mays (Cannon Beach City Manager)
    Bill Vanderberg (Emergency Management Consultant)
    Mark See (Public Works Director)
    Matthew Gardner (Cannon Beach Rural Fire Protection District)
    Bill Brehm (Cannon Beach EPREP)
    Doug Wood (Cannon Beach EPREP)
    Les Wierson (Cannon Beach EPREP)

Bob Mushen (Cannon Beach EPREP
Jason Schermerhorn (Cannon Beach Police Chief)
Sam Steidel (Cannon Beach City Council)

2012 Mitigation Activities Completed

1. Pre-Deployed Cache Container project completed.
2. Located an Evacuation Site (cache container) branch within the Cannon Beach ICS.
3. The PERC/PreCon Committee began a six-step strategic plan for 2012-13 focusing on:
    a. Training and education,
    b. Volunteer recruitment,
    c. Pre-Deployed cache container expansion,
    d. Program marketing and
    e. Post Cascadia Subduction Zone event emergency management preparedness.
4. Developed a graphic concept of operations that explains the orderly flow of survivors from:
    a. Location within the City,
    b. Assembly areas,
    c. Evacuation site.
5. Opened cache container site for citizen storage of personal cache containers.
6. Established a Family Cache Container newsletter to inform and educate citizens as to community progress and future emergency management events concerning the cache container program. There were 12 family cache container updates in 2012.
7. Purchased and installed a diesel emergency generator (30 KVW) to power the Elkland lift pump station.
8. Conducted weekly evacuation route walks from various points within the City to all ten assembly areas.
9. Van Buren Foot Path completed allowing for quicker access to assembly areas.
10. Completed Ecola Creek diking inspection for stability and hardened for seismic stability.
11. Coaster Construction remodeled shops and offices to serve as an evacuation site. In addition, stored tents, food, water and added a dual fuel emergency generator (30 KVW).
12. Implemented and continue to update a "wiki" which is a vehicle for internal and external cache container education, volunteer recruitment, training and information exchange.
13. Conducted two community outreach events. Each focused on cache container education, cache container sign-ups, evacuation map updates and explained the City operations plan.

2013 Planning Process

1. Cannon Beach has conducted annual forums at the Coaster Theater to

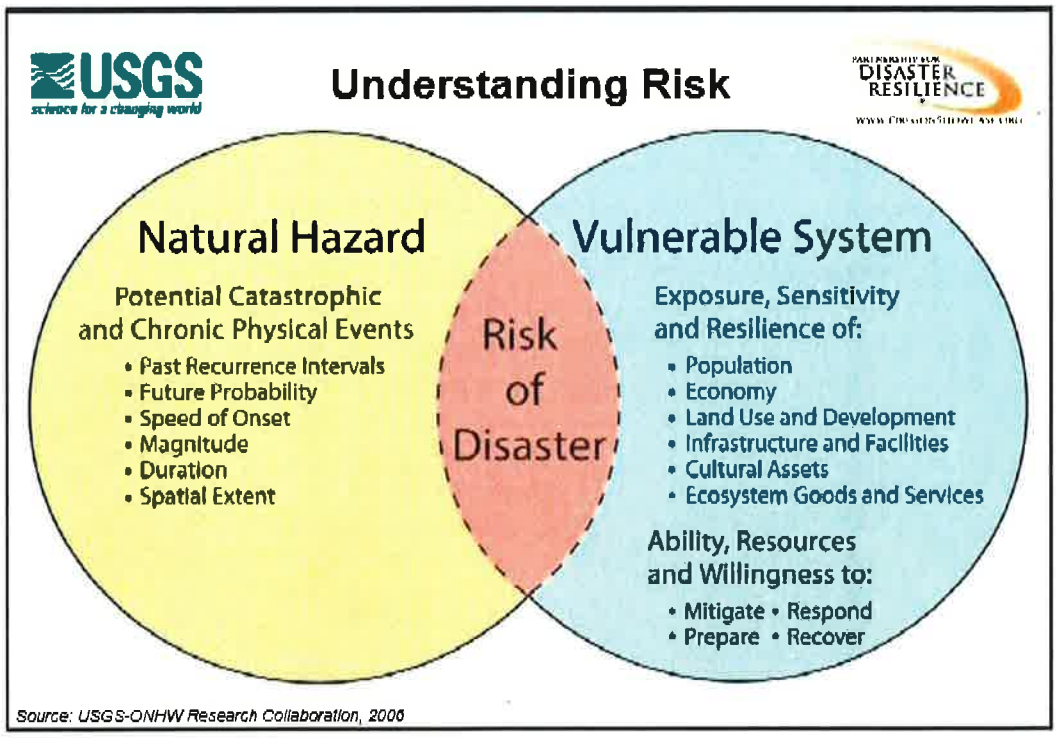
both educate the public to the tsunami threat and to gather public input. These take place in April or May each year.
2. The Cannon Beach Emergency Preparedness Committee meets monthly, in public, to discuss disaster preparedness.
3. The PERC Committee meets on a monthly basis.
4. The PreCon Committee meets on a bi-weekly basis
5. The City Council meets at least once a month.

2013 Mitigation Activities Completed

1. The Family Cache Container newsletter program continues to update citizens as program progress. There have been 8 family cache updates in 2013.
2. Closed the Cannon Beach Elementary School.
3. Implemented the PERC/PreCon Oregon Unlimited digital forum for information exchange and project management.
4. Implemented a Business Training Program for local business evacuation to assembly areas.
5. Completed a Cascadia Subduction Zone Tabletop Exercise focused on the initial reaction phase.
6. Completed a Cascadia Subduction Zone Communications Functional Exercise.
7. Trained 15 citizens in Red Cross shelter operations.
8. Completed a Cascadia Subduction Zone Tabletop Exercise focused on response phase evacuation site setup and shelter operations.
9. Purchase a BGAN Satellite Internet receiver for communications.
10. Developed a community-training framework to include CERT, Red Cross and a Cannon Beach Basic Operations training program.
11. Created an evacuation-site leader operations guide.
12. Completed orders for all evacuation site Tourist/Employee/Visitor kits. These individual kits include food and water for four days plus a shelter system consisting of a tube tent, space blanket and rain proof poncho.
13. Developed and implemented a marketing media pamphlet for community cache container education.
14. Earth Week event that consisted of the following:
    a. A cache container booth for education and volunteer recruitment.
    b. A shuttle to evacuation sites for community education.
15. Opened cache container site for citizen storage of personal cache containers.
16. Completed two educational community outreach events focused on cache containers and emergency evacuation.
17. Implemented an emergency management innovation queue. Where new technology is reviewed, quantified and a cost benefit analysis is accomplished prior to placement in the queue. Once funds become available PERC/PreCon review the prioritized items for purchase.

Community Profile

The following section describes the City of Cannon Beach 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 in this section represents a snapshot in time of the current sensitivity and resilience factors in the City when the plan was developed. The information documented below, along with the hazard assessments should be used as the local level rationale for the risk reduction actions identified in this addendum. The identification of actions that reduce the City's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 2.1 below.



Geography & Climate

The City of Cannon Beach is located on the Oregon Coast 80 miles west of Portland and 25 miles south of Astoria (Figure 2.2). Ecola Creek runs through the northern

part of the town and empties into the Pacific Ocean. Cannon Beach's urban growth boundary contains 1.4 square miles (890 acres).

The climate in the City of Cannon Beach is considered moderate. During the summer and winter, temperatures tend to be in the 60s and 40s, respectively (Table 2.1). September is the warmest month with an average maximum temperature of 70°F, while the coldest month of the year is December with an average minimum temperature of 38 °F (Table 2.1). The City receives approximately 75.74 inches of precipitation annually, mostly in winter. Monthly precipitation ranges from a maximum of 11.38 inches in November to 1.34 inches in September (Table 2.2).[ii]

Figure 2.2 Map of Cannon Beach

Source: Yahoo Maps

Table 2.1 Average Temperature in Cannon Beach, OR

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max °F	52	54	56	58	62	65	68	69	70	64	56	52	60.5
Mean °F	45	47	48	50	54	58	60	61	60	55	49	45	52.7
Min °F	38	39	40	42	46	50	53	53	50	46	42	38	44.8

Source: weather.com 2013

Table 2.2 Average Precipitation in Cannon Beach, OR

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Inch	10.8	8.75	8.75	5.91	4.08	3.10	1.45	1.39	2.44	6.52	11.80	10.55	75.54

Source: weather.com City monthly averages 2013

Knowledge of geographic factors like soil types can help identify areas vulnerable to natural hazards, specifically landslides and earthquake related hazards such as liquefaction, and can assist in mitigation planning. The types of soil found in Cannon Beach can be characterized as being sedimentary rocks, mudstones, siltstones, clay stones, silt clay and basalts. The majority of soil types in the City have a potentially moderate to severe erosion hazard (K= 0.02-0.37).[iii] Other soils are poorly drained and are subject to flood hazards.

Population & Demographics

Cannon Beach is know as a resort area and hosts over 750,000 visitors annually. Cannon Beach was first incorporated as a City in 1957, but was settled before that by native cultures, and, since the late 1800s, by American settlers.[iv] In 2010, the City was home to 1,692 permanent residents, which made up approximately 4.5% of Clatsop County's total population.

Table 2.3 Population Growth, City of Cannon Beach, 1990-2010

Census	Population	Percent Change
1990	1,221	2.90%
2000	1,588	30.10%
2010	1,692	6.54%

Source: City of Cannon Beach <http://www.ci.cannon-beach.or.us/docs/census.pdf>

The impact 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 Cannon Beach's residents fall into these special needs populations.

According to the US Census, 13% of the City's population speaks a language other than English at home.

Table 2.4 Population by Age, City of Cannon Beach, 2010

	Year			
	2000		2010	
Age	Number	Percent	Number	Percent
Under 5 years	79	5%	79	5%
5-19 years	292	18%	292	18%
20-44 years	442	28%	442	28%
45-64 years	510	32%	510	32%
65+ years	265	17%	265	17%
Median Age	43	3%	43.7	3%

Source: US Census, 2010

Employment & Economics

As of 2010, 23% of Cannon Beach's employed population was employed in "Arts, entertainment, recreation, accommodation and food services," 17% in "retail trade," and 2% in "educational, health and social services" (Table 2.7). This is expected given Cannon Beach's reliance on the tourism industry. The top five employers in Cannon Beach are Martin Hospitality (Tourist Facilities – 240 employees), Cannon Beach Conference Center (80 employees), Hallmark Resort (50 employees) and the City of Cannon (30 employees).

Table 2.7 Employment by Industry, City of Cannon Beach, 2010

Industry	Percent
Arts, entertainment, recreation, accommodation and food services	23%
Retail trade	17%
Educational, health and social services	2%
Professional, scientific, management, administrative, and waste Management services	16%
Finance, insurance, real estate and rental and leasing	14%
Construction	5%
Other services (except public administration)	4%
Manufacturing	6%
Public administration	2%
Wholesale trade	0%
Transportation and warehousing, and utilities	2%
Agriculture, forestry, fishing and hunting, and mining	3%
Information	6%

Source: US Census, 2010

Median income can be used as an indicator of the strength of the region's economic stability. In 1999, the median household income in Cannon Beach was $39,271. This is nearly $3,000 below the 1999 national median household income of $41,994, but almost $3,000 above the $36,301 median household income for Clatsop County. Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Housing

Housing type and year-built dates 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 homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above Base Flood Elevation.

In 2000, the City of Cannon Beach had 1,641 housing units. Of those, 26.4% (433) were owner occupied, 16.9% (277) were renter occupied, and 56.7% were vacant (931). 86.9% (849) of the vacant housing units are for seasonal or recreational use.[ix] Around 53% of the City's housing stock was built prior to 1980, before stronger seismic building codes were put into place. Other housing characteristics for Cannon Beach are provided in Tables 2.8 and 2.9 below.

Table 2.8 Housing Type, City of Cannon Beach, 2000

Housing Type	Percentage
Single-Family	**83.4%**
Multi-Family	**15.4%**
Mobile Home	**1.1%**
Boat, RV, Van, Etc.	**0.1%**

Table 2.9 Housing Structure Age, City of Cannon Beach, 200

Year Built	Percent of Structures
1980-2000	47%
1960-1980	18.7%
Before 1960	34.3%

Source: US Census, 2000

Land Use & Development

Development in Cannon Beach is primarily residential with a significant mixture of tourist accommodations, and is located between the Pacific Ocean and Highway 101 (Figure 2.3). Most of the housing is located between the coast and Hemlock Street, the main road through Cannon Beach that connects to Hwy 101. According to the Cannon Beach Comprehensive Plan (2010), there were 236 undeveloped single-family lots within the City Limits. Within the UGB there were an additional 102 lots available, resulting in 338 potential lots available for construction. [x]

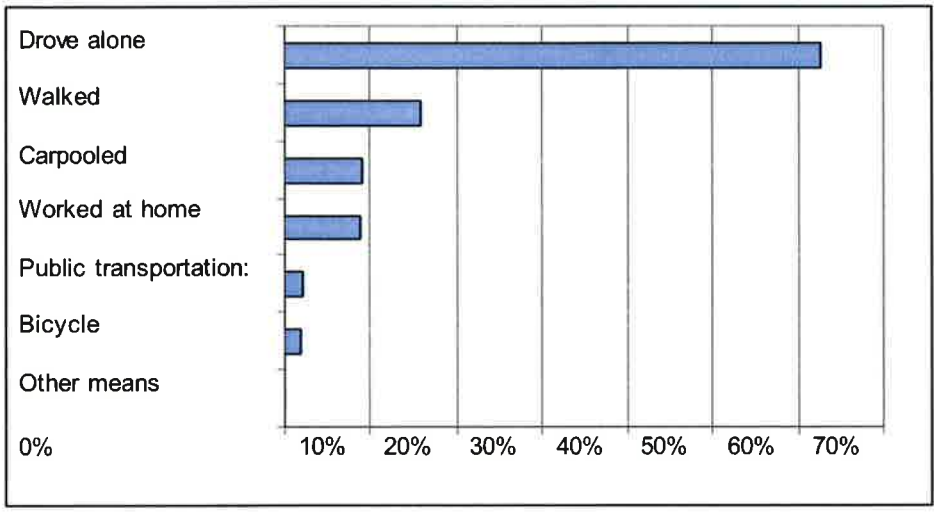
Cannon Beach also has a central business district that contains retail shops, restaurants, and other commercial buildings and hotels. There are two other commercial areas, Midtown and Tolovana Park, which also contain a mixture of commercial uses, including hotels. The oceanfront is a mixture of dwellings.

Transportation & Commuting Patterns

One major transportation route runs past Cannon Beach - Federal Highway 101. The major arterial going through Cannon Beach, Hemlock St., connects to Highway 101 on its northern and southern ends. U.S. Highway 101 connects Cannon Beach with Astoria and Washington to the north and Newport and California to the south. There is access to State Highway 26 approximately four miles north of Cannon Beach, which is the main east- west route between the Pacific coast and Portland. Figure 2.3 is a map detailing the transportation routes in Cannon Beach.

Transportation is an important consideration when planning for emergency service provisions. Growth within the City will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles. How people travel to work is indicative of the prevalence of single occupancy vehicle travel, and can help predict the amount of traffic congestion and the potential for accidents. Figure 2.4 represents the different methods city residents use to travel to work.

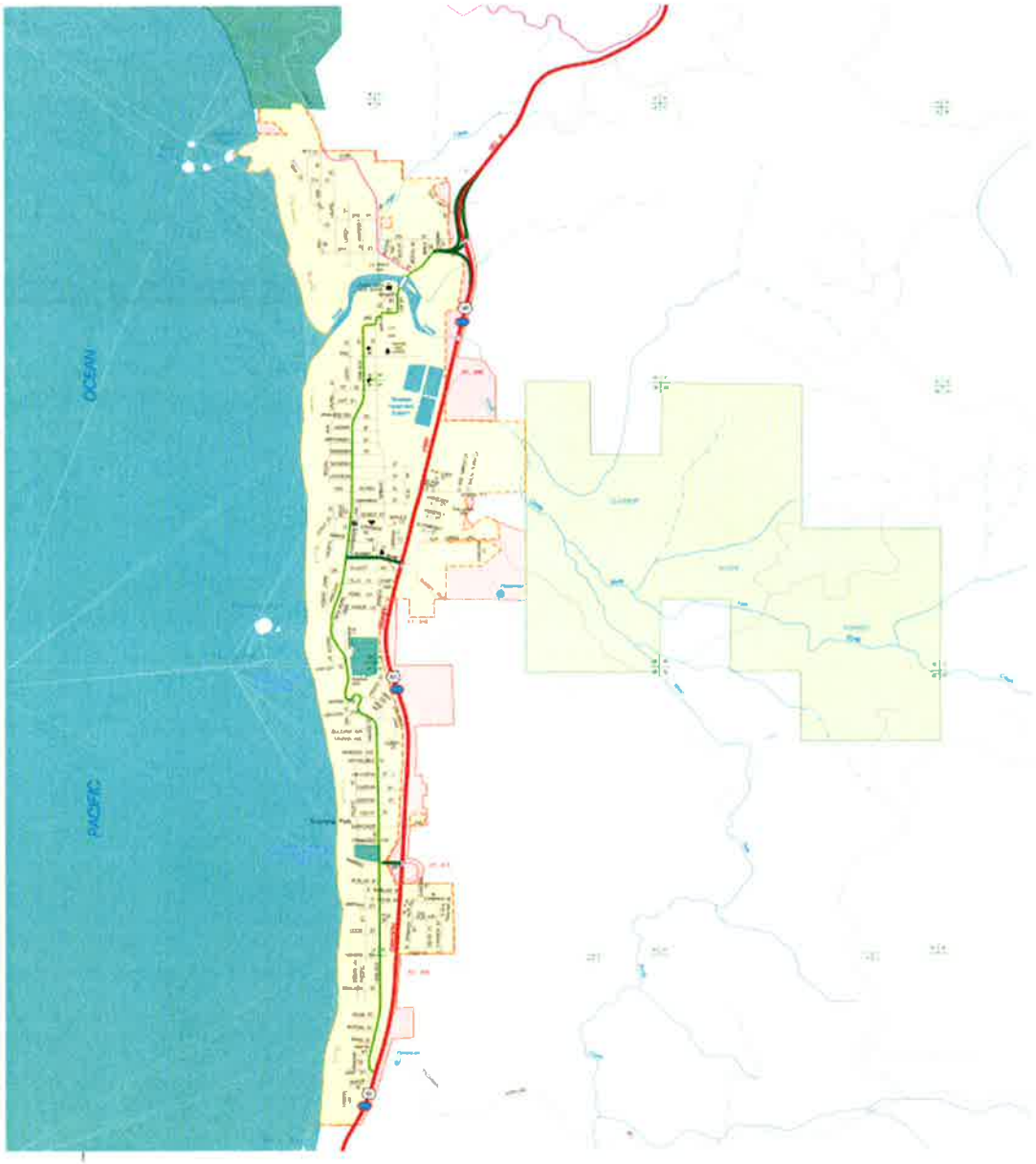
Figure 2.4 Transport Mode Used to Commute to Work in Cannon Beach



Source: US Census, 2000

Currently, Cannon Beach is served by the "Blue Star Fish Route" of the Sunset Empire Transportation District. The bus travels to various locations within Cannon Beach seven days a week and connects with other bus routes that go to Seaside, Gearhart, Warrenton and Astoria. The bus runs hourly from approximately 9AM to 6PM.[xi]

Figure 2.3 Transportation Map of Cannon Beach



Source City of Cannon Beach <http.www ci.cannon-beach. or.us/docs/News/CannonBeach2006.pdf>

Critical Facilities & Infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. Individual communities should inventory their critical facilities to include locally designated shelters and other essential assets, such as fire stations, and water and waste treatment facilities.

According to the Cannon Beach Case Study Report, the City of Cannon Beach owns its drinking water system and waste management facilities. Pacific Power Company supplies electricity to the City, and Northwest Natural Gas provides the natural gas service. Other utilities include telephone services, provided by CenturyLink, and data lines, provided by Charter Communications.

The Providence North Coast Clinic is located in downtown Cannon Beach. This facility offers a limited range of medical services. The closest hospital is located in Seaside, 11 miles north of Cannon Beach. Columbia Memorial Hospital is located 24 miles to the north in Astoria. Also, the Cannon Beach Fire Protection District has two main stations, the Cannon Beach Station and the Arch Cape Station. Cannon Beach also has one police station. There is currently no active school in the City of Cannon Beach. For elementary, middle, and high school, Cannon Beach students attend schools located in Seaside.

Historic & 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. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

The National Register of Historic Places lists four historic sites within the City of Cannon Beach. These sites include 3 Native American Archeological Sites - Bald Point, Ecola Site and Indian Creek Village Site – and the Oswald West Coastal Retreat.

Cannon Beach is also a major tourist destination. For outdoor recreation, there is Ecola State Park, Ecola Point, Haystack Rock and the Coast Range. There is also a hiking trail from Ecola Point to Indian Beach, and another trail that leads to Tillamook Head. Cannon Beach also hosts a number of festivals every year that draw thousands of tourists. These festivals include the Stormy Weather Art Festival and Haystack Holidays in November and December along with Sandcastle Day in June.[xiv]

Government Structure

According to the City Charter, Cannon Beach has a council composed of a mayor and four councilors elected from the City at large. The councilors serve four-year terms with two of the councilors being elected in biennial elections. The mayor is elected for four-year terms. The council appoints a City Manager, City Attorney, and Municipal Judge. The City of Cannon Beach currently has the following departments: [xvi]

Administration: The Administration Department of City Hall is responsible for all

the City's general governmental functions: financial planning and budgeting; accounts receivable, payable, and payroll; building maintenance; public contracts; meeting agendas and minutes; legislation; records retention; community services; personnel; and information technology planning and implementation. The Administration Department also administers the City's Municipal Court.

Building: The Building Department provides plan review for construction and remodeling plans for buildings within the City limits. This plan review, along with subsequent structural, plumbing and mechanical inspections, assures compliance with state building codes.

Planning: The Planning Department prepares short-term and long-term recommendations for land use in compliance with City and State policies, and implements adopted development goals and visions for the community. Planning Department Staff support the Planning Commission and the Design Review Board; provide land use and planning assistance to residents and property owners, and coordinates with other departments on related issues.

Public Works: The Public Works Department plans, organizes, integrates and directs the programs and maintenance functions of the City's water treatment and distribution system, roads and streets, wastewater treatment plant and wastewater collection system, storm water, and parks and community services, to ensure the safe and ongoing operations of the City's utility systems and services and overall infrastructure.

Public Safety: The Public Safety Department is dedicated to providing services which improve quality of life by protecting life and property, maintaining order, and reducing crime and disorder through education and prevention. The Public Safety Department consists of two components:

- The Cannon Beach Police Department consists of seven sworn members and three administrative/support members. The department provides service seven days a week on a 24-hour basis. In addition to responding to emergency and non-emergency calls for service, the department provides patrol and investigative services.
- The Community Policing Team was established for the purpose to encourage and expand citizen participation in public safety and welfare issues. The team is a collaboration of law enforcement and community members working to protect and improve the quality of life in the community.

Existing Plans & 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.

The City of Cannon Beach's Addendum to the Clatsop County multi- jurisdictional Natural Hazards Mitigation Plan 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 helps identify what resources already exist that can be used to implement the action items identified in the Plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the City's resources.

The following table documents the plans and policies already in place in Cannon Beach.

Table 2.10 Existing Plans, City of Cannon Beach

Parking and Traffic Management Plan	Updated Annually	City of Cannon Beach	This plan addresses specific issues concerning parking and traffic in Cannon Beach
Cannon Beach Municipal Code	updated continuously	City of Cannon Beach	The Code covers such things as fees, zoning, construction, traffic laws, utility guidelines, and taxes. It also dictates powers held by governing bodies. It provides a framework for regulation on many issues.
Cannon Beach Municipal Code: Chapter 17, Zoning Ordinance of Cannon Beach, Oregon	January-08	City of Cannon Beach	Chapter 17 is the Zoning Ordinance for the City of Cannon Beach. The zoning ordinance chapter sets up and encourages standards for development throughout the City
Ecola Creek Forest Management Plan		City of Cannon Beach	Cannon Beach owns the 220-acre Ecola Creek Forest Reserve. The City's largest source of drinking water exists here, along with its water treatment facility. This plan lays out strategies for the protection of the City's drinking water source.
Cannon Beach Emergency Management Plan	January-06	City of Cannon Beach	This document is an inventory of the different procedures that the public agencies will follow in a disaster evenly. The primary focus of this document is the immediate response during the 72 hours following the disaster.

City of Cannon Beach Residential Building Permit and Zoning Information	May-08	City of Cannon Beach Planning Department	This manual is designed to provide individuals with information about building permit and zoning

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 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 Countywide Community Organizations and Programs table can be found in Section 2: Community Overview of the Clatsop County Multi- Jurisdictional Natural Hazard Mitigation Plan. The table highlights organizations that are active within the County and may be potential partners for implementing mitigation actions.

Existing Mitigation Activities

Existing mitigation activities include:

- "S-Curve" stabilization maintenance; a drainage improvement project aimed at stabilizing the windy section of roadway that separates Cannon Beach from Tolovana Park, the two primary sections of the City (winter storm, flooding, earthquake, landslide).
- Emergency Preparedness Committee; a citizen committee tasked with developing evacuation routes and providing signage for the routes, and keeping the public educated as to the hazard.
- Prepare for Emergency Recovery Committee (PERC) meets periodically with the goal of caching adequate shelter, food, water, survival blankets, etc. to meet the needs of residents and visitors following a severe earthquake/tsunami event.
- Shelter Committee; a group dedicated to the staffing and operation of community shelter sites when disaster disrupts normal community services (multi-hazard).

- Resilience Committee; a group of community leaders working to develop a plan for getting the community back to economic stability following a major disaster (multi-hazard).
- Emergency Helipad; the City has graded and maintained a large clear area suitable for landing large military helicopters should they be needed to bring in relief supplies and transport out the sick and injured. This project is 90% complete. (multi-hazard).
- Setup a reserve fund for matching monies to upgrade or replace the Ecola Creek Bridge on Fir Street (earthquake / tsunami).

- Cannon Beach is currently addressing ODOT with its concerns concerning seismic upgrades for the following bridges; 1) Highway 101 overpass at Warren Way (MP 30.3); 2) Hwy 101 overpass at Sunset Blvd. (MP 29.5); and 3) Hwy 101 at Ecola Creek Bridge. Each of these bridges is in the statewide bridge sufficiency-rating plan (earthquake).

- Conduct a seismic evaluation of the City water treatment plant and make any necessary upgrades required to ensure continuity of operations following a severe earthquake (earthquake).

- Held annual public educational forums regarding Cascadia Subduction Zone Earthquakes and subsequent tsunamis (see Emergency Preparedness Committee above).

- Disaster Medical Supplies; purchased and cached trauma supplies at various locations in the City. The Clatsop County Health Department has also staged disaster supplies (multi-hazard) in the Cannon Beach Fire Station.

- Red Cross Trailer; the American Red Cross has staged a disaster-supplied trailer at the Cannon Beach Public Works facility (multi-hazard).

  Communications Upgrades; the City has purchased upgrade satellite telephones for disaster use and has installed Ham Radio equipment in the each of the evacuation sites for use during a disaster (earthquake/tsunami) when other communication systems are not operational. In addition, the City now has a BGAN satellite Internet receiver for communication and information exchange.

- Warning Sirens: the Cannon Beach Fire District has installed multiple outdoor warning sirens intended to warn people on the beach and in the low-lying commercial areas of Cannon Beach of possible tsunami inundation, in operation since 1986.

Risk Assessment

The following hazards have been addressed in the Clatsop County Natural Hazard Mitigation Plan. The City of Cannon Beach reviewed the County's plan and

assessed how Cannon Beach's risks vary from the risks facing the entire planning area.

Coastal Erosion

Clatsop County's Coastal Erosion Hazard Annex adequately describes the causes and characteristics of coastal erosion hazards. Cannon Beach is a city of roughly 4 miles in length and ½ mile in width. All four miles are bordered on the west by the Pacific Ocean. While there has been relatively little significant erosion in the past two or three decades, the threat is always present, especially during the winter months when Pacific storms bring huge surf, heavy rain, and strong winds to the region.

There are five primary areas of concern to Cannon Beach regarding coastal erosion. These are: 1) Silver Point at the south end of Cannon Beach; 2) the "S-Curves area in the middle of Cannon Beach; 3) the Ecola Creek mouth just in front of the City's largest commercial area; 4) Ecola State Park; and 5) The Cove Beach / Falcon Cove area, approximately six miles south of Cannon Beach. Although Cove Beach is not within City limits, Cove Beach's residents are a part of Cannon Beach's social fabric. Likewise, Ecola State Park is not in the City Limits but it is adjacent to the City's northern boundary and one of the major tourist attractions to the City of Cannon Beach. All five of these areas are further described below:

- Silver Point ~ this area includes the southern portion of the City and the area immediately adjacent to the City. A large landslide in the early 1970s took out two residential structures and a large portion of Highway 101, interrupting commerce on the north Oregon coast for months. The slide was due to a combination of coastal erosion and poor drainage in the sub soils.

- S-Curves ~ this area is at risk due to a combination of poor drainage and coastal erosion. The City continues maintain this area as needed.

- Drainage mitigation measures and monitors the ground motion. Most of the recent problems have been associated with exceptionally wet winters. Sliding in this area has the potential to damage water and sewer services to the Tolovana Park area of Cannon Beach, disrupt the major north-south City street, and compromise public safety operations.

- Ecola Creek ~ the point where Ecola Creek meets the Pacific Ocean is subject to coastal erosion due to the combination of incoming wave action and outgoing creek drainage. The resultant turbulence has undermined seawalls and eroded large amounts of fore dune on various occasions during the past three decades.

- Ecola State Park ~ while not part of the City Limits, this park has had a history of active slides caused by coastal erosion. In the1960s, most of what is now the main park area slid into the ocean. Within the past 5 years, the trail to Crescent Beach, the southern part of the State Park, slid away due to erosion and has not been repaired. This park is a major draw for the tourists who visit Cannon Beach and without it, the City's economy

would suffer greatly. The City is at this time, unaware of any mitigation efforts that could be made to harden the park against such erosion.

- Cove Beach/Falcon Cove ~ this area forms the southern-most part of the Clatsop County coastline. During the past 40 years, some homes have been lost to the sea due to erosion and several have been moved eastward to new foundations in an effort to protect. Cove Beach/Falcon Cove is entirely residential.

A mixture of fore-dunes and manmade structures protects much of the City's frontage on the Pacific Ocean. Significant storms or rising ocean levels may reduce or remove these structures, suddenly or gradually. Additionally, the entire municipal oceanfront is at high risk for coastal erosion due to its proximity to the ocean.

Clatsop County describes coastal erosion as a 'chronic' hazard along the Oregon Coast, especially on sand spits, bluffed coastline, and dune-backed beaches. Damages caused by chronic hazards are usually gradual and cumulative. As such, the County estimates a 'high' probability that coastal erosion will continue to occur along the County's coastline. The same is true for the City of Cannon Beach.

Likewise, the County estimates a 'high' vulnerability to coastal erosion, meaning more than 10% of the population or regional assets are likely to be affected by this hazard. Due to the City's large amount of development along its coastline, Cannon Beach estimates the same level of vulnerability.

Drought

Clatsop County's Plan adequately describes the causes and characteristics of droughts, as well as the location and extent of a potential drought event. Clatsop County has no record of a severe drought affecting the County, and the same is true for Cannon Beach. Drought is averted as a result of the area's high rainfall, especially during winter months. Clatsop County estimates a 'low' probability that drought will occur, meaning no more than one incident is likely within a 75-100 year period. Likewise, the County estimates a 'low' vulnerability to drought hazards; meaning less than 1% of the population or regional assets would be affected by a drought. Both estimates are true for Cannon Beach as well. Potential drought-related community impacts are adequately described within Clatsop County's Drought Hazard Annex.

Earthquake

Cannon Beach's location along the Oregon Coast makes it susceptible to earthquakes, especially a Cascadia Subduction Zone earthquake. The extent of the earthquake hazard includes the entire community of Cannon Beach, although damage from an earthquake may be more severe in the downtown area where buildings are old and sit on fill that has liquefaction potential.

Clatsop County's Natural Hazards Mitigation Plan adequately describes the causes, characteristics, and location of earthquake hazards for the region. The County's

Plan additionally identifies all previous occurrences that have affected the City. It is difficult to estimate recurrence intervals, but the state has experienced seven Cascadia Subduction Zone (CSZ) events in the last 3500 years – some of which were probably as large as magnitude (M) 9. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1000 years. The last CSZ event occurred approximately 300 years ago. Scientists estimate that there is a 10-20% probability that a subduction zone earthquake will occur within the next 50 years.[xviii] Based on this information, Clatsop County estimates a 'high' probability than an earthquake will occur in the future. Cannon Beach agrees.

The Department of Geology and Mineral Industries developed the following earthquake hazard maps. The figures illustrate the location of the amplification, liquefaction, earthquake-induced landslide, and relative earthquake hazards in Cannon Beach, Seaside, and Gearhart.

Figure 2.5 Relative Amplification Hazard Map

The majority of the City's built lands are located in areas of medium amplification hazards. The surrounding areas have a low risk of amplification.

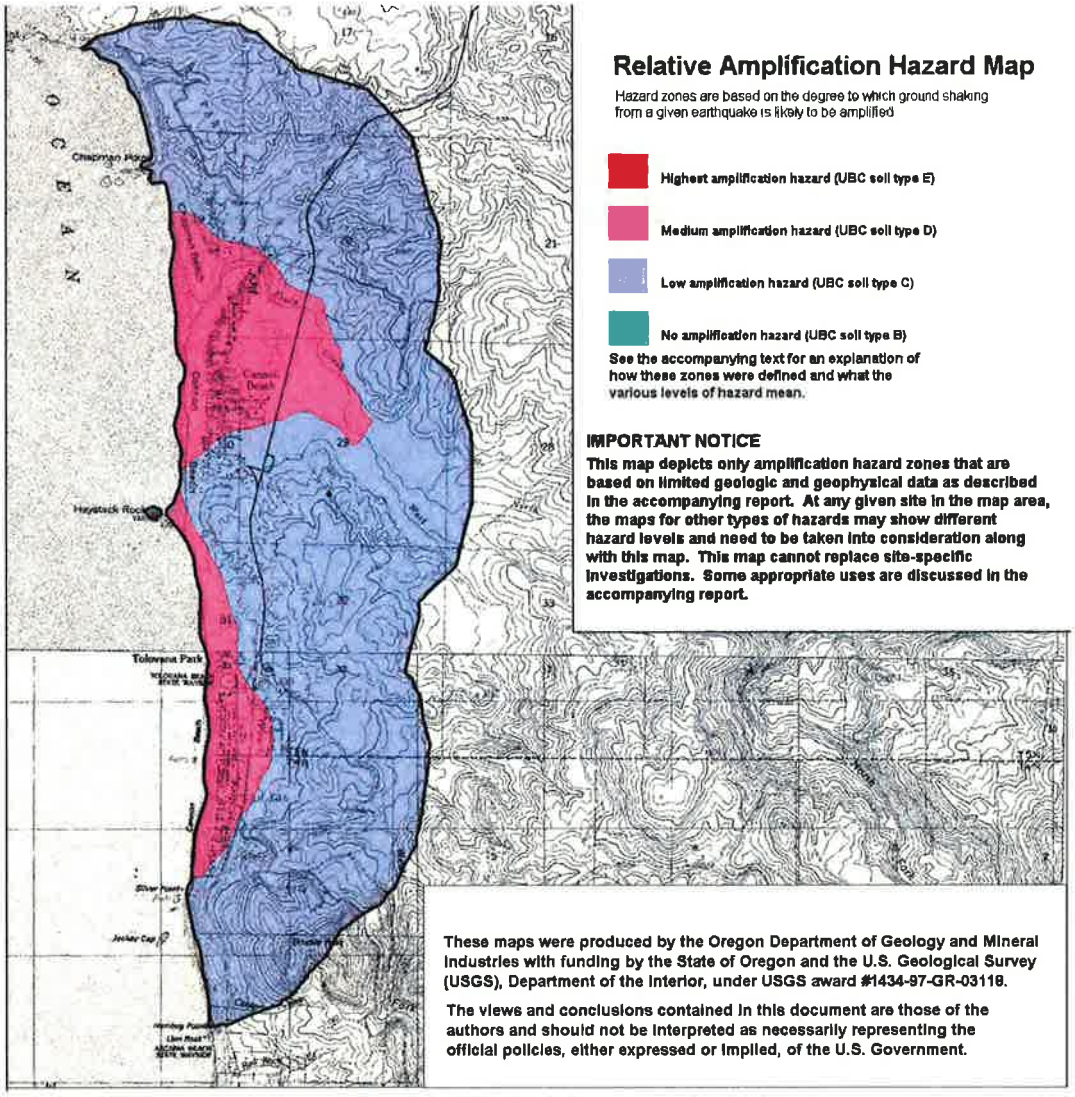


Figure 2.6 Relative Liquefaction Hazard Map

The majority of the City's built lands are located in the highest liquefaction hazard areas. The surrounding areas have a low (or zero) risk of liquefaction.

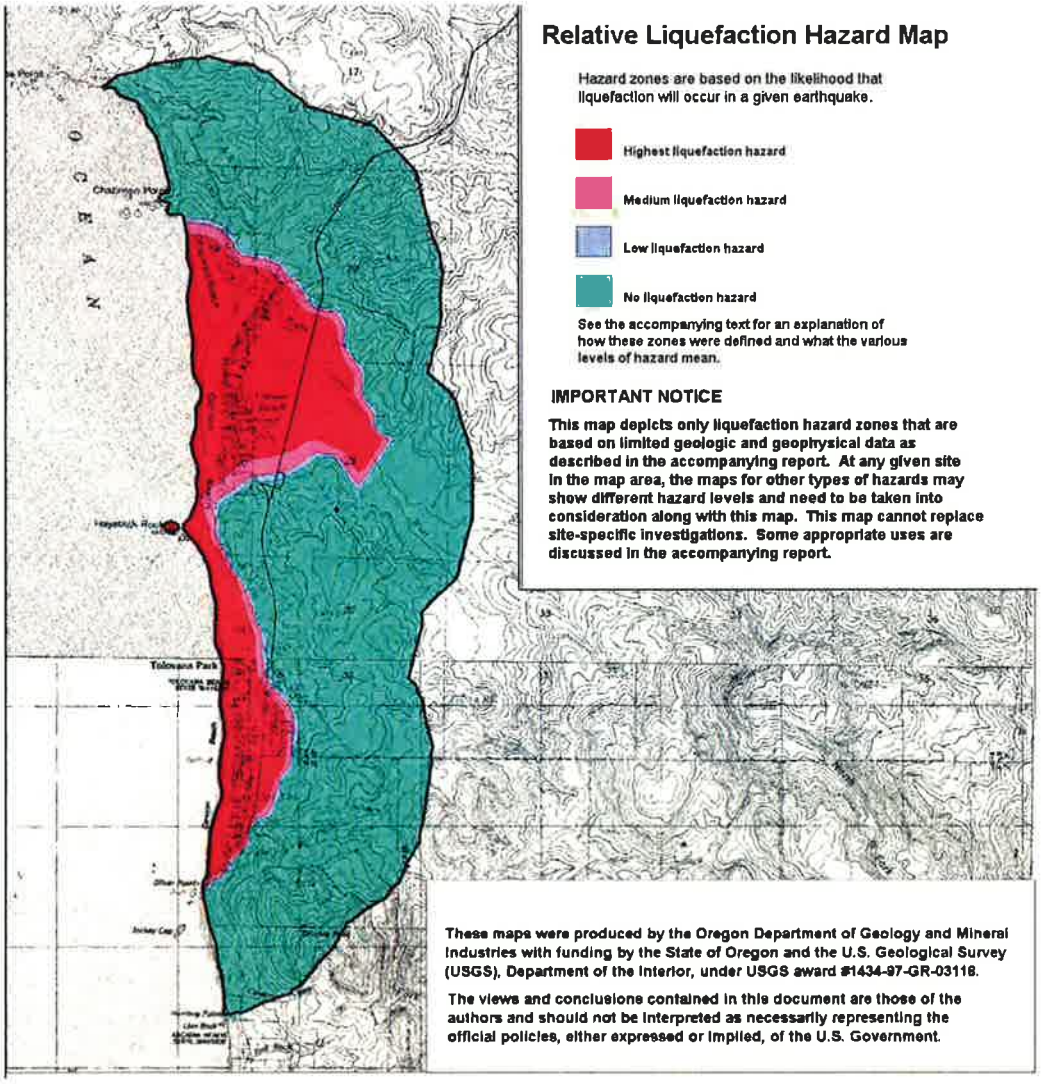


Figure 2.7 Earthquake- Induced Landslides

The majority of the City is located in areas of low landslide hazards. Areas immediately outside the City have medium and high earthquake-induced landslide hazards.

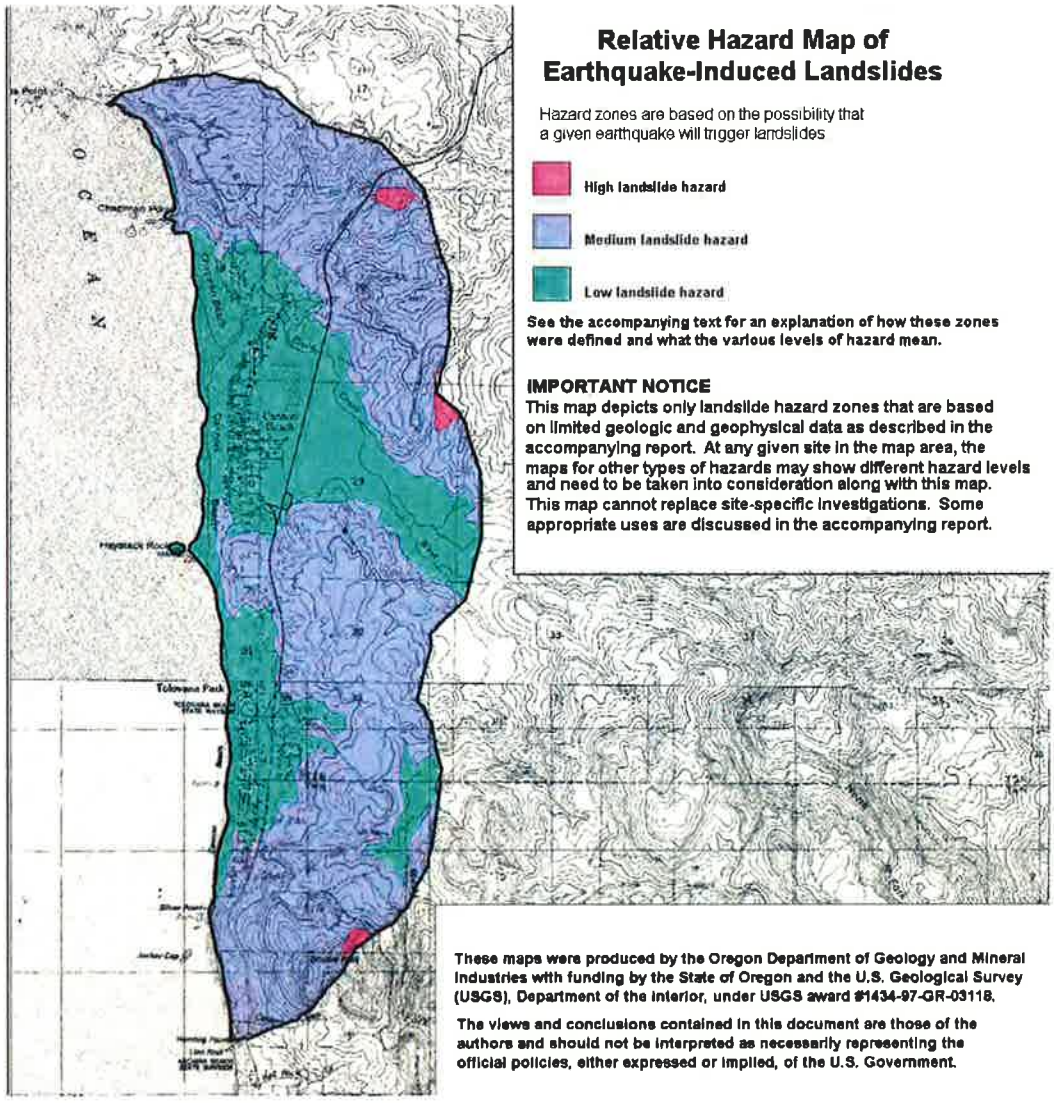
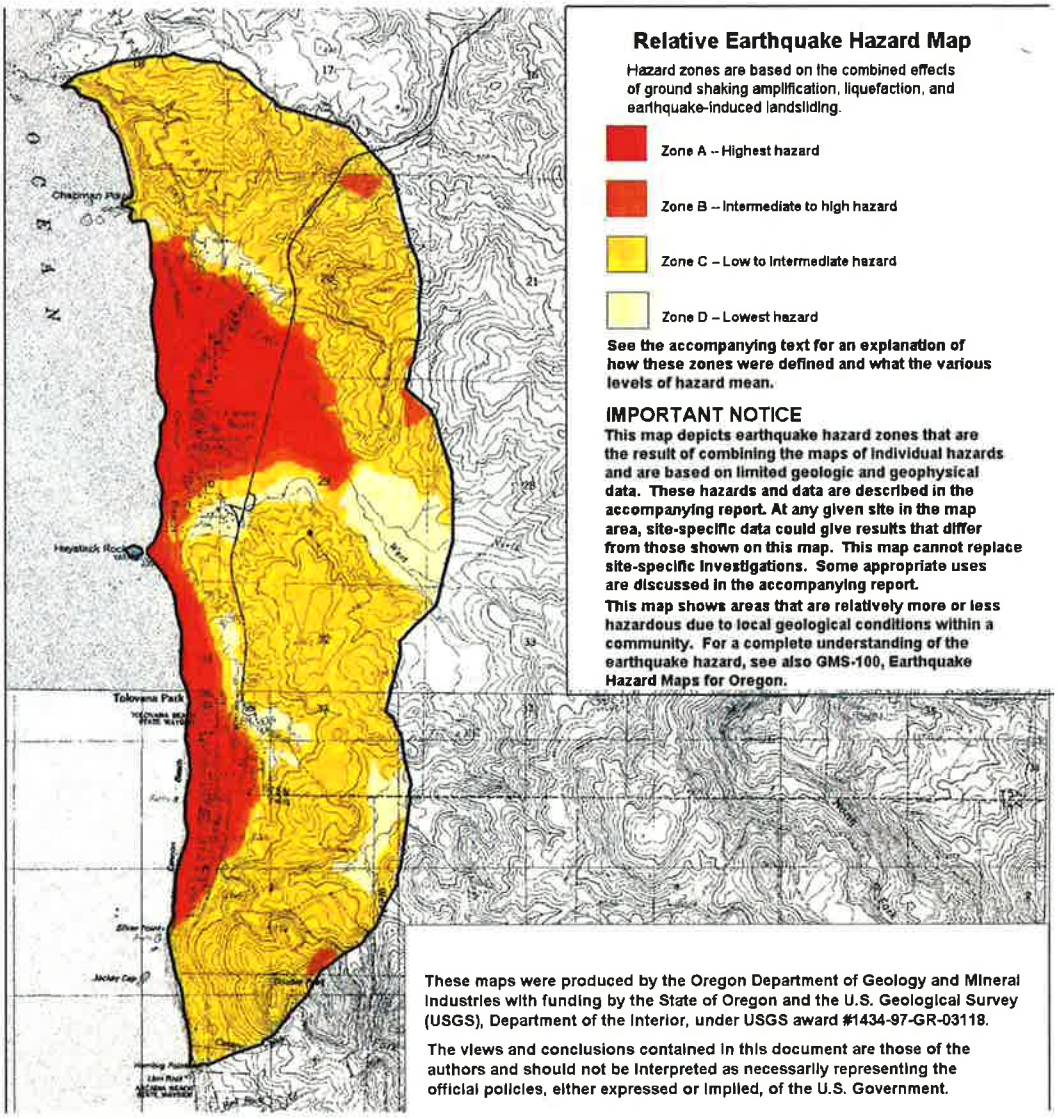


Figure 2.8 Relative Earthquake Hazard

The majority of the City is located in the highest hazard zone. Areas immediately outside the City are in the intermediate and low hazard zones.



Clatsop County estimates a 'high' vulnerability to earthquake hazards, meaning more than 10% of the population or regional assets would be affected by a major emergency or disaster. As shown by the figures above, the City has a moderate risk of amplification, and a very high risk of liquefaction. The majority of the City's developed lands are located in Zone A – the highest hazard area for earthquakes. Additionally, as described above on page 7, about 53% of the City's housing stock was built prior to 1980, before stronger seismic building codes were put into place. The combination of these hazards makes Cannon Beach extremely vulnerable to high magnitude earthquake events.

In 2006, DOGAMI conducted a seismic needs assessment for public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings. Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. Within Cannon Beach, the following buildings were rated as 'moderate' or 'high.' No buildings in Cannon Beach were assigned the 'very high' rating.

- Cannon Beach Police Department; *moderate*

In addition to the structures listed above, the City's infrastructure is highly vulnerable to a severe earthquake event. Sewer lines, water lines, power lines, water tanks, reservoirs, and cell towers are vulnerable assets. The City would expect significant damage to roads and bridges following a Cascadia Subduction Zone event, as well as deaths and severe injuries region-wide. Education and outreach regarding earthquakes (and a resultant tsunami) is an ongoing endeavor in Cannon Beach. Additional community impacts are adequately described within the County's Earthquake Hazard Annex.

Flood

Cannon Beach is at risk of flooding from two primary sources: riverine flooding and Ocean flooding. Riverine flooding generally occurs during periods of heavy rainfall that cause the streams that drain the hills east of Cannon Beach to overflow their banks. Ocean flooding results from exceptionally high tides or tsunamis. On some occasions, high tides and riverine flooding can combine to produce flooding in the City.

An additional flooding hazard that impacts the safety and the well being of Cannon Beach residents is the annual riverine flooding of Highway 101 between the south limits of the City of Seaside and the junction of Highways 26 and 101. During periods of heavy rainfall each winter season, the roadway becomes impassable by floodwater from the Necanicum River, often closing the road to passenger vehicles. While the flooding causes little damage to structures, it interrupts commerce along the only North-South roadway on the Oregon Coast and the major transportation route between the North Oregon Coast and the Portland-Vancouver metro area on the Interstate 5 corridor. It also isolates The City of Cannon Beach from Clatsop County's two hospitals, and impairs ambulance, police, and fire services.

The City's Flood Insurance Rate Map highlights the location of the flood hazard in Cannon Beach. The City's current effective date for the Flood Insurance Rate Maps is September 17, 2012.

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan adequately identifies the previous occurrences of floods for the City of Cannon Beach. The

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the vulnerability of floods as moderate. The County Plan also indicates that the probability of floods is high. These scores would be representative of Cannon Beach's risk as well.

The City of Cannon Beach is a participant in the National Flood Insurance Program. The City has a total of 487 policies under the NFIP, 124 of which are located in A zones. The total coverage for the City under the NFIP is $120,819,700. There have been 13 claims since 1978, with $157,247 paid on those claims. As of June 2008, there has been one repetitive loss property in the City of Cannon Beach.

The number and types of structures located in the floodplain are not available at this time.

Absent a tsunami, Cannon Beach has had a low incidence of serious flooding since a dike was constructed along the banks of Ecola Creek in the immediate vicinity of the main commercial areas in the 1960s. Prior to dike construction, the business district in Cannon Beach became flooded routinely during periods of heavy rainfall. Mitigation measures for the Cannon Beach business district should be focused on assessing and maintaining the integrity of the Ecola Creek diking structures. Mitigation measures for the routine flooding of Highway 101 should continue.

Landslide

As previously noted in the Coastal Erosion Hazard, four of the five erosion hazard areas are primary areas of concern to Cannon Beach for landslides. All of the landslide hazard areas are problematic due to a combination of drainage and coastal erosion. The four landslide areas documented under the Coastal Erosion Hazard section are Falcon Cove/Cove Beach, Silver Point, the "S-curves", and Ecola State Park.

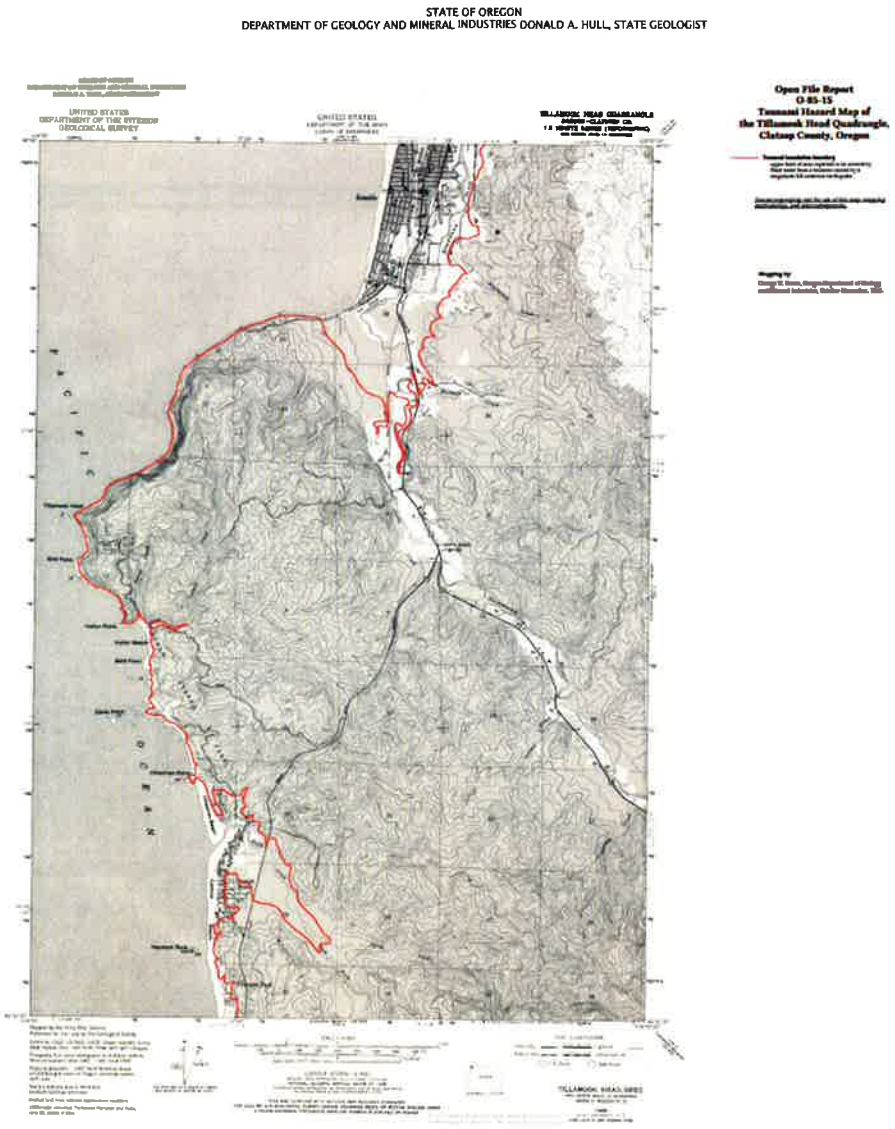
Clatsop County's Plan identifies a number of locations within the County that are at risk of landslides. Due to Cannon Beach's location along the coast, landslides primarily occur during rain and/or coastal erosion events. Beyond this, regional landslides can cause regional commerce and transportation difficulties.

Clatsop County estimates a 'high' probability that landslides will occur in the future; meaning one incident is likely within a 10-35 year period. Cannon Beach estimates a 'moderate' probability due to its more level topography. Clatsop County estimates a 'moderate' vulnerability to landslides, and the same would be true for Cannon Beach as well. Potential community impacts are adequately described in Clatsop County's Landslide Hazard Annex.

Tsunami

Clatsop County's Natural Hazards Mitigation Plan adequately describes the causes and characteristics of tsunami hazards, as well as the previous occurrences of tsunami events within the region. In 1995, The Department of Geology and Mineral Industries (DOGAMI) conducted an analysis resulting in extensive mapping along the Oregon Coast. The maps depict the expected inundation for tsunamis produced by a magnitude 8.8 to 8.9 undersea earthquakes. The tsunami maps were produced to help implement Senate Bill 379 (SB 379), which was passed during the 1995 regular session of the Oregon Legislature. SB 379, implemented as Oregon

Revised Statutes (ORS) 455.446 and 455.447, and Oregon Administrative Rules (OAR) 632-005, limit construction of new essential facilities and special occupancy structures in tsunami flooding zones. The following tsunami-inundation zone map was produced for Cannon Beach.



Because Cannon Beach was the focus of a pilot-mapping project, the recent inundation mapping had no significant changes for Cannon Beach. Using the latest advances in mapping technology (LIDAR), computer technology and computer modeling. The new maps will be scenario based, meaning that variations in inundation levels (given local or distant tsunamis) will be shown.

The extent of a tsunami event in Cannon Beach will depend on where the tsunami originated, and the size of the earthquake that produced the tsunami. Clatsop County appropriately describes the probability of a tsunami event for Cannon Beach. Geologists predict a 10-14% chance that a Cascadia tsunami will be triggered by a shallow, undersea earthquake offshore Oregon in the next 50 years. The forecast comes from evidence for large but infrequent earthquakes and tsunamis that have occurred on the Oregon coast every 500 years, on average.

A Cascadia Subduction Zone event will begin with a magnitude 9.0 near shore earthquake closely followed by a series of devastating coastal Tsunami waves. It can occur at any time and during any season. The challenge for Cannon Beach is how to provide shelter, water and food for up to 4 thousand survivors depending on the season. Through a series of tabletop exercises, Cannon Beach has developed a "Hub and Spoke" emergency management concept. With the Cannon Beach Emergency Operation Center as the "hub" and three-evacuation community support sites as the spokes.

Based on a recently completed innovative pilot project, each evacuation support site will consist of two 20' shipping containers placed on a concrete pad. The pilot project containers are loaded with the following community resilience support items:

- Family Cache Containers
- Medical, administrative, and support equipment containers
- Tourist, Employee and Visitor Kits

Depending on the floor plan, each container can benefit up to a minimum of 700 survivors for at least 96 hours. Once the pilot project is replicated at two more sites, Cannon Beach can provide sustainable support for up to 4,200 survivors.

Cannon Beach has three population demographics influenced by a Cascadia Subduction event. They are:

a. Residents who live above the inundation line
b. Residents who live below the inundation line.
c. Tourists, visitors and employees who work or temporarily reside below the inundation line

Oregon's North Coast climate can present hypothermia as the primary danger long before water or food becomes an issue. Exercise outcomes measured resiliency, in terms of shelter first, water second and food last. Group 1 would most likely shelter in place leaving groups 2 and 3 as those most in need of initial support. Based on exercise outcomes Cannon Beach began an innovative cache container pilot project consisting of the following components:

a. A support site consisting of two 20' shipping containers.
b. Family Cache Containers.
c. Tourist/Employee/Visitor kits.
d. Medical, administration and equipment support containers.

Each group was provided, at cost, storage containers in the form of 55 gallon drums, 30 gallon barrels or 5 gallon buckets for use as personal cache containers.

Each family determined how many cache containers' they would need and packed them per their family's needs. Because group 3 could makeup the largest population segment Cannon Beach has developed an innovative Tourist/Employee/Visitor kit. It consists of a shelter system (poncho, space blanket, tube tent), water and food for 500 survivors.

For more information regarding our project please go to the following link: http://connectipedia.org/Tsunami_Response_Cannon_Beach

The County estimates a 'high' vulnerability to tsunami hazards, which indicates that at least 10% of the County's population and regional assets are likely to be affected by a tsunami event. This rating appropriately describes Cannon Beach's vulnerability as well. More than 50% of Cannon Beach's developed lands are within the tsunami inundation zone. This includes close to 1,000 residents, and more than 1,000 employees. Additionally, more than 25 overnight-tourist facilities are within the inundation zone.

Cannon Beach recognized the serious nature of the tsunami threat in the middle 1980s and the Fire District began the purchase and installation of warning sirens to mitigate the threat of massive loss of life along the beaches and in low lying areas of the community. The first sirens became operational in 1996 and still function today. The December 2004 quake near Sumatra made the value of these sirens clear to the rest of the world.

Since the siren installations, Cannon Beach has taken additional steps to help insure its survival when a tsunami strikes the area. Past and current activities include:

- Adding satellite phones and a BGAN Internet satellite receiver to the communication tools;
- Purchase of portable water tanks for emergency distribution of potable water;
- Constructing cache sites for storing personal, administrative, support tools and emergency medical supplies throughout the community;
- Establishing an Emergency Preparedness Committee;
- Sponsoring annual Tsunami Education Forums for community members;
- Printing and distributing informational brochures;
- Establishing designated shelters in the community and supplying them with emergency generators;
- Grading and maintaining an emergency helicopter landing pad;
- Wrote, adopted and updated emergency management plans;
- Established committees to address tsunami preparedness.
- Worked with local, state and federal agencies to better understand the tsunami hazard and prepare the community to deal with it;
- Worked with the community elementary school to implement evacuation plans and drills;
- Conducted seismic evaluations of the designated shelter sites;
- Stored County Health Dept. supplies in the Fire Station;
- Purchased a cache of blankets, food, water and shelter supplies for

use following a tsunami;
- Created a Red Cross trailer that could hold disaster supplies;
- Established tsunami evacuation routes and sites; and
- Met the objectives established by the National Oceanic and Atmospheric Administration's "Tsunami Ready" program.

Some of the mitigation projects still needing to be initiated and/or completed are the seismic upgrades to the two local bridges (to provide safe evacuation routes after a quake and before a tsunami arrives), relocation of the community elementary school to high ground, relocation of both local fire stations to high ground, creating vertical evacuation sites in the community, relocation of City Hall/Police Dept. facilities to high ground, and preparing emergency medical facilities to care for the injured following a tsunami.

Volcano

The Clatsop County Natural Hazard Mitigation Plan adequately describes the City's risk to volcanic events. Generally, an event that affects the County is likely to affect Cannon Beach as well. The causes and characteristics of a volcanic event are appropriately described within the County's Plan, as well as the location and extent of potential hazards. Previous occurrences are well documented within the County's Plan, and the community impacts described by the County would generally be the same for Cannon Beach as well. Cannon Beach is very unlikely to experience anything more than a small amount of volcanic ash during a volcanic event. The County estimates a 'low' probability of future volcanic events and a 'low' vulnerability to future eruptions. The County's probability and vulnerability estimates are accurate of Cannon Beach's as well.

Wildfire

The Clatsop County Natural Hazard Mitigation Plan adequately describes the causes and characteristics of wildfires, as well as the County and City's history of wildfire events. Cannon Beach has no recorded history of wildfire, and County wildfires are mostly related to debris burns. Clatsop (CWPP) will become part of the Clatsop County Hazard Mitigation Plan when it is completed. Cannon Beach is participating in the County's CWPP planning process as well.

Clatsop County estimates a high probability that wildfires will occur in the future. Most wildfires can be linked to human carelessness. This rating is true for Cannon Beach as well.

Clatsop County estimates a moderate vulnerability to wildfire events; meaning 1-10% of the population of regional assets is likely to be affected by a major event. Wildfires are most likely to occur in wild land-urban interface areas, and Cannon Beach is considered to be an 'interface community.[xxi]' Cannon Beach is particularly vulnerable to catastrophic wildfires. The area is bounded on the east by commercial forestland, and on the north and south by forested state parks (Ecola State Park & Oswald West State Park). Additionally, there are numerous wooded areas throughout the community, making the spread of fire from one area of the City to

another highly likely. The natural mitigation factor is the maritime climate, which reduces the rate at which vegetation dries during the summer months. Potential community impacts are adequately described in Clatsop County's Wildfire Hazard Annex.

Wind and Winter Storms

The Clatsop County Natural Hazard Mitigation Plan adequately describes the causes and characteristics of wind and winter storms, as well as the location and extent of wind and winter storm hazards. The region's (and City's) history of events are adequately described within the County's Plan as well. Because coastal wind storms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow. More than likely, however, the coast's winter will just be windy, cold, and wet.

The County estimates a 'high' probability that wind and winter storms will occur in the future. Windstorms occur yearly, and the more destructive storms occur once or twice per decade. The County additionally estimates a 'high' vulnerability to windstorms; meaning more than 10% of the population or regional assets would be affected by a major windstorm event. Both estimates are true for the City as well.

Cannon Beach's long, narrow configuration on the Pacific shoreline makes it very vulnerable to windstorms blowing in from the ocean. Winter storms with snow and ice that are severe in nature are relatively uncommon along the coastal strip. Because of the infrequent nature, many drivers lack necessary skills and equipment to continue routine travel, and many homes are not constructed to adequately protect their plumbing systems from freezing. Additionally, roughly 65% of the homes in the community are for vacation use and not occupied year-round. During prolonged periods of freezing weather, it is common to find water pipes broken with water running unchecked into homes and onto the ground. When this becomes widespread, the public water reservoirs drain with resultant loss of flow needed for fire protection and public health.

Action Items

The Cannon Beach addendum includes 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. Implementing the addendum's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the City's resources.

The following action items are detailed recommendations for activities that local departments, citizens, and others could engage in to reduce risk.

1. Provide Seismic Upgrades to the Hwy. 101 Bridge spanning Arch Cape Creek (approx. MP 35.6).

2. Encourage ODOT to upgrade or replace Ecola Creek Bridge on Fir Street.

3. Encourage ODOT to upgrade or replace Ecola Creek Bridge at Highway 101 in Cannon Beach to withstand M9.3 quake.

4. Encourage the State to take appropriate action to avoid annual winter flooding on multiple sections between the City of Seaside and the Junction of Highways 101 and 26. Following on the action being taken in 2013, monitor results of that effort and make appropriate action to mitigate.

5. Stabilize "S-Curves" area to reduce risk of landslide activity so that utility lines in the Hemlock Street right-of-way are protected.

6. Encourage ODOT to seismically upgrade the Hwy 101 overpass at Warren Way in Cannon Beach (approx. MP 30.3).

7. Conduct seismic upgrades of municipal water reservoirs and water treatment facilities.

8. Encourage ODOT to seismically upgrade the Hwy 101 overpass at Sunset Blvd. in Cannon Beach (approx. MP 29.5).

9. Conduct a seismic evaluation of the Cannon Beach Water Treatment Plant and make any necessary upgrades required to ensure continuity of operations following a severe earthquake.

10. Improve emergency helipad to facilitate utilization by large military helicopters. Level and grade the site and install semi- impervious surface.

The City will use the same prioritization process and plan maintenance schedule as outline in the County's Plan [See Section 4: Plan Implementation and Maintenance of the Clatsop County Multi- Jurisdictional Natural Hazard Mitigation Plan and Appendix D: Economic Analysis of Natural Hazard Mitigation Projects].

Proposed Action Item:	**Alignment with Plan Goals:**
Provide Seismic Upgrades to the Hwy. 101 Bridge spanning Arch Cape Creek (approx. MP 35.6)	Protect life. Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

- Arch Cape can anticipate an earthquake associated with the Cascadia Subduction Zone up to a Magnitude 9.3. The geologic record shows that large Cascadia Subduction Zone earthquakes are accompanied by tsunamis occurring every 500 years, plus or minus 200 years, with the last event occurring 300 years ago.
- A failure of the Arch Cape Creek Bridge would isolate the Cove Beach/Falcon Cove area from its police and fire protection services as well as less emergent services. Since a strong quake would likely induce rockslides on Hwy. 101 to the south, the second-tier emergency services from Tillamook County would not be available. This bridge is essential for the survival of these residents.
- The Oswald West State Park is often filled with visitors and campers. It too is dependent upon emergency services provided via the bridge over Arch Cape Creek.
- A tsunami following a local earthquake will create a significant life safety threat and the bridge would be a vital link to provide for rescue of those in Cove Beach/Falcon Cove and in Oswald West State Park.

Ideas for Implementation:

- Consult with ODOT to obtain engineering data relevant to providing seismic upgrades to the bridge.
- Obtain estimates for installing the upgrades.
- Locate and secure funding for the project.
- Solicit bids for the project.
- Award contract to the bidder with the best proposal.
- Complete the project.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Public Safety	ODOT, US Dept. of Transportation, FEMA, OEM, Clatsop County, Tillamook County

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
ST		

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Encourage ODOT to upgrade or replace Ecola Creek Bridge on Fir Street	Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

- Bridge serves as primary tsunami evacuation route to high ground for the entire downtown area. The bridge must remain passable after a major quake (M9.3) in order to accommodate throngs of evacuees.
- Alternate routes cannot be accessed within the time frame necessary for survival.

Ideas for Implementation:

- Develop an engineering cost-benefit analysis for upgrading or replacing the structure.
- Secure funding source for improvements.
- Develop plans for best option construction.
- Coordinate anticipated construction issues with City of Cannon Beach, County, State, Feds.
- Complete project.
- Adjust evacuation plans to utilize improved bridge.

Coordinating Organization:	Public Works

Internal Partners:		**External Partners:**
		ODOT, FEMA, ODFW, Army Corps of Engineers, Dept of State Lands
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Encourage ODOT to upgrade or replace Ecola Creek Bridge at Highway 101 in Cannon Beach to withstand M9.3 quake.	Protect life. Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

- Cannon Beach can anticipate an earthquake associated with the Cascadia Subduction Zone up to a Magnitude 9.3. The geologic record shows that large Cascadia Subduction Zone earthquakes are accompanied by tsunamis occurring every 500 years, plus or minus 200 years, with the last event occurring 300 years ago.
- Bridge loss would divide City, making delivery of emergency services impossible following a major earthquake.
- Bridge loss during quake would sever vital transportation link on Oregon Coast.

Ideas for Implementation:

- Conduct an engineering study of the bridge structure.
- Develop recommendations for upgrading or replacing the bridge.
- Develop construction drawings for capital improvement
- Seek bids for construction
- Contract for work with best proposal.
- Make selected improvement

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
	ODOT, City of Cannon Beach, Clatsop Co., FEMA, ODFW, Army Corps of Engineers, OR Div. of State Lands

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Encourage the State to take appropriate action to avoid annual winter flooding on multiple sections between the City of Seaside and the Junction of Highways 101 and 26. Following on the action being taken in 2013, monitor results of that effort and make appropriate action to mitigate.	Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

Routine winter flooding of this section of Highway 101 has several negative effects:

- Disrupts coastal economy from Tillamook to Astoria and beyond
- Prevents or delays timely ambulance response between Seaside and points south and west.
- Prevents or delays police and fire mutual support to and from Seaside during emergencies.
- Prevents or delays routine patrols by Oregon State Police and Clatsop County Sheriffs Office.
- Damages vehicles attempting to drive through the flooded sections of roadway
- Causes vehicles to be swept off the roadway while attempting to drive through sections of flooded roadway, posing a threat to life.
- Consumes many hours of labor for ODOT and other public agencies attempting to control or warn motorists of the hazard
- Consumes motorist funds for towing and repairs to vehicles disabled by floodwaters.

Ideas for Implementation:

- Gain political consensus for project from ODOT and affected counties, cities, state & federal agencies, and citizens
- Conduct engineering studies for raising roadway elevations or utilize existing studies in ODOT files.
- Prepare or utilize existing job specifications
- Estimate job costs
- Obtain funding
- Solicit bids for the specified work
- Award a contract for the work
- Complete the project

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Planning	State of Oregon, Dept. of Transportation , FEMA, Clatsop Co. Cities, Oregon Emergency Management, Dept. of State Lands, Dept. of Fish and Wildlife

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	Alignment with Plan Goals:
Stabilize "S-Curves" area to reduce risk of landslide activity so that utility lines in the Hemlock Street right-of-way are protected.	Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

- Cannon Beach can anticipate an earthquake associated with the Cascadia Subduction Zone up to a Magnitude 9.3. The geologic record shows that large Cascadia Subduction Zone earthquakes are accompanied by tsunamis occurring every 500 years, plus or minus 200 years, with the last event occurring 300 years ago.
- "S-Curve" area of South Hemlock Street has a history of sliding, causing disruption to wired and piped utilities and to traffic. Projects should be undertaken to prevent additional sliding and prevent damage.

Ideas for Implementation:

- Conduct engineering studies to continue and expand the existing de-watering program.
- Obtain cost estimates for implementation of the chosen solutions.
- Advertise for bids.
- Award contract(s) for the work.
- Complete the projects.

Coordinating Organization:	City of Cannon Beach, Public Works Dept.

Internal Partners:		**External Partners:**
Planning, Building, Parks & Recreation		Engineering firms, Excavation Contractors, FEMA, OEM
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Encourage ODOT to seismically upgrade the Hwy 101 overpass at Warren Way in Cannon Beach (approx. MP 30.3).	Protect life. Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

- The Cannon Beach area is at risk of a major earthquake. Oregon Dept. of Geology and Mineral Industries estimates the current odds of a M9 quake as 1 in 7 in then next 40 years.
- The Warren Way overpass is a vital transportation link on Highway 101, the sole route into and out of the City of Cannon Beach.
- If the overpass were to collapse as a result of an earthquake, it would block traffic on Highway 101.
- The loss of the overpass would create a serious economic loss to the City of Cannon Beach and other communities on the Oregon Coast.
- Loss of the overpass would significantly hamper the provision of fire protection, law enforcement, and emergency medical services to a large part of the Cannon Beach Area.

Ideas for Implementation:

- Request proposals from engineering firms for determining necessary seismic upgrades establishing project costs.
- Secure funding for the project
- Seek construction bids for the project.
- Award contract to firm with best proposal.
- Complete the project.

Coordinating Organization:	City Manager

Internal Partners:	**External Partners:**
City Council	ODOT, City of Cannon Beach, Clatsop County, US Dept of Transportation, FEMA, OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Conduct seismic upgrades of municipal water reservoirs and water treatment facilities.	Minimize damage to public and private buildings and infrastructure. Decrease disruption of critical services.

Rationale for Proposed Action Item:

- Water is essential for human health, business activities, and fire suppression. Cannon Beach can anticipate an earthquake associated with the Cascadia Subduction Zone up to a Magnitude 9.3. The geologic record shows that the Cascadia Subduction Zone earthquakes are accompanied by tsunamis, occurring every 500 years, plus or minus 200 years, with the latest event occurring 300 years ago. The City's reservoirs should be inspected for resistance to such a quake and upgrades made to provide stability. Life for residents and visitors in Cannon Beach would return to normal at a much more rapid pace following a large quake if the municipal water supply were to remain intact.

Ideas for Implementation:

- Hire an engineering firm with expertise in reservoir construction and stability, to develop a report on the current status of the reservoirs and make recommendations on adding seismic stability in order to sustain a M9.3 quake without loss of service.
- Develop specifications for the recommended upgrades.
- Locate funding sources for the project(s).
- Advertise for bids.
- Award a contract for the upgrades.
- Complete the project(s).

Coordinating Organization:	City of Cannon Beach, Public Works

Internal Partners:	**External Partners:**
Building and Planning Departments	Engineering firm(s), FEMA, OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Encourage ODOT to seismically upgrade the Hwy 101 overpass at Sunset Blvd. in Cannon Beach (approx. MP 29.5).	Protect life. Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

- The Cannon Beach area is at risk of a major earthquake. Oregon Dept. of Geology and Mineral Industries estimates the current odds of a M9 quake as 1 in 7 in then next 40 years.
- The Sunset Blvd. overpass is a vital transportation link on Highway 101, the sole route into and out of the City of Cannon Beach.
- If the overpass were to collapse as a result of an earthquake, it would block traffic on Highway 101.
- The loss of the overpass would create a serious economic loss to the City of Cannon Beach and other communities on the Oregon Coast.
- Loss of the overpass would significantly hamper the provision of fire protection, law enforcement, and emergency medical services to a large part of the Cannon Beach Area.

Ideas for Implementation:

- Request proposals from engineering firms for determining necessary seismic upgrades establishing project costs.
- Secure funding for the project
- Seek construction bids for the project.
- Award contract to firm with best proposal.
- Complete the project.

Coordinating Organization:	City Manager

Internal Partners:	**External Partners:**
City Council, Public Works	Oregon Dept. of Transportation , City of Cannon Beach, Clatsop County, US Dept of Transportation, FEMA, OEM

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Conduct a seismic evaluation of the Cannon Beach Water Treatment Plant and make any necessary upgrades required to ensure continuity of operations following a severe earthquake.	Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical facilities.

Rationale for Proposed Action Item:

- Cannon Beach can anticipate an earthquake associated with the Cascadia Subduction Zone up to a Magnitude 9.3. The geologic record shows that large Cascadia Subduction Zone earthquakes are accompanied by tsunamis occurring every 500 years, plus or minus 200 years, with the last event occurring 300 years ago.
- Water is essential to life.
- Life for residents and visitors in Cannon Beach would return to normal at a much more rapid pace following a large quake if the municipal water supply were to remain intact.
- The water treatment plant was built prior to current geologic forecast for stronger shaking and may need hardening against such violent quakes.

Ideas for Implementation:

- Hire an engineering firm with expertise in treatment plant construction and seismic stability, to develop a report on the current status of the water treatment facility and make recommendations on adding seismic stability in order to sustain a 9.3 quake without loss of service.
- Develop specifications based on recommended upgrades.
- Locate funding sources for the project.
- Advertise for bids.
- Award a contract for the upgrades.
- Complete the project.

Coordinating Organization:	Cannon Beach Public Works

Internal Partners:	**External Partners:**
Planning, Administration, Parks and Community Services.	ODF, FEMA, Dept. of State Lands, Engineering Firm(s)

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
ST		

Form Submitted by:	Cannon Beach Steering Committee

Proposed Action Item:	**Alignment with Plan Goals:**
Improve emergency helipad to facilitate utilization by large military helicopters. Level and grade the site and install semi-impervious surface.	Protect life.

Rationale for Proposed Action Item:

- Cannon Beach can anticipate an earthquake associated with the Cascadia Subduction Zone up to a Magnitude 9.3. The geologic record shows that large Cascadia Subduction Zone earthquakes are accompanied by tsunamis occurring every 500 years, plus or minus 200 years, with the last event occurring 300 years ago.
- Site near south end of community is the only site at elevation above tsunami inundation, owned by the City, and capable of accommodating large military aircraft. This could be an important method of moving relief supplies into the community and evacuating the sick and injured after a serious disaster. It is anticipated that all major and minor roadways will be impassable due to slides, floods, buckling, and bridge collapse.

Ideas for Implementation:

- Conduct Civil Engineering study to determine type and amount of fill needed to reduce the slope of existing site to nearly level and provide necessary drainage.
- Secure necessary funding.
- Explore possible sources for fill material.
- Seek bids for required work.
- Award contract and complete the project.

Coordinating Organization:	Public Works

Internal Partners:	**External Partners:**
Planning	ODOT, County Road Dept.,

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT	

Form Submitted by:	Cannon Beach Steering Committee

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City of Gearhart

Natural Hazards Mitigation Plan Addendum

APRIL 2015

City of Gearhart
PO Box 2510
698 Pacific Way
Gearhart, OR 97138

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Volume III: City Addendum
City of Gearhart, Oregon

Natural Hazard Mitigation Plan

The City of Gearhart developed this addendum to the Clatsop County Multi-Jurisdiction Natural Hazard Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect the City of Gearhart, Oregon, including flood/heavy rain, windstorm, winter storm, El Nino/La Nina, earthquake, tsunami, forest fire/wildfire, landslide/subsidence, dust storm, volcanic hazard, and drought. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect Gearhart. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

The addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use and watershed management programs. The actions described in the addendum are intended to be implemented through existing plans and programs within Gearhart.

The steps included in this natural hazard mitigation plan include:

(1) adoption by the local governing body: by resolution after approval date
(2) multi-jurisdiction plan adoption: by resolution after approval date
(3) documentation of multi-jurisdiction plan participation
(4) documentation of the local planning process
(5) identifying hazards that can affect the jurisdiction
(6) profiling hazards and events that can and have affected the jurisdiction
(7) assessing vulnerability: identifying assets and community hazard impacts
(8) assessing vulnerability: identifying potential losses (confidential data)
(9) assessing vulnerability: analyzing development trends
(10) multi-jurisdictional risk assessment: assessing local risks
(11) local hazard mitigation goals
(12) identification and analysis of mitigation measures: Gearhart action items
(13) implementation of mitigation measures: prioritization, implementation, and administration of action items using a cost benefit analysis
(14) multi-jurisdiction mitigation strategy: specific action items are included in section 12
(15) monitoring, evaluating, and updating the plan: five-year cycle update schedule
(16) implementation through existing programs: mitigation incorporated into plans
(17) continued public involvement: how to ensure continued public participation

1. Adoption by the Local Governing Body:

Documentation that the plan has been formally adopted by the governing body

_____: The City of Gearhart will adopt the Gearhart Natural Hazard Mitigation Plan by resolution when FEMA determines that the plan is complete. Gearhart will submit this documentation of adoption to OEM and FEMA.

2. Multi-jurisdiction plan adoption:

Documentation that the plan has been formally adopted by the governing body

_____: Gearhart will adopt the Clatsop County Multi-Jurisdiction Natural Hazard Mitigation Plan by Resolution when FEMA determines that the Plan is complete. Gearhart will submit this documentation of adoption to OEM and FEMA.

How the Gearhart Addendum was developed:

3. Documentation of Multi-jurisdiction Plan Participation

Documentation of participation in the multi-jurisdiction plan development

Fall 2006 — Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon (UO) Community Service Center partners with Oregon Emergency Management (OEM) and Clatsop County to develop a pre-disaster mitigation planning grant to develop a natural hazard mitigation plan.

Clatsop County Commissioners sign a memorandum of understanding for this project.

Grant awarded by OEM

Fall 2007 — The Clatsop County Sheriff Emergency Services Department hires Columbia River Estuary Study Taskforce (CREST) to facilitate the development of a multi-jurisdiction natural hazard mitigation plan for county and city.

The Clatsop County Multi-Jurisdiction Natural Hazard Mitigation Plan Steering Committee is established.

Steering committee role:

- coordinate local plan development with section for multi-jurisdiction plan
- organize internal meetings
- organize public involvement
- meet with steering committee
- plan and information published at website: www.oregonshowcase.org

April 16, 2008: Mission statement developed:
"To create a disaster resilient Clatsop County"

Public Events

January 11, 16, 17: Daily Astorian publishes media announcement of process

February 12, 2008 — City of Seaside holds Open-for-Business Workshop: property protection and disaster planning

April 30, 2008: City of Seaside Civic and Convention Center: Emergency Preparedness Fair.

May 1, 2008: Public meeting at Clatsop Community College Performing Arts Center to answer questions about the process.

November 12, 2009: Town hall meeting – HMP noticed with minutes.

April 13, 2010:	Tsunami awareness/emergency preparedness meeting
December 08, 2011	Planning Commission and staff prioritized hazards. Staff compiled data. Planning Commission volunteered for hazard mitigation emergency prep committee.
April 21, 2012	Gearhart community preparedness meeting at the Gearhart Volunteer Fire Station.
May 8, 2014	Planning Commission and staff identify hazards/profile hazards
June 12, 2014	Planning Commission and staff assess vulnerability/existing plans and policies/multi-jurisdiction risk assessment.
July 10, 2014	Review hazard mitigation goals and action items
August 14, 2014	Review with planning commission
September 11, 2014	Review with planning commission
October 9, 2014	Review with planning commission

Steering Committee Meetings

November 15, 2007: The steering committee met to discuss the purpose and outcomes of the process by answering questions about what is mitigation, why it is important, the role of the steering committee, the plan mission and goals, the public involvement strategy and to review the state community profiles, and approve a memorandum of understanding to participate in the process.

February 14, 2008: The steering committee met at Bob Chisholm Community Center in Seaside to draft community profiles, hazard plans, and city addendums. The committee reviewed maps, developed stakeholder lists, and planned public forums.

April 16, 2008: The steering committee met in the Warrenton City Hall City Commissioners' Room to finalize the mission statement and to plan goals. Committee members developed the initial list of mitigation items for the county plan and met with city representatives to discuss addendum plan progress.

August 7, 2008 The steering committee met to present and prioritize mitigation action items and finalize the county plan and city addendums. The steering committee decided that biannual meetings will be held in May and November of each year. The next update to each local plan is due five years from the date the county plan is approved.

November 10, 2011 Gearhart planner and staff met to discuss two committees for HMP planning.

Steering Committee Schedule:

Semi-Annual Meetings: In November and May of each year, steering committee members will meet to coordinate action item priorities. Stakeholder meeting dates and events will be planned at these meetings.

Five Year Update: An update to the local plan is due five years from the date the county plan is approved.

Clatsop County Multi-Jurisdiction Hazard Mitigation Plan

Steering Committee Members

#	Organization	Name	Phone Number	Email
1	Clatsop County EMD	Tom Manning (Emergency Mgr) Tiffany Brown (Emergency Mgr)	(503) 325-8645 (503)338-3774	tmanning@co.clatsop.or.us tbrown@co.clatsop.or.us
2	Clatsop County Development Director	Jennifer Bunch (GIS & Lead Planner)	(503) 325-8611	jbunch@co.clatsop.or.us
3	CC Elected / Appointed Official	(County Planning Chair)	(503) 325-8611	
4	County Public Health	Michael McNickle (Environmental Health)	(503) 325-1000 (extension 1927)	mmcnickle@co.clatsop.or.us
5	City of Astoria	(Planner)	(503) 338-5183	rjohnson@astoriaor.us
6	City of Warrenton	(Planning Director)	(503) 861-0920	Planningdirector@ci.warrenton.or.us
7	City of Seaside	(Planning Director)	(503) 738-7100	kcupples@cityofseaside.us
8	City of Cannon Beach	(Planning Consultant)	(503) 436-1581 x 118	mays@ci.cannon-beach.or.us
9	City of Gearhart	Chad Sweet (City Administrator)	(503) 738-5501 / (503) 355-8282	cityadmin@freedomnw.com
10	OSU Sea Grant	Patrick Corcoran (Coastal Hazards)	(503) 325-8573	Patrick.corcoran@oregonstate.edu
11	Columbia Memorial Hospital	Tara Dyrset (Emergency Prep. Coordinator)	(503) 338-7505	tara_dyrset@columbiamemorial.org
12	Port of Astoria	Lora Eddy	(503) 325-0435	leddy@columbiaestuary.org
13	Seaside School District	Doug Dougherty	(503) 738-5591	ddougherty@seaside.k12.or.us
14	Fire Defense Board Chief	Ron Tyson	(503)298-8524	rtyson@pacifier.com
15	Clatsop Community College	Joann Zahn (Vice President – Finance & Operations)	(503) 338-2421	jzahn@clatsopcc.edu
16	CREST	(Coastal Planner)	(503)325-0435	jflint@columbiaestuary.org

Gearhart Planning Process:

4. Documentation of the Local Planning Process

A narrative description that explains the plan's development process, including who led the development at the staff level, any external contributors such as contractors, who was involved, who provided information, who reviewed drafts, and how the public was involved.

In November 2007, with authorization from the Gearhart City Council, Gearhart City Administrator Dennis McNally began the process of developing the Gearhart Hazard Mitigation Plan. McNally participated in the multi-jurisdiction planning process and began a draft plan with the assistance of the multi-jurisdiction steering committee and the plan facilitator hired by CREST. McNally reviewed the draft with the Gearhart fire chief, building official, police chief, and planner.

In April of 2008, Gearhart Planner Sabrina Pearson began reviewing the draft with the Gearhart Planning Commission. The commission reviewed the draft updates at each subsequent public planning commission meeting held April 10, May 8, June 12, July 10, August 14, and October 9. The draft is written in Microsoft Word (.doc) format and converted to an Adobe Acrobat (.pdf) file. This will enable the city to make necessary edits and updates and to upload the document onto the Gearhart city website.

On October 14, 2008, Gearhart submitted a printed copy and an electronic DVD copy of the Gearhart Natural Hazard Mitigation Plan to Oregon Emergency Management (OEM), FEMA Federal Emergency Management Agency, and Clatsop County.

In November 2013, Gearhart participated in the Clatsop County multi-jurisdiction meeting with the Clatsop County OEM.

5. Identifying Hazards

The risk assessment includes a description describing the characteristics of each hazard for each type of probable natural hazard that can affect the jurisdiction.

The following hazards are considered to be of risk to the City of Gearhart in Clatsop County:

1. FLOOD / HEAVY RAIN

Flooding generally occurs quickly due to heavy concentrated rainfall. Tidal changes in conjunction with high winds and/or snow accumulation at higher elevations have influence on the severity as well. Flood season is in effect from November 1 through March 31. Principal riverine flood sources in Gearhart are Neacoxie Creek, Neawanna Creek, and Necanicum River.

2. WINDSTORM

Wind storm hazards are common in Gearhart and usually result in localized power outages or large scale power outages, which can affect all of Clatsop County. Windstorms can reach hurricane strength in the exposed areas and damage to homes and property is not unusual during the winter months. Structures the most vulnerable to high winds include insufficiently anchored manufactured homes and older buildings in need of roof repair. It is essential that tie down standards are enforced. Fallen trees can affect emergency operations by blocking roads and can down power and utility lines. Strategic pruning and establishing a tree removal and maintenance program is prudent.

3. WINTER STORM

In most cases this hazard is limited to the mountain passes in Clatsop County with limited impact to the populated area. The hazard results in travel hazards throughout the county and both localized and large-scale power outages, which are more serious with low temperatures.

4. El NINO/LA NINA

Water temperatures in the Pacific Ocean play an important factor in determining the event of localized weather patterns. Some of our worst flood events coincide with La Nina where water temperatures are below average along the equator. El Nino sets up most of the weather pattern south of Gearhart, which can lead to dry or drought conditions. With La Nina we are at a higher risk for flood and severe weather patterns, and with El Nino we have a higher wildland fire hazard or drought.

5. EARTHQUAKE

This hazard is created by tectonic movement within the earth's crust. This movement is manifested as localized ground shaking and may include soil liquefaction and ground subsidence. After the initial seismic event, tremors or aftershocks can occur for an extended period of time resulting in additional structural damage to buildings and public facilities. Additionally there are earthquake fault lines throughout the Willamette Valley and the Cascadia Subduction Zone approximately 65 miles off the Oregon coastline. The movement of the Pacific Plate and Juan de Fuca Plate with the North American Plate may create a more serious situation not only to the magnitude of the earthquake itself, but also the likely tsunami which would immediately be generated.

6. TSUNAMI

This is a series of traveling ocean waves of extremely long length and period, generated by disturbances associated with earthquakes. As it enters the shoaling water of coastlines in its path, the velocity of its waves diminishes and wave height increases. In shallow waters they can crest to heights up to 40-60 feet and become a threat to life and property. The Gearhart coastline is particularly vulnerable with all residents in need of early warning.

7. FOREST FIRE/WILDFIRE

A major threat in Clatsop County is forest fire in the large areas of public and private forest lands. Needles from the trees are highly flammable. There is a high forest fire hazard particularly during the dry months of August, September, and October. The City of Gearhart is also surrounded by grasslands particularly on the ocean dunes that have potential for fire danger.

8. LANDSLIDE/SUBSIDENCE

This hazard is the downslope movement of rock, soil, or other debris or the opening of sink holes. These hazards are often associated with other incidents such as heavy rainfall, snow melt run-off, and floods or earthquakes. Our past history has been that we have frequent landslides during the rainy months on our mountain roads, highways, and city streets. The landslide hazard within Gearhart includes the erosion of ocean beaches. Beach landslides in addition to regular landslides increase this hazard in its severity level for the county.

9. DUST STORM/SAND STORM

Dust storms are rare in Clatsop County; however, Gearhart does suffer from blowing sand and sand storms that are mitigated by the maintenance of vegetated dunes. The Oregon Department of State Parks and the City of Gearhart work together with property owners in addressing this problem. City ordinances require the maintenance of vegetation on exposed sand areas. Sand storms could bury oceanfront homes without the stabilizing effect of vegetation.

9. VOLCANIC HAZARD

Another hazard experienced in some areas of Clatsop County in 1980 included volcanic ash. The eruption of the Mount St. Helen's Volcano in the Cascade Range created 4-6 inches of ash fallout. An epidemiological emergency could occur particularly within the rural agricultural community including salmon habitat and wildlife habitat. The volcanic ash was very difficult to remove and damaged some road maintenance equipment.

10. DROUGHT

Historically, Clatsop County has very few drought years. However, when drought conditions prevail, area creeks and fish can suffer. In addition, the surrounding forest is more susceptible to disease and the Clatsop plains and forests are susceptible to wildland fire.

6. Profiling Hazard Events

The risk assessment identifies the location and extent of all natural hazards that can affect the jurisdiction. The Plan includes information on previous occurrences of hazard events and on the probability of future hazard events.

Gearhart obtained a regional risk assessment from the Oregon Natural Hazard Mitigation Plan Oregon Coast Regional Profile for Region 1 (2012) included in the Gearhart Natural Hazard Mitigation Plan as an appendix to this document. The regional plan is important as it accurately identifies the location of each hazard addressed in the plan, the extent of each hazard identified in the plan, previous occurrences of each natural hazard, and the probability of future hazard events. Probability and vulnerability scores are upgraded or downgraded depending on the locality characteristics using existing plans, maps, and historical documentation.

The regional profile determination of probability and vulnerability is summarized below. Details of local occurrences are included in the Oregon Coast Regional Profile.

Probability

H: High = One incident likely within a 1 to 35 year period
M: Moderate = One incident likely within a 35 to 75 year period
L: Low = One incident likely within a 75 to 100 year period

Vulnerability

H: High = More than 10% affected
M: Moderate = 1% to 10% affected
L: Low = Less than 1% affected

	Hazard	Probability	Vulnerability	Local Occurrences?	Occurred Since 2008
1	Flood/Heavy Rain	H	H	Yes	Yes
2	Windstorm	H	H	Yes	Yes
3	Winter Storm	H	H	Yes	Yes
4	El Nino/La Nina	H	H	Yes	Yes
5	Earthquake	M	H	Yes	No
6	Tsunami	M	H	Yes	No
7	Forest fire/Wildfire	H	M	Yes	No
8	Landslide/Subsidence	H	M	Yes	No
9	Dust Storm	H	L	Yes	No
10	Volcanic	L	M	Yes	No
11	Drought	L	L	Yes	No

Gearhart Community Profile

7. Assessing Vulnerability: Identifying Assets

The plan provides an overall summary description of the community vulnerability to each hazard and the potential hazard impact on the community.

Hazards

The natural hazards that could affect the City of Gearhart, Oregon, include flood/heavy rain, windstorm, winter storm, El Nino/La Nina, earthquake, tsunami, forest fire/wildfire, landslide/subsidence, dust storm, volcanic hazard, and drought. The State of Oregon provides a detailed description of the community vulnerability to each hazard documenting probability for the Oregon Coast Region; this State of Oregon documentation is included in the multi-jurisdiction plan.

Using Existing Plans and Maps to document vulnerability and impact

The plan uses existing public facility master plans and capital improvement plans, city county insurance services documentation, and tax assessor records to document the types and numbers of buildings, infrastructure, and critical facilities within the hazard area. Existing maps document where these lie within identified hazard areas.

Critical facilities, Communications and Power

During disaster events, communications and power transmission lines can easily be lost due to their location above ground. Critical facilities need power and communication equipment to function. The community relies upon imported public facilities and services and goods to meet community needs and requires a local sustainability program to ensure that those needs are met in the event of a disaster.

Water

The City of Gearhart has its own water treatment facility and reservoirs. The jurisdiction also currently obtains water service from the City of Warrenton plant located less than 2 miles east of Gearhart. Water service could easily be lost in the event of a disaster that requires sustainability. Plans to strengthen and make the water system safe-to-fail in the event of a system wide shut down are a priority

Transportation

Transportation in and out of the city relies upon US Highway 101. This highway is two lanes each direction at each end of the city, one north and one south, and four or five lanes in central Gearhart. During disaster events, evacuation may make the highway unusable within the necessary evacuation timeline as all surrounding jurisdictions also rely upon it for transportation. Lewis and Clark Road, a two lane roadway that travels east across the forest lands towards Astoria with access to the county interior, may provide secondary access if it is not impacted in a disaster event.

8. Assessing Vulnerability: Estimating Potential Losses

Vulnerability in terms of an estimate of the potential dollar loss to vulnerable structures and a description of the methodology used to prepare the estimate.

The types and numbers of future and existing buildings located in the identified hazards areas, the potential dollar losses, and a general description of land uses and development trends are reflected in existing plans, policies, and maps. The Clatsop County Tax Assessor's Record calculates the current assessed value and market value of each structure. Clatsop County Insurance Services records calculate the current value of each city owned facility based on official appraisal records.

9. Assessing Vulnerability: Analyzing Development Trends

Vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

The Gearhart Zoning Ordinance, the Gearhart Comprehensive Plan, FEMA flood maps, and the Gearhart Wetland Delineation Study Guide influence land use, land development, and population growth. Existing plans and policies already in existence with documented support from local residents, businesses and policy makers, are updated regularly and can adapt easily to changing conditions and needs.

Land Use & Development

A detailed description of the Gearhart Land Use and Development requires review of the Gearhart Comprehensive Plan, the Gearhart Zoning Ordinance, the census data, the Gearhart Zoning Map, the Clatsop County Tax Assessor Plat Maps, FEMA flood maps, wetland delineations, and the existing plans, policies, and maps sited above.

Land use is governed by the Gearhart Land Use Zoning Map and the Gearhart Zoning Ordinance which define the permitted uses for each zone. Specific land use patterns and ownership distribution are shown on the tax assessor plat maps. Development in Gearhart is divided by US Highway 101. The majority of the residential housing is located west of US Highway 101 between the highway and the Pacific Ocean. Housing density east of US 101 increased rapidly between 2000 and 2014. High density condominium units and a higher density of single family dwellings are located near or on oceanfront. Commercial land use is dense east of US 101 and limited to neighborhood use in a small area west of US 101. Two golf courses are located west of US Highway 101.

Transportation & Commuting Patterns

A detailed description of the Gearhart Transportation and Commuting Patterns requires review of the Gearhart Comprehensive Plan, the Gearhart Zoning Ordinance, census data, the coordinated population forecast, and the existing plans, policies, and maps referenced above.
In summary, transportation facilities are described on the City of Gearhart ODOT Transportation Map and the Clatsop County ODOT Transportation Map. Currently, Gearhart is served by the Sunset Empire Transportation District. The bus connects Cannon Beach, Seaside, Gearhart, Warrenton and Astoria.

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

mode of travel is by automobiles. How people travel to work is indicative of the prevalence of low occupancy vehicle travel and can help predict the amount of traffic congestion and the potential for accidents. Census data for 2008-2012 indicates 77.36% of those employed Gearhart residents 16 and older drive to work alone, 8% work at home, 11.99% carpool, 1.9% walk, and less that .5% uses public transportation.

Geography & Climate

Gearhart is located on the Pacific Ocean front on the central coast of western Clatsop County. The climate in Gearhart is moderate. The monthly average temperatures range from highs around 68 degrees and lows around 51 degrees in July and August, to highs around 51 degrees and lows around 36 degrees in December and January. The city receives approximately 42 inches of rain annually. Monthly precipitation averages range from 10 inches during the wetter months of November through January, to less than 1 inch during the drier summer months of June through August. Knowledge of geographic factors like soil types can help identify areas vulnerable to natural hazards, specifically landslides and earthquake related hazards such as liquefaction, and can assist in mitigation planning. The types of soil found in Gearhart can be characterized as sandy loam and sand with small sections of silt and peat. The majority of soil types in the city have a slight to moderate hazard of erosion (K = 0.02-0.32).

Population & Demographics

Gearhart began to draw attention as a result of the railroad between Astoria and Seaside built in 1889. Gearhart attracted many vacationers from Portland and Astoria as a pleasant and quiet landscape for relaxation. Eventually, people began moving to Gearhart, some making permanent residences and many others setting up vacation and second homes. In 2010 the city was home to 1462 permanent residents, which made up approximately 3.9% of Clatsop County's total population. Census data describes the city population and demographics. Population growth forecasts are developed from the trend of population growth. Population in Gearhart increased from 967 in 1980 to 1,027 in 1990, decreased to 995 in 2000, and increased to 1462 in 2010. The impact 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 and may be placed upon special needs groups such as children, the elderly, the disabled, minorities, and low income persons. The 2010 census data provides the following statistics for these groups: children under 19 years of age are 19.2% of the population and those over 60 years of age are 28.5% of the population. Residents who speak English as a second language constitute 2.7% of the city's population.

Employment & Economics

A review of the official US Census 2008-2012 data reveals the employment distribution and median income in Gearhart. In the 2008-2012 survey, the median household income in Gearhart was $49,063. This is almost $4,000 below the 2008-2012 national median household income of $53,046 and almost $5,000 above the $44,330 median household income for Clatsop County. Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Housing

Housing type and year-built dates 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 homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because more strict building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1980s in the Northwest and California use earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot above base flood elevation.

In the 2010 Census, Gearhart had 1,450 housing units. Per the 2008-2012 American Community Survey the majority of the housing units, 74.76% is single family dwellings, 24.46% of the housing is multifamily, and less than 1% of the housing is mobile homes. For all housing units, 33.52% (486) are owner occupied, 11.24% (163) are renter occupied, and 55.24% (801) are vacant seasonal, recreational, or occasional use homes. Of the Gearhart housing stock, 90% was built prior to 1980 before stronger seismic building codes were put into place. This aging housing stock is susceptible to damage during disaster events.

Historic & 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. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important. The National Register of Historic Places lists two historic sites within the City of Gearhart – the Charles David Latourette House and Sea Lyft.

Critical Facilities

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan.
Critical facilities in Gearhart include the fire station, city hall, police station, and water treatment facility and reservoirs. Gearhart Elementary School located in Gearhart is part of the Seaside School District. These facilities can serve as temporary shelters until locally designated shelters are developed. The nearest hospitals are North Coast Providence Hospital in Seaside and Columbia Memorial hospital in Astoria.

Public Facilities and Services

Water Service is provided by the City of Gearhart Water Treatment Facility and water transmission lines from the City of Warrenton and City of Seaside. In the event of a disaster, Gearhart's first priority will be to restore local services, then aid Seaside and Warrenton using established connections.

Sewer Service is provided to each lot by on-site septic systems that must be approved by the Oregon Department of Environmental Quality. The regional office is located in the Clatsop County building in Astoria.

Power Supply is provided by Pacific Corp who is responsible for system maintenance and repair in the event of a disaster.

Telephone and Cable Charter and Century Link communications provide cable TV, computer, and local telephone service. Multiple mobile phone services such as Verizon, Sprint, and AT&T are available. During a disaster event each respective service provider will be responsible for system maintenance and repair.

Gas Service is provided by transmission lines by Northwest Natural Gas. LP gas is provided by multiple delivery companies such as Suburban Propane. Each respective service provider will be responsible for system maintenance and repair.

Existing Plans & Policies

Data included in this plan and all other data available upon request

Gearhart Comprehensive Plan	goals and policies and description of the jurisdiction in terms of the Oregon Statewide Planning Goals
Gearhart Zoning Ordinance	Governs land use, implements comprehensive plan.
Gearhart General Ordinances	Govern city administration.
Water Facilities Plans	Ensures adequate water supply.
Oregon Fire Code	Ensures adequate access and water supply are available prior to approval of any land use application.
Oregon Building Code/IBC	Building code compliance regulates construction.
Gearhart Local Wetland Inventory	Depicts riparian areas identified by the Oregon Department of State Lands.
Gearhart Flood Hazard Rate Study	Describes the potential flood risks
Census Data	Describes population, income, housing, and employment data to document potential loss.
Coordinated County Population Forecast	Predicts population growth.
City County Insurance Services Assessment	documentation of the current value of Gearhart assets and critical facilities including the fire station the police station, city hall, and city vehicles
Tax Assessors Tax Account Records	information about the current value of structures to document potential loss

Maps

Maps depict geographic characteristics of the jurisdiction and assist the jurisdiction in planning for natural hazards when making land use decisions.
* = Map included in this plan; all other maps available upon request
Gearhart Zoning Map

*ODOT Transportation System
Map for Gearhart

*ODOT Transportation System
Map for Clatsop County

*Gearhart FEMA NFIP FIRM,
June 16, 1999;
City Map: CPN# 4100300001D
Product Kit: 410030P
Flood Insurance Study: 410030S

*Gearhart Local Wetland Map
Oregon Department of State Lands

*DOGAMI and USGS File #0A-95-13
Tsunami Hazard Map of the Gearhart Quadrangle

USGS File #O846123A8 Geo
Topographic Survey

DOGAMI
Coastal Erosion Rate Maps

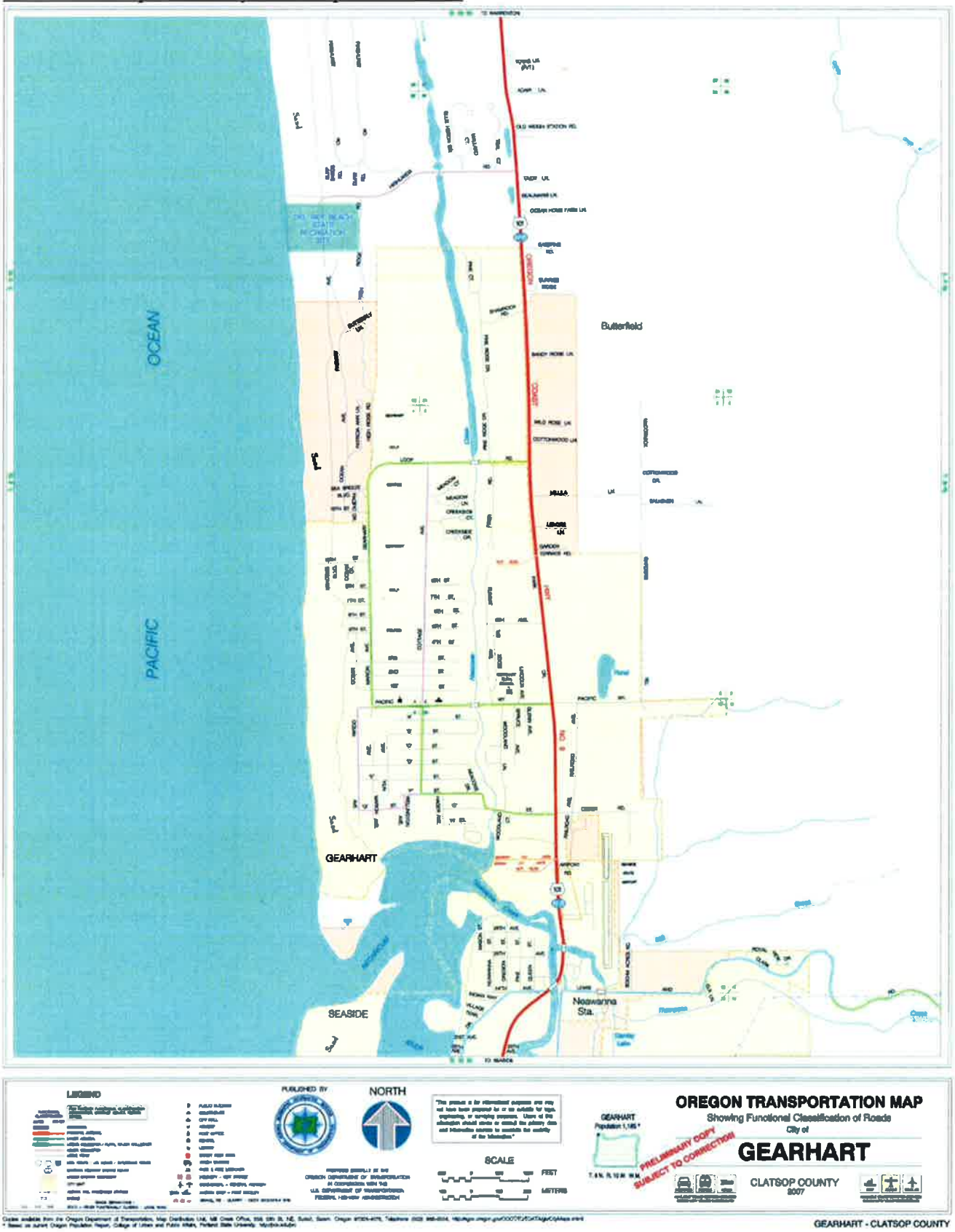
Clatsop County
Tax Assessor Plat Maps

*Cascadia Subduction Zone Map

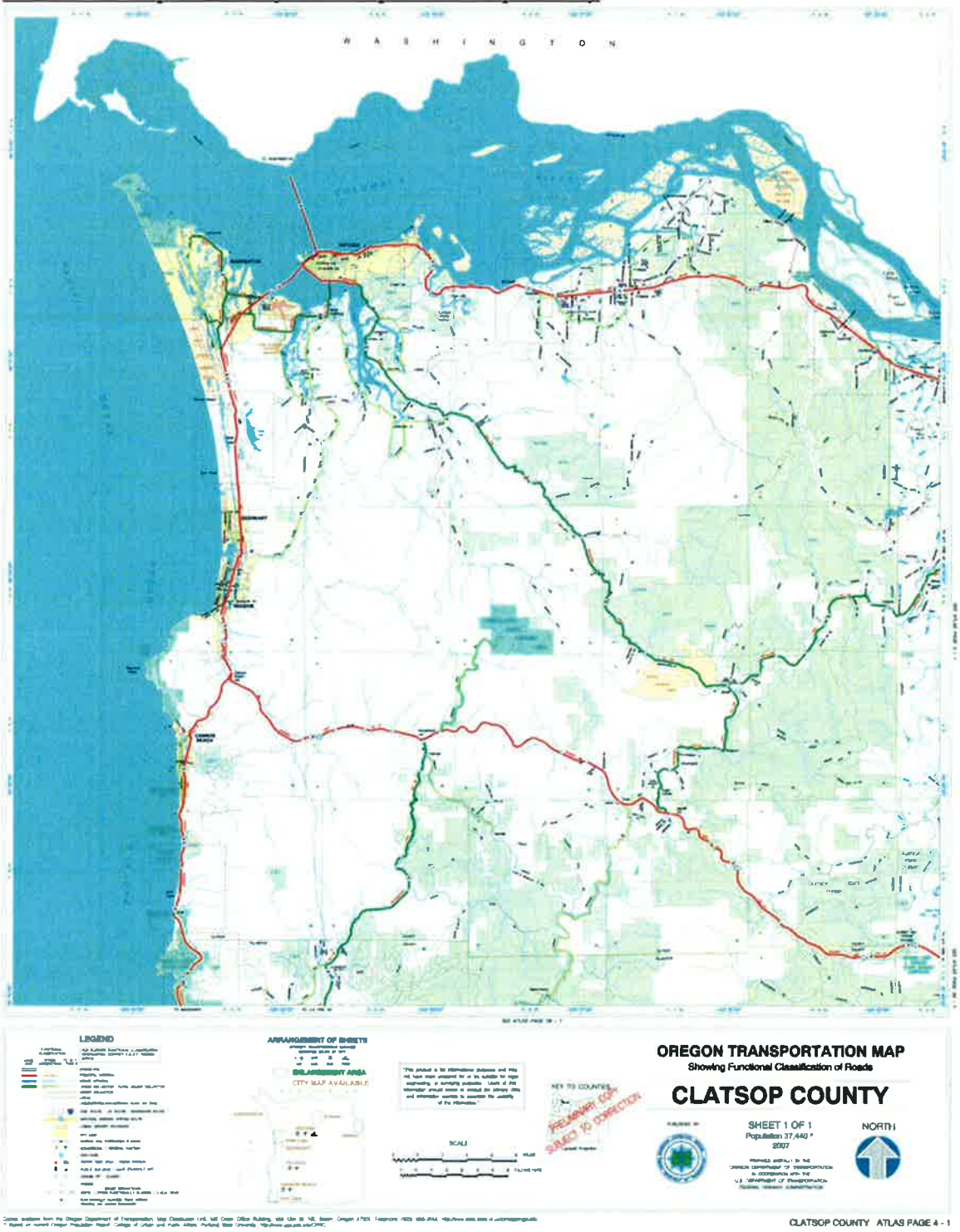
DOGAMI IMS-10 Map

Gearhart Comprehensive Plan
Geology Map

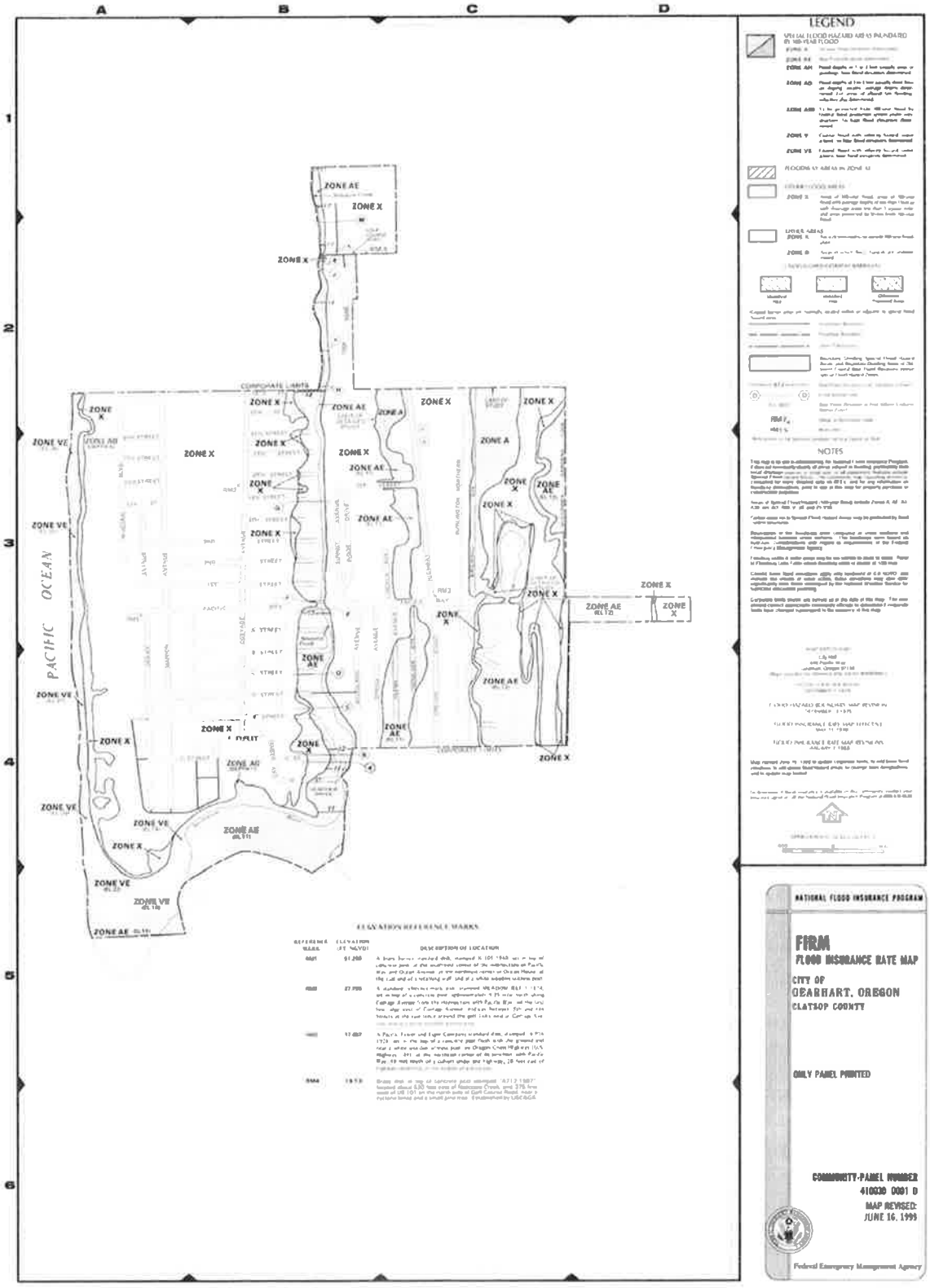
*ODOT Transportation System Map for Gearhart

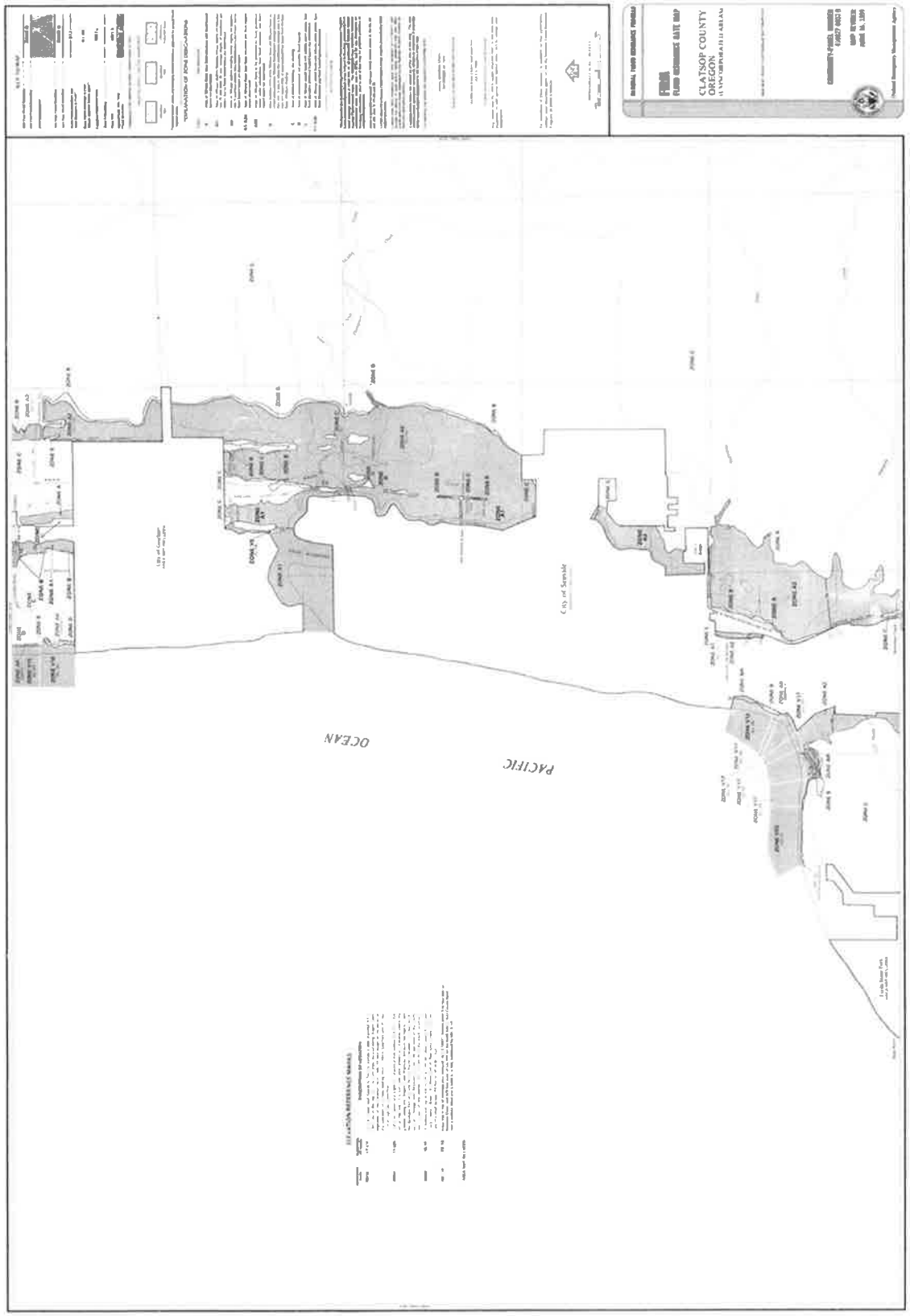


*ODOT Transportation System Map for Clatsop County

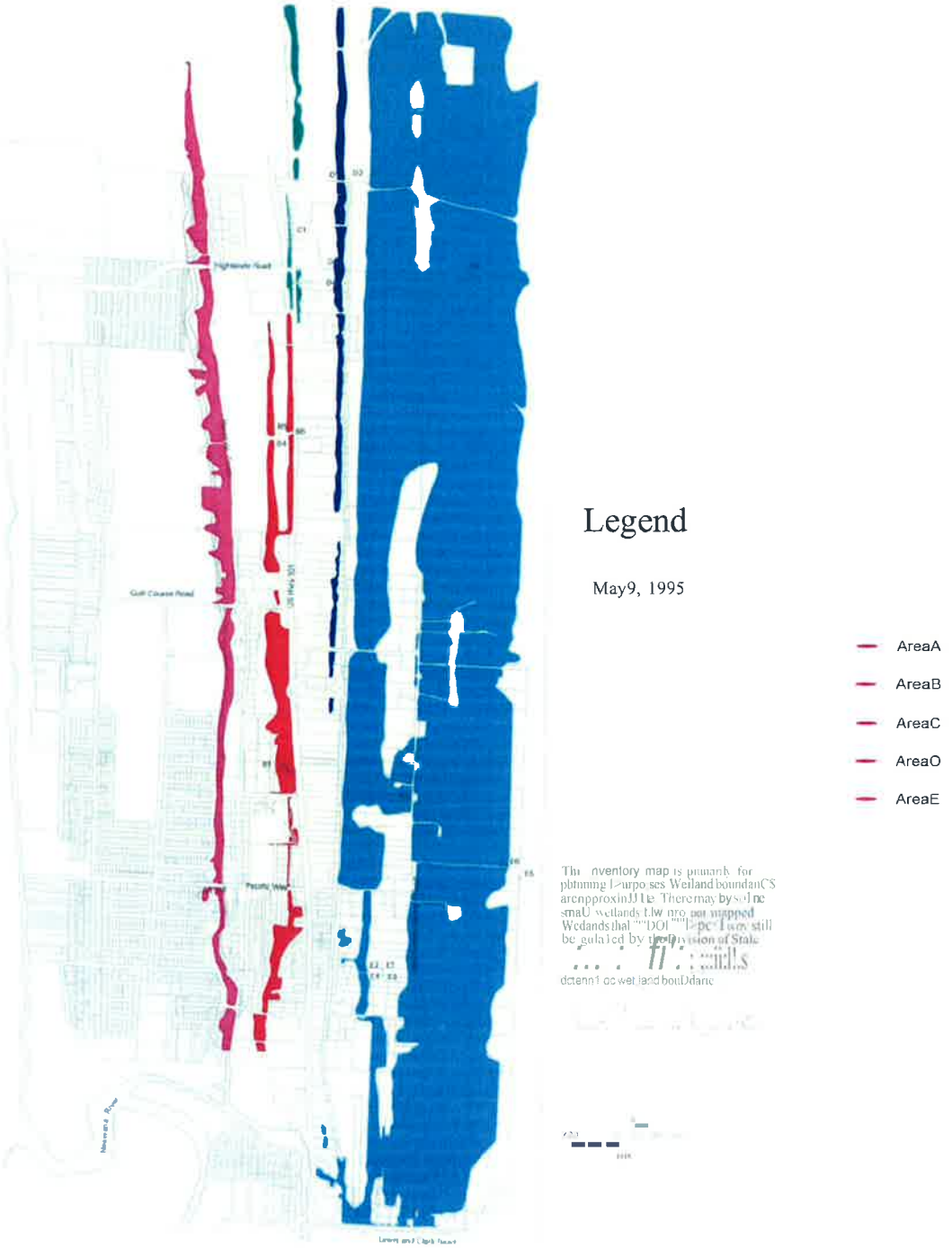


FLOOD MAPS


A
B
C
D
1
2
3
4
5
6
PACIFIC OCEAN
ZONE AE
ZONE X
ZONE VE
ZONE A
LEGEND
NOTES
ELEVATION REFERENCE MARKS
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
CITY OF
GEARHART, OREGON
CLATSOP COUNTY
ONLY PANEL PRINTED
COMMUNITY-PANEL NUMBER
410030 0001 D
MAP REVISED:
JUNE 16, 1999
Federal Emergency Management Agency

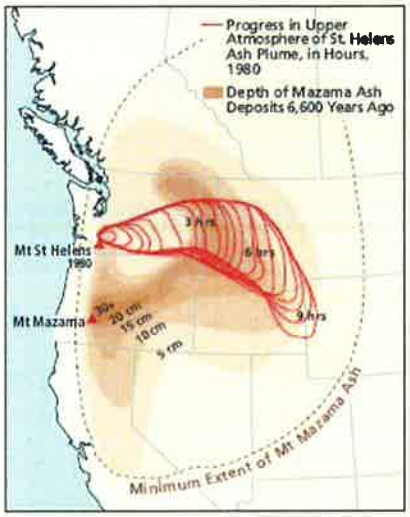

CLATSOP COUNTY
OREGON
OCEAN
PACIFIC

City of Gearhart
Local Wetlands Inventory

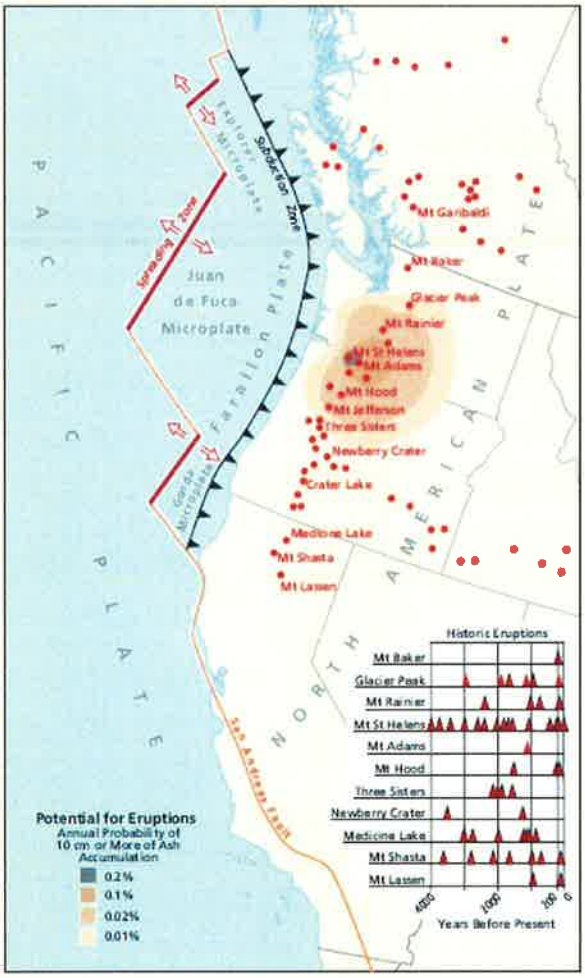


Volcanoes

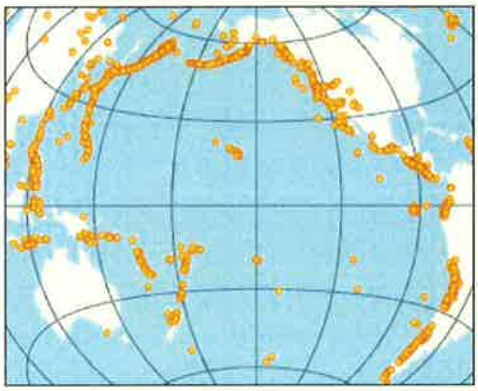
Mount Mazama and Mount St. Helens Ash Fall



Subduction and Volcanism



Ring of Fire: Volcanoes Around the Pacific



The Oregon Cascades are part of the archipelago of volcanoes that extends from northern California to British Columbia. These volcanoes typically experience episodes of growth punctuated by long periods of inactivity. They erupt very intermittently and almost always give advance warning of an impending eruption.

Loy, W.G., ed. 2001. *Atlas of Oregon, 2nd edition*. Eugene: University of Oregon Press. pp. 136-137

Maps from: Atlas of Oregon, 2nd edition
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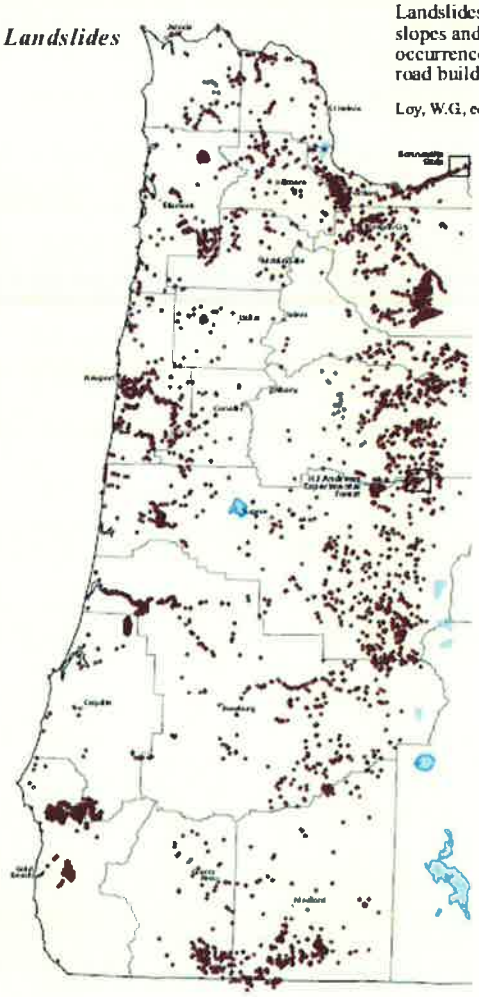
Landslides and Earthquakes

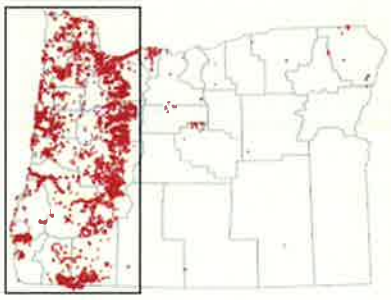
Landslides



Landslides are common in Western Oregon as a result of favorable conditions - steep slopes and high rainfall. Rare during the dry summer and fall, landslides are frequent occurrences in the winter and spring. Causes include undercutting of steep slopes, road building, and earthquake activity.

Loy, W.G, ed. 2001. *Atlas of Oregon, 2nd edition*. Eugene: University of Oregon Press. pp. 140-141

1996–1997 Landslides in Oregon



Area Shown in Detail

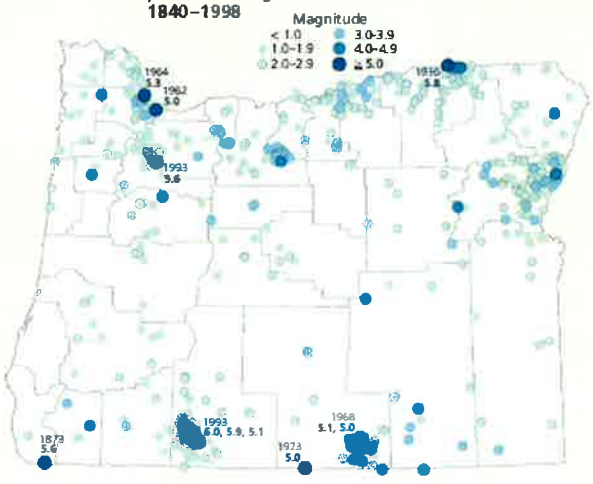
Earthquakes are caused by the bending and breaking of rocks along faults, which are most abundant in boundary zones between tectonic plates, as depicted in the Subduction and Volcanism map. Seismometers locate earthquakes and measure the resulting ground movement. The size and location of past earthquakes (map below) can be a powerful tool for predicting where future earthquakes will occur.

The Seismic Hazard map on the bottom left shows the maximum level of ground shaking likely to occur during a fixed interval of time (here, 1,000 years) from all possible earthquakes. Damage becomes significant at shaking levels of about 20% of the pull of gravity (Seismic Hazard map).

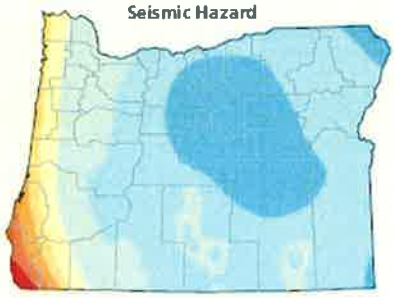
Loy, W.G, ed. 2001. *Atlas of Oregon, 2nd edition*. Eugene: University of Oregon Press. pp. 138-139

Earthquakes

Earthquakes in Oregon 1840–1998



Seismic Hazard



Peak ground acceleration (measured as a percentage of gravity) expected in Oregon once every 1,000 years

Percentage of Gravity

80% 70% 60% 50% 40% 30% 20% 10%

Maps from: Atlas of Oregon, 2nd edition
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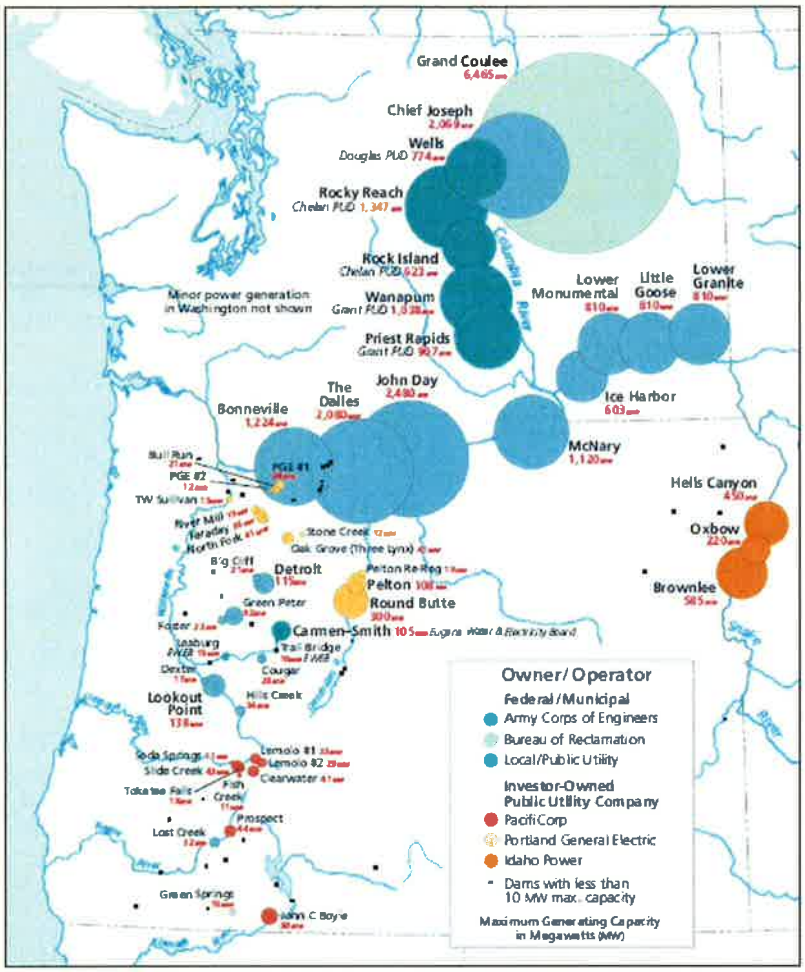
Power

Hydropower

Hydropower plants, the largest of which are on the Columbia River, account for most of Oregon's electricity generation. Coal and natural gas each account for 5% to 10% of Oregon's electricity generation. Electricity was first produced commercially in Oregon by a hydropower facility installed at the Willamette Falls in 1889. Large scale production of hydropower began in the 1930s when the federal government built dams and power plants on the Columbia, Umpqua, Rogue, and Klamath Rivers, and their tributaries.

Loy, W.G, ed. 2001. *Atlas of Oregon, 2nd edition*. Eugene: University of Oregon Press. pp. 100

Hydropower Facilities



Facilities with Greater Than 10 MW Capacity	Owner/ Operator	Date in Service	Current Capacity (MW)
Columbia			
Bonneville Dam	USACE	1938	1,224
Chief Joseph Dam	USACE	1961	2,069
Grand Coulee Dam	BuRec	1942	6,465
John Day Dam	USACE	1968	2,480
McNary Dam	USACE	1953	1,120
Priest Rapids Dam	Grant PUD	1961	907
Rock Island	Chelan PUD	1933	623
Rocky Reach	Chelan PUD	1961	1,347
The Dalles Dam	USACE	1957	2,080
Wanapum Dam	Grant PUD	1964	1,038
Wells Dam	Douglas PUD	1967	774
Lower Snake			
Brownlee Dam	iD Power	1959	585
Hells Canyon Dam	iD Power	1967	450
Ice Harbor Dam	USACE	1962	603
Little Goose Dam	USACE	1970	810
Lower Monumental Dam	USACE	1975	810
Lower Granite Dam	USACE	1969	810
Oxbow Dam	iD Power	1961	220
Willamette			
Big Cliff Dam	USACE	1954	21
Carmen-Smith Project	EWEB	1963	105
Cougar Dam	USACE	1964	28
Detroit Dam	USACE	1953	115
Dexter Dam	USACE	1955	17
Faraday Dam	PGE	1965	36
Foster Dam	USACE	1968	23
Green Peter Dam	USACE	1967	92
Hills Creek Dam	USACE	1962	34
Leaburg Dam	EWEB	1930	15
Lookout Point Dam	USACE	1954	138
North Fork Dam	PGE	1958	41
Oak Grove (Three Lyns)	PGE	1923	41
River Mill Dam	PGE	1911	19
Stone Creek	PGE	1956	12
T.W. Sullivan	PGE	1923	15
Trail Bridge Dam	EWEB	1963	10
Sandy/Deschutes			
Bull Run Dam	PGE	1894	21
PGE (Bull Run) No. 1	PGE	1929	24
PGE (Bull Run) No. 2	PGE	1962	12
Pelton Dam	PGE	1957	108
Pelton Re-Regulating Dam	PGE	1958	19
Round Butte Dam	PGE	1961	300
Umpqua/Rogue/Klamath			
Clearwater Dam	PacifiCorp	1953	41
Fish Creek Dam	PacifiCorp	1952	11
Green Springs/Keene Cr. Dam	BuRec	1959	16
John C. Boyle Dam	PacifiCorp	1958	80
Lemolo Dam/Plant No.2	PacifiCorp	1956	29
Lemolo Plant No.1	PacifiCorp	1955	33
Lost Creek/William L. Jess Dam	USACE	1976	32
Prospect Dam	PacifiCorp	1911	44
Slide Creek Dam	PacifiCorp	1951	43
Soda Springs Dam	PacifiCorp	1952	11
Toketee Falls Dam	PacifiCorp	1949	18

Maps from: Atlas of Oregon, 2nd edition
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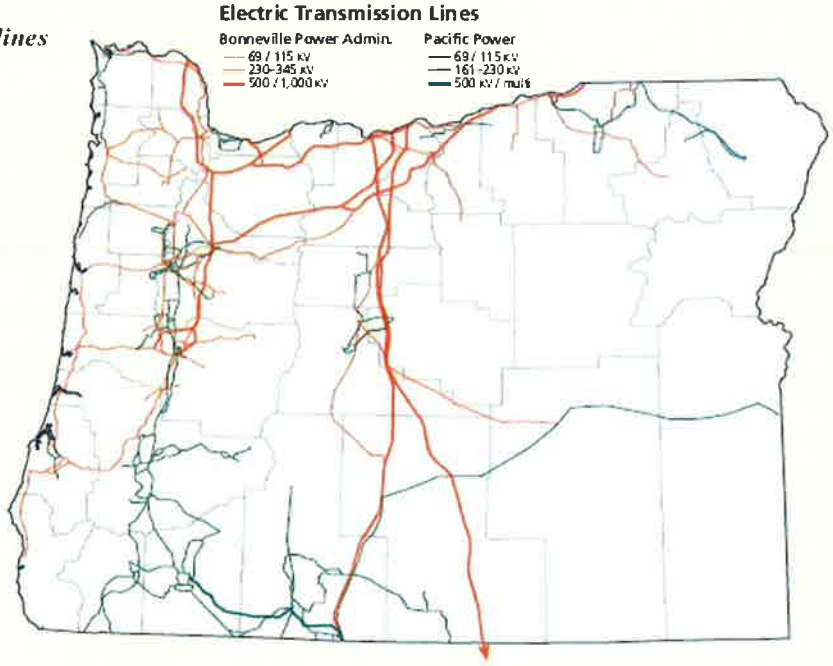
Energy Distribution

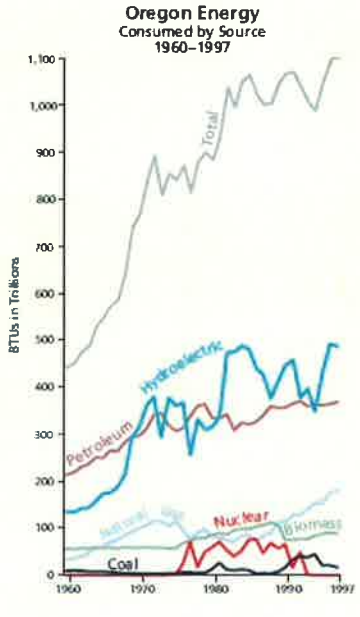
Power Grid and Pipelines

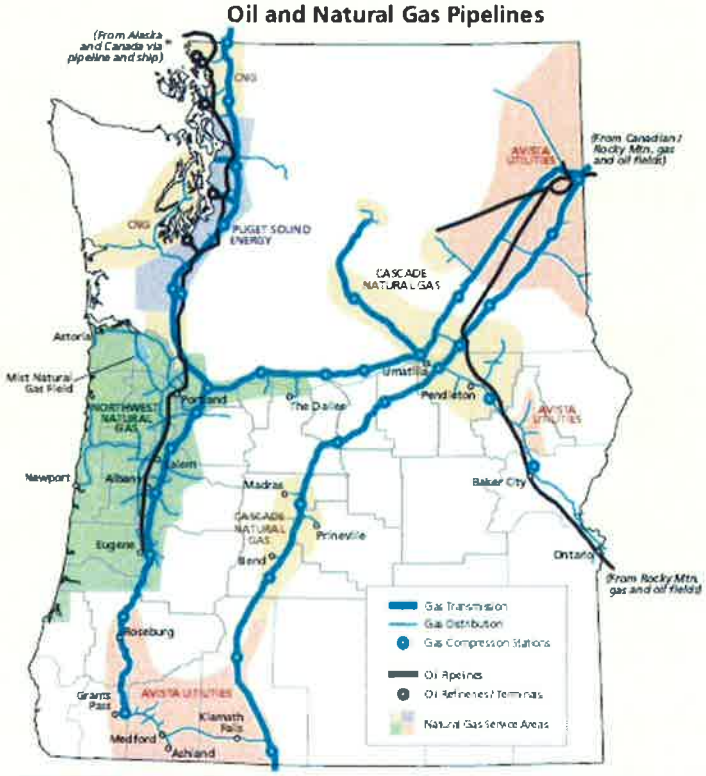
The West Coast power grid consists of numerous electricity-generating facilities and connecting transmission lines. Utilities in Oregon exchange electricity with other states and Canada. The top companies in retail sales revenue are Portland General Electric and Pacific Power and Light.

Most of Oregon's petroleum products, including gasoline, come from Northern Alaska. Natural gas burned in Oregon comes mostly from Alberta, Canada. Although a small amount of natural gas is produced in Columbia County, most comes by pipeline from Canada and several Rocky Mountain states. Long-distance gas transmission service is provided throughout the state.

Loy, W.G, ed. 2001. *Atlas of Oregon, 2nd edition*. Eugene: University of Oregon Press. pp. 102-103







Maps from: Atlas of Oregon, 2nd edition
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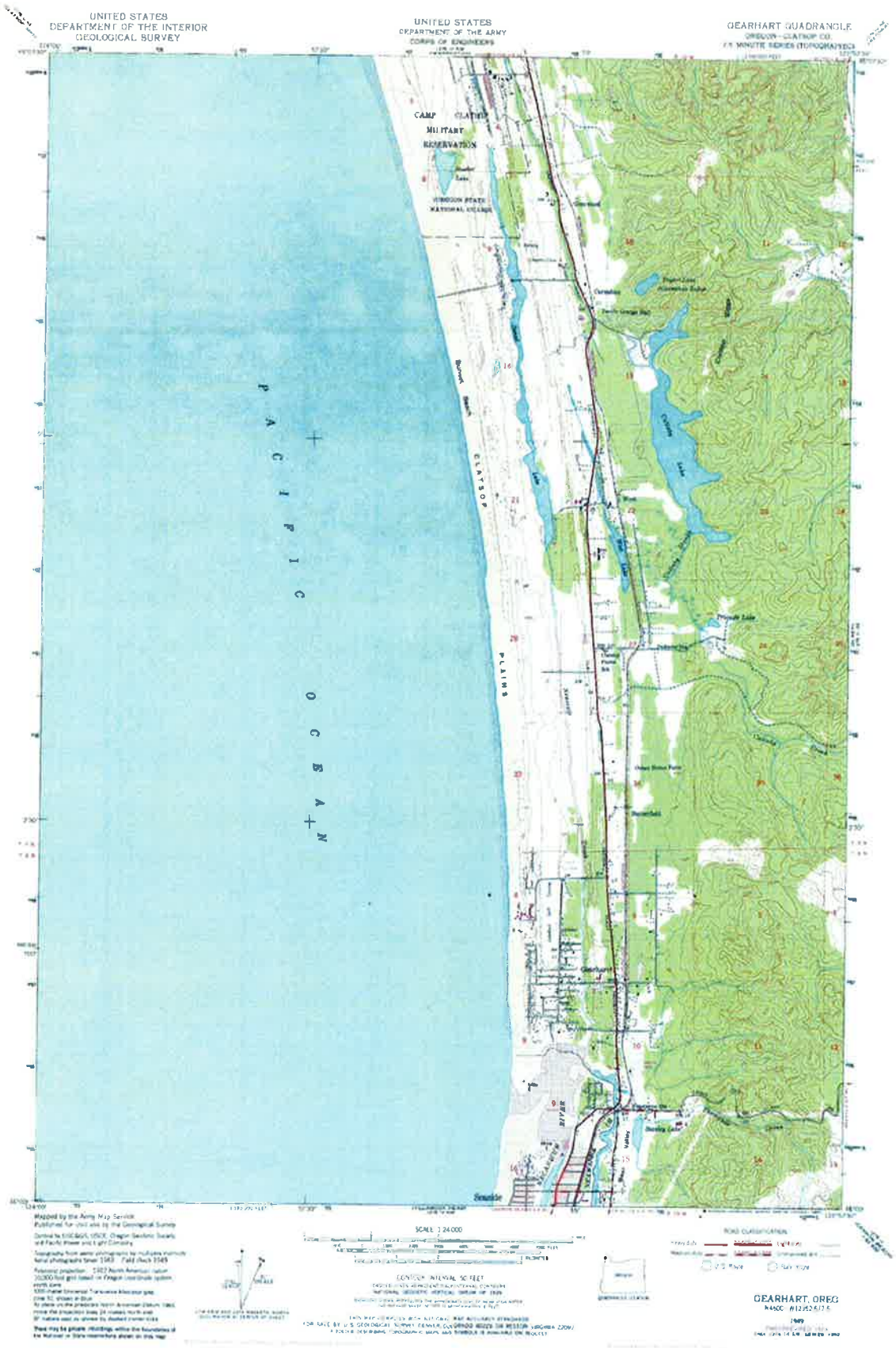
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UNITED STATES
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CORPS OF ENGINEERS
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Seaside
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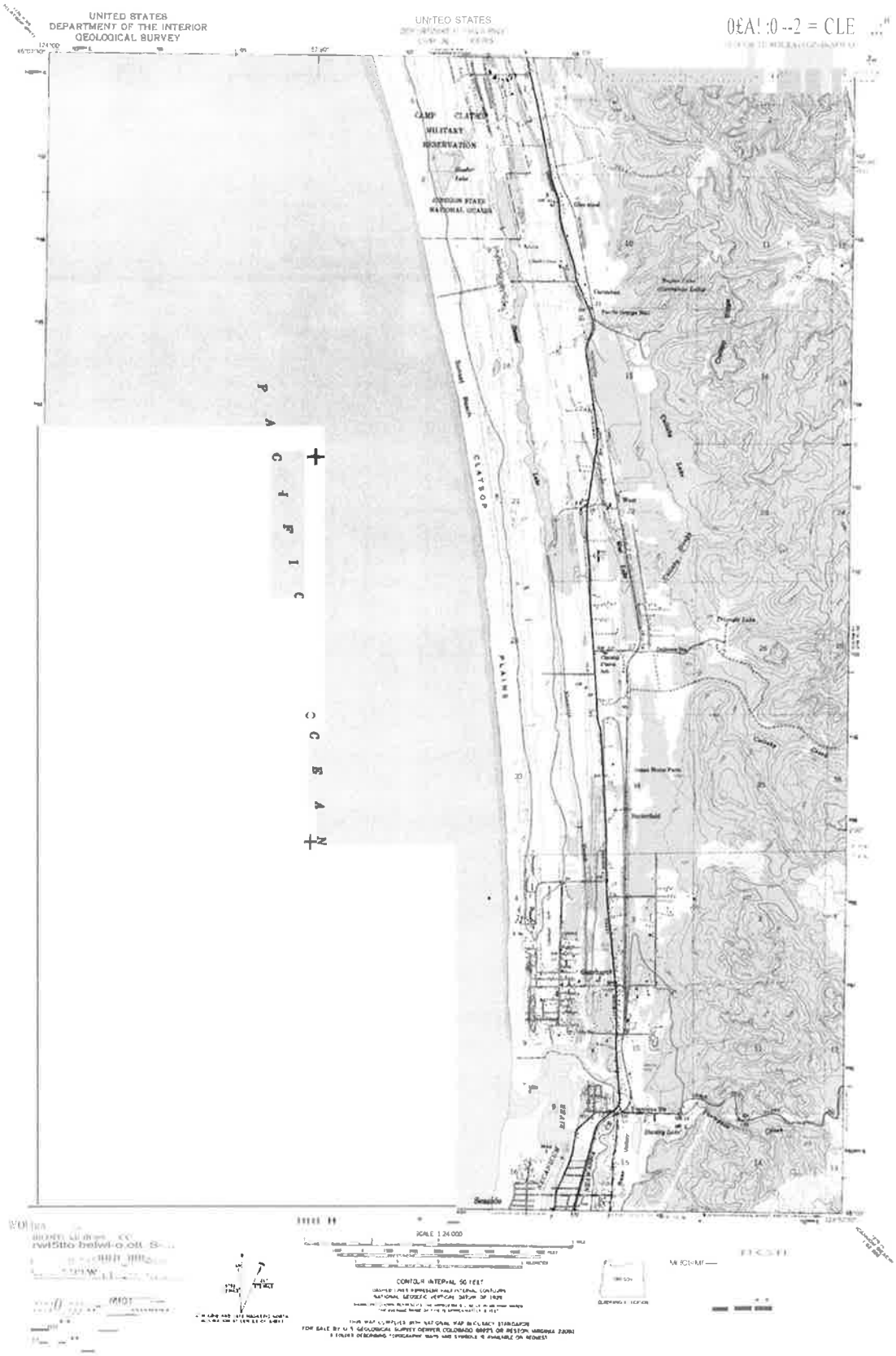
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Oregon Coast/Lower Columbia Region

Comprised of the state's costal line and the lower Columbia River, the Oregon Coast/Lower Columbia region has experienced an eight percent increase in population since 1990. This represents a lower rate of growth than other regions of the state. Just over half of the region's population lives in incorporated areas. Thirty percent of the region's houses were built before 1960, 35% between 1960 and 1980, and 35% were built after 1980. Transportation networks are an even greater consideration for the coastal region given the physical boundary of the ocean to the west and the Coast Range to the east. The average commute for workers in this region is 22 minutes each way. Seventy-five percent of the region's workers drive alone to work, 13% carpool, and five percent work from home. Most bridges in the area have not been seismically retrofitted, creating significant risk to the commuting population in areas at risk from earthquakes.

REGION FACTS

Population:

Total	208,000
Rural	93,010
Urban	114,990

Housing:

Single-Family	55%
Multi-Family	16%
Mobile Homes	18%
Boat, RV, Van, etc	2%

County	# of Hospitals	# of Hospital Beds	Police Stations	Fire & Rescue Stations	Power Plants	Dams	Bridges
Clatsop	2	60	7	19	2	6	186
Coos	3	152	9	19	0	14	258
Curry	1	24	5	13	0	4	91
Douglas	1	17	1	1	0	0	12
Lane	1	21	1	1	0	0	19
Tillamook	1	30	6	9	0	2	242

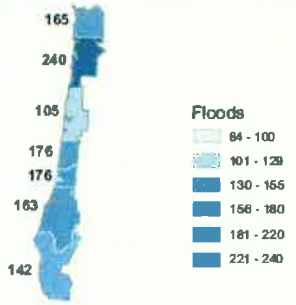
County Hazard Analysis

As part of the County Hazard Risk Analysis, each county develops risk scores for Oregon's major natural hazards. This score, ranging from 24 (low) to 240 (high), reflects the County's perceived risk for the particular hazard. Scores are current as of July 2003.

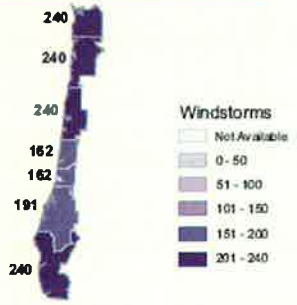
To obtain the most current scores, see http://www.oregonshowcase.org or contact Oregon State Police—Office of Emergency Management http://www.osp.state.or.us/oem/.

Seismic

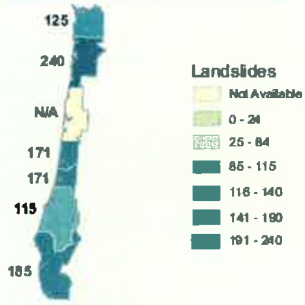
Floods



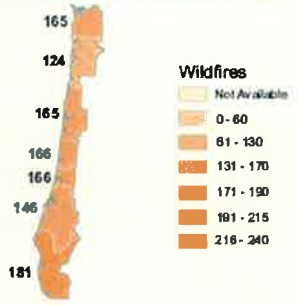
Windstorms



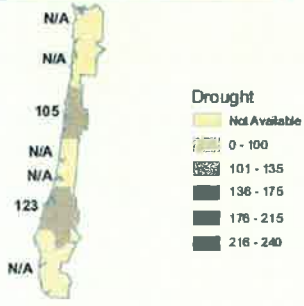
Landslides



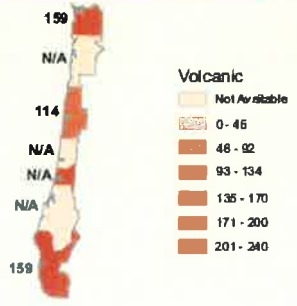
Wildfires



Drought



Volcanic



10. Multi-Jurisdiction Risk Assessment

Provides a local jurisdiction risk assessment where they differ from the entire planning area.

Increased Natural Hazard Risk

The City of Gearhart is subject to increased disaster risk from:

1. Flood/Heavy Rain
2. Windstorm
3. Winter Storm
4. El Nino/La Nina
5. Earthquake
6. Tsunami
7. Forest Fire/Wildfire
8. Landslide/Subsidence
9. Dust Storm
10. Volcanic
11. Drought

Assessing Risk

Identifying hazard risks involves collecting historical data and reviewing scientific knowledge including geographic and geologic evaluation. This knowledge can be further enhanced by utilizing technical evaluation tools such as Geographic Information Systems Mapping technologies.

Evaluating Concurrent Hazards that can Compound Disasters

When considering the impacts of natural hazards on development, it is important to understand that depending on the triggering event, other hazards can be triggered as well. For example, heavy rainfall can cause landslides and floods. Earthquakes can trigger landslides, tsunamis, and volcanic eruption. A major landslide, earthquake, tsunami or flood could destroy a road, damage utility systems, and isolate an area. Sometimes a proposed solution for one hazard can aggravate another hazard. Multi-hazard risk analysis is therefore recommended where more than one hazard exists.

11. Local Hazard Mitigation Goals

The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The following goals and objectives apply comprehensively to each potential hazard

GOAL 1: Develop and implement mitigation initiatives as potential projects to reduce hazards to human life, businesses, public and private property, and environmental systems.
*Gearhart Planning Commission – Ongoing – Initial review 2015/2016

1. Evaluate applicable city ordinances and capital improvement plans to ensure that they guide development that reduces potential for hazard
2. Promote insurance coverage to provide economic recovery after a disaster
3. Preserve environmental systems to serve natural hazard mitigation functions
4. Continuously develop and update natural hazard related data

GOAL 2: Implement effective mitigation projects and activities
*City Administrator, Planning Consultant – As projects are proposed.

1. Evaluate mitigation projects and activities for benefit/cost analysis and cost effective solutions
2. Educate the public about hazard risks and mitigation project implementation
3. Consistently seek diverse funding and resource partnerships for mitigation project and activity implementation

GOAL 3: Enhance emergency services and local first responders
*Fire Chief, Police Chief – Ongoing – Initial review 2015/2016

1. Enhance community self-sustainability
2. Prepare first responders with training and equipment
3. Strengthen emergency operations through improvements to communication and coordination
4. Coordinate hazard mitigation with emergency operations plans and procedures

GOAL 4: Improve regional coordination and communication
*Planning Commission, City Administrator – Ongoing – Quarterly Review of HMP

1. Participate in the Regional Hazard Mitigation Steering Committee
2. Maintain an active emergency preparedness committee
3. Survey neighboring communities and develop coordinated response plans for each potential hazard

12. Identification and Analysis of Mitigation Measures: Action Items

For multi-jurisdiction plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

The City of Gearhart addendum includes 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. Implementing the addendum's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the city's resources.

All Hazards

1. Review, revise, and update the natural hazard mitigation plan with local and multi-jurisdiction plan adoption by resolution at least once every five years calculated from the date of local plan and county multi-jurisdiction plan approval.
2. Use a cost benefit analysis to ensure that mitigation action items are efficient and meet mitigation criteria.
3. Evaluate city ordinances and capital improvement plans at least once every five years to ensure that they require new development and provide incentives for existing development to reduce the potential for hazard.
4. Evaluate the construction of critical facilities and structures and relocate structures and facilities in disaster impacted areas where possible
    a. Rebuild the fire station to withstand earthquakes and aid in recovery
    b. Rebuild Gearhart City Hall to withstand earthquakes and aid in recovery
5. Evaluate the construction of critical facilities, public utilities and services and retrofit, relocate, or bury as necessary to withstand the impact of disaster events.
    a. Provide generators, stand-by power capabilities, fuel sources for critical facilities, emergency equipment, and public utilities and services. Ensure that disaster gathering sites are accessible to those with special needs.
    b. Develop a local water facility capital improvement plan that incorporates failsafe and safe-to-fail systems.
6. Develop a Gearhart Self-Sustainability Program to provide food, shelter, water, communication, and public utilities and services in the event of a disaster.
    a. Conduct an annual census of Gearhart to identify those with special skills, special equipment and resources, and identify those with special needs.
    b. Develop and identify neighborhood suitability programs. Identify leaders in each neighborhood. Encourage each community member to have disaster event communication equipment and supplies.
    c. Strengthen emergency operations by developing a disaster event communication plan. Improve communication equipment. Ensure improvements to communication and coordination.
    d. Identify and enhance disaster evacuation routes; practice mass emergency evacuation.
    e. Prepare Gearhart Community Emergency Response Team (CERT) with training and equipment to act as first responders and deputize necessary persons.
    f. Identify disaster gathering sites and improve their identified functions.

7. Develop and implement a community disaster preparedness program.
    a. Conduct a periodic survey to identify and mitigate, or encourage the mitigation, of potential hazardous trees.
    b. Encourage retrofitting of external building features such as awnings, signs, propane tanks, etc, and interior features such as water heaters.

8. Educate the community about hazard risks and hazard mitigation. Encourage participation in mitigation and community sustainability programs by holding a periodic/annual open house or town hall meeting.

Flood/Heavy Rain

1. Comply with FEMA Floodplain recommendations for development within a floodplain.

Windstorm

1. Encourage the maintenance of trees to prevent tree hazards.
2. Develop an emergency shelter and operation center.
3. Train Gearhart CERT for each neighborhood.

Winter Storm

1. Retrofit structures, infrastructure, and critical facilities to reduce vulnerability to storms.
2. Develop and practice an evacuation plan.
3. Develop an emergency shelter and operation center.
4. Train Gearhart CERT for each neighborhood.

El Nino/La Nina

1. Comply with FEMA floodplain recommendations.
2. Implement a water conservation plan to ensure adequate water supply.
3. Ensure that run-off does not pollute ground water supplies.
4. Implement winter storm preparation standards.

Earthquake

1. Retrofit structures, infrastructure, and critical facilities to reduce vulnerability to seismic activities as identified by Gearhart city staff.
2. Develop and practice an evacuation plan.
3. Develop an emergency shelter and operation center.

Tsunamis

1. Retrofit structures, infrastructure, and critical facilities to reduce vulnerability to seismic activities.
2. Develop and practice an evacuation plan.
3. Develop an emergency shelter and operation center.
4. Train Gearhart CERT for each neighborhood.

Forest fire/Wildfire

1. Provide information about smoke alarms, fire safety, and fire sprinkler systems for individual structures.
2. Ensure adequate space between structures to reduce vulnerability
3. Construct fire access roadways and turnarounds within vulnerable neighborhoods and purchase land where rights-of-way are not available.
4. Retrofit sources of potential fires such as fuel tanks.
5. Initiate and maintain routine fire inspection and prevention within neighborhoods.
6. Conduct a periodic fire inspection for vegetative fuels reduction and vegetation maintenance program to provide fire buffer to structures.

Landslide/Subsidence

1. Install drainage systems where necessary to prevent soil erosion.
2. Require the maintenance of vegetation on bare soils.
3. In areas of slope hazard, require site investigation reports and soils engineering.

Dust Storm

1. Conduct a periodic survey of the vegetation on the dune and exposed sand areas. Require the maintenance of vegetation on exposed sand dune areas to increase resilience.

Volcanic Hazard

1. Develop and practice an evacuation plan.
2. Develop an emergency shelter and operation center.
3. Train Gearhart CERT for each neighborhood.

Drought

1. Develop a water conservation plan to be used during a drought event.

This form is a template to use when developing the above natural hazard mitigation action items.

PRE-DISASTER MITIGATION ACTION ITEM

<table>
<tr><td colspan="3">Proposed Action Item:</td><td>Alignment with Plan Goals:</td></tr>
<tr><td colspan="3"></td><td></td></tr>
<tr><td colspan="4">Rationale for Proposed Action Item:</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Ideas for Implementation:</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="2">Coordinating Organization:</td><td colspan="2"></td></tr>
<tr><td colspan="3">Internal Partners:</td><td>External Partners:</td></tr>
<tr><td colspan="3"></td><td></td></tr>
<tr><td colspan="3">Timeline:</td><td>If available, estimated cost:</td></tr>
<tr><td>Short Term (0-2 years)</td><td colspan="2">Long Term (2-4 or more years)</td><td rowspan="2"></td></tr>
<tr><td></td><td colspan="2"></td></tr>
<tr><td>Form Submitted by:</td><td colspan="3">City of Gearhart</td></tr>
</table>

13. Implementation of Mitigation Measures:

The mitigation strategy section shall include an action plan describing how the actions identified shall be prioritized, implemented, and administered by the city. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Hazard mitigation follows an orderly process that includes:
Step 1: Identify the hazard risks
Step 2: Characterize the location, probability, and potential severity of the hazards
Step 3: Educate the community about the hazards
Step 4: Define acceptable risks
Step 5: Identify appropriate hazard mitigation measures
Step 6: Use a cost benefit review to review mitigation measures.

Hazard mitigation consists of activities with one overriding goal: to lessen future losses from hazard events. Hazard mitigation actions coordinate public policy, intergovernmental relations, public-private partnerships, economics, acceptable risk and a wide range of activities and programs all based on the evaluation of the risk, probability, and severity of the potential hazard.

"Hazard mitigation means any action taken to reduce or eliminate the long-term risk to human life and property from hazards." 44 CFR Subpart M 206.401

The easiest, but often not the most feasible hazard mitigation action, is to avoid the hazard. This takes a combination of knowledge and a willingness by public and private decision-makers to define such situations as unacceptable risks. For example, often it is much safer and less environmentally disruptive to avoid construction improvements in high velocity floodplains and to avoid landslide prone hillsides than it is to build expensive structures to control flooding or landslides.

There are societal benefits to be achieved by developing and implementing effective hazard mitigation strategies and programs. Actions taken by local, regional, and federal governments, the private sector, public utilities, and others who invest in hazard mitigation help ensure the continuity and survivability of assets at risk from hazards. Some of the most apparent benefits of hazard mitigation include reduced human and structural losses, lower response costs and demands on emergency services, and reduced losses to the economy. Further benefits of hazard mitigation include maintaining or improving natural, recreational, and environmental assets such as water quality and agricultural and forest productivity.

Economic Analysis for Natural Hazard Mitigation

Much of the loss from natural disasters comes in the form of property damage, additional living and business interruption costs, and other costs directly related to the impacts of hazard events. It is usually important to determine the economic feasibility of preventative actions that may lessen future losses. Governmental agencies should ensure that the benefits of hazard mitigation exceed the costs.

Cost Benefit Review and Analysis

If federal funding is involved in hazard mitigation projects, a cost to benefits analysis must determine that the benefits exceed the costs. Cost benefit analysis methods and training have been developed and guidance is available from OEM in Appendix 9 of the State of Oregon Natural Hazards Mitigation Plan (SNHMP). A cost benefit ratio of 1:1 is required to meet the minimum review criteria.

Cost benefit analysis by itself does not address the full range of considerations, including non-economic impacts such as but not limited to community values, historic properties, habitat and environmental issues, and especially important or critical facilities.

The City of Gearhart currently distributes the responsibility for the prioritization, implementation, and administration of existing plans, policies, ordinances, and the natural hazard mitigation plan including the action items among the police, fire, public works, planning commission, city council, and CERT.

Government Structure:

The City of Gearhart is led by a mayor and a four-member city council. The city council meets a minimum of one time per month on the first Wednesday of each month in Gearhart City Hall Council Chambers at 7 pm.

Administration:

The Gearhart city administrator serves the council and administrates the city zoning ordinances.

Two office employees work under the direction of the city administrator. An administrative assistant-treasurer handles the office work and a city clerk works with the local court and the planning commission.

Public works employees work under the direction of the city administrator. Professional consultants serve Gearhart exclusively under the direction of the city administrator. Consultants include an attorney to serve council; the planner to review land use applications and work with the planning commission; and a land use attorney to review land use issues at the request of the planning commission.

Police:

Gearhart has one police department with four officers, one of whom is a reserve officer.

Fire:

The Gearhart Fire Department has two stations and one full-time fire chief. The remaining 26 members of the Gearhart Fire Department are volunteers.

Land Use:

Land use applications are administered under the direction of the Gearhart city administer with the technical assistance of the city planner and attorney. Input may be given by the city clerk, the planning commission, the city council.

The Planning Commission:
The Gearhart Planning Commission, a committee of the city council, is established to study and make recommendations to the city council, public officials, and individuals regarding matters relating to planning and development of Gearhart and the surrounding area.

Hazard Mitigation Plan:
The Gearhart Planning Commission and City Council function as public review bodies. City staff including the planner, the administrator, the public works director, the fire chief and police chief provide technical information and review of the hazard mitigation plan.

Hazard Mitigation Plan and Emergency Preparedness Committee:
Gearhart has established a hazard mitigation and emergency preparedness committee including the fire chief, city administrator, public works director, police chief, planner, building official, a member of the planning commission, and a member of the city council.

Prioritization, Implementation, and Administration of Action Items:
The Gearhart Hazard Mitigation Committee will meet no fewer than two times each year. The committee will review, prioritize, and implement action items through applicable funding mechanisms and programs. A reference document with these programs is provided by FEMA. These meetings will be open to the public. Notice will be published and posted consistent with public meeting requirements. Minutes of this public meeting will be taken and distributed. Periodically, surveys will be sent to the public requesting information critical to hazard mitigation and emergency preparedness planning. Emergency preparedness information will be available at city hall.

14. Multi-Jurisdiction Mitigation Strategy

For multi-jurisdiction plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

A member of the Gearhart Hazard Mitigation and Emergency Preparedness Committee will meet with the Clatsop County Multi-Jurisdiction Mitigation Steering Committee in May and November of each year.

Building Permits:

Building permits are reviewed by the Gearhart administrator and the city building official for consistency with Oregon building codes/IBC, the National Floodplain Insurance Program, the Gearhart fire code, zoning ordinances, public works standards, and general ordinances.

Community Organizations and Programs:

Community organizations and programs 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. Actions identified by the plan include the establishment of communication channels with the public and specific subgroups within the population such as the elderly and school children.

Clatsop County and Gearhart 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 is natural hazard mitigation and emergency preparedness.

Clatsop County Multi-Jurisdiction Hazard Mitigation Plan:

A Clatsop County Community Organizations and Programs Guide is provided in Section 2 of the Clatsop County Multi-Jurisdiction Hazard Mitigation Plan. The guide highlights organizations that are active within the county and may be potential partners for implementing mitigation actions.

15. Monitoring, Evaluating, and Updating the Plan: Five-year cycle

The plan maintenance process shall include a section describing the method of monitoring, evaluating, and updating the plan within a five year cycle.

Gearhart shall review the hazard mitigation plan at no fewer than two public meetings per year. Currently, the planning commission and city council serve as the public meeting review bodies. These meetings are currently scheduled to be held at the regular April and September planning commission meetings. Meetings shall be noticed to the public consistent with public meetings laws. Minutes shall be taken of each meeting. Gearhart staff including, but not limited to, the city administrator, public works superintendent, planner, fire chief and the police chief will provide technical input for the Gearhart Hazard Mitigation Plan and will review each draft.

Gearhart will participate in the Clatsop County Multi-Jurisdiction Hazard Mitigation Plan meetings no fewer than two times per year. Multi-jurisdiction plan meetings are currently scheduled to be held on a date to be determined each May and November. Meetings shall be set by the steering committee members who shall also set the time and place. Special meetings may be called by the steering committee. Meetings shall be noticed to the public consistent with public meetings laws. Minutes shall be taken of each meeting. Committee members receive no compensation for their membership.

The Gearhart Hazard Mitigation Plan shall be reviewed, revised if appropriate, and resubmitted to the Oregon State Hazard Mitigation Officer for approval within five years of the date that the Clatsop County Multi- Jurisdiction Plan is approved in order to continue to be eligible for HMGP project grant funding. The state will then send the plan to the appropriate FEMA regional office for formal review and approval. When Gearhart is notified that their plan is approved, the city shall adopt the plan by resolution.

At the public meetings to be held, the review body shall review the Gearhart Hazard Mitigation Plan and shall incorporate the requirements of the hazard mitigation plan, existing plans, studies, reports, and technical information into planning mechanisms such as the comprehensive plan, zoning ordinances, or capital improvement plans where appropriate.

16. Implementation through Existing Programs

The plan shall describe the process by which the local government incorporates the requirements of the mitigation plan into other mechanisms such as comprehensive plans or capital improvement plans when appropriate.

Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and updated, and maximizes the city's resources. Linking existing plans and policies to the natural hazard mitigation plan helps identify what resources already exist that can be used to implement the action items identified in the plan to reduce natural hazard risk.

Gearhart shall review the plan and, at regularly scheduled public meetings, shall provide recommendations to incorporate the requirements of the hazard mitigation plan into other mechanisms such as comprehensive plans or capital improvement plans when appropriate. The planning commission shall undertake a post acknowledgement plan amendment process when processing a zoning ordinance or comprehensive plan amendment. The city council shall follow public meeting and public hearing processes when incorporating mitigation plans into capital improvement plans and city ordinances.

17. Continued Public Involvement: Ensure continued public participation

The plan shall explain how continued public participation will be obtained.

Gearhart shall review the hazard mitigation plan at no fewer than two public meetings per year. Currently, the planning commission and city council serve as the public meeting review bodies. These meetings are currently scheduled to be held at the regular April and September planning commission meetings. Meetings shall be noticed to the public consistent with public meetings laws. Minutes shall be taken of each meeting. Gearhart staff including, but not limited to, the city administrator, public works superintendent, planner, fire chief and the police chief will provide technical input for the hazard plan. Gearhart will participate in the Multi-Jurisdiction Hazard Mitigation Plan meetings and will review each draft.

Gearhart will participate in the Clatsop County Multi-Jurisdiction Hazard Mitigation Plan meetings no fewer than two times per year. Multi-jurisdiction plan meetings are currently scheduled to be held on a date to be determined each May and November. Meetings shall be set by the steering committee who shall also set the time and place. Special meetings may be called by the steering committee. Meetings shall be noticed to the public consistent with public meetings laws. Minutes shall be taken of each meeting. Committee members receive no compensation for their membership.

At the public meetings to be held, the review body shall review the Gearhart Hazard Mitigation Plan with the public, neighboring communities, and local and regional agencies involved in hazard mitigation activities. The review body shall note and address concerns about hazard risks. In this manner, the plan will be reviewed regularly by the public during the drafting stage and prior to adoption.

[ii] Sunset Empire Transportation District, *Pink Salmon Route, http://www.ridethebus.org/routes/rt101.html.*

[iii] National Weather Service Forecast Office. 2007, *http://www.wrh.noaa.gov/pqr/climate/ast_clisummary.php>*

[iv] United States Department of Agriculture. Natural Resources Conservation Service, *Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx*

[v] City of Gearhart. *http://www.ci.gearhart.or.us/cityhall.html.*

[vi] National Register of Historic Places. 2008, *http://www.nps.gov/nr/research/nris.htm.*

U. S. Census Bureau, 2010 Census Profile, Portland State University, Population Research Center

U.S. Census Bureau, American Fact Finder, 2008-2012 American Community Survey, census.gov

City of Seaside

Natural Hazards Mitigation Plan Addendum

City of Seaside
989 Broadway
Seaside, OR 97138

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Volume III: City Addendum Seaside

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Overview

The City of Seaside has developed this addendum to the Clatsop County multi-jurisdictional Natural Hazards Mitigation Plan (NHMP) in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Seaside, Oregon, which include coastal erosion, wildfires, droughts, floods, landslides, volcanoes, winter storms, tsunamis, earthquakes, and tornadoes. This plan addresses the specific challenges and sensitivities faced by the city, as well as the local resources to mitigate these risks. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the City. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize damage and speed recovery from natural disasters.

This addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as infrastructure improvements. Natural disaster planning is prudent both economically and socially; it can profoundly reduce the loss of hundreds, if not thousands of lives, and ensure an easier path to recovery after a significant event.

This addendum to the County's Multi-Jurisdictional Plan is comprised of the following sections:

1) Public Outreach: This section describes the process the city used to develop the plan, city staff's participation, and the stakeholder committees involvement in the planning process.

2) Community Profile: This chapter provides background information about the city's demographics, infrastructure and socio-economic conditions.

3) Hazard Assessment: The Hazard assessment includes a description of potential natural hazards that could trigger emergency conditions in Seaside. This information is intended to supplement the hazard information in the County NHMP by identifying risks that are specific to Seaside or vary from the concerns in the County's broader plan.

4) Action Items: The Plan includes a list of recommended action items based on input from the city staff and community stakeholders.

Section 1:
Public Outreach

The City of Seaside has taken several steps to build public support for the Natural Hazard Mitigation Plan and develop coalitions to oversee implementation of the plan's action items. The involvement of community groups as well as the emergency responder community and city administrators will ensure that the plan reflects progress on the ground towards a more resilient and prepared Seaside.

1.1 Stakeholder Involvement

Tsunami Advisory Group
The Tsunami Advisory Group (TAG) is a volunteer group of citizens that meets regularly to organize outreach events and support the city's efforts to prepare for a Cascadia Subduction Zone (CSZ) earthquake and tsunami event. The TAG influenced the development of the plan's recommendations for future action through the group's independently drafted *Tsunami Strategic Investment Plan, Seaside, Oregon: Education, Evacuation and Survival, 20,000 refugees for 20 Days by 2020*, which was completed by the group in 2009 and updated in 2012. TAG members were also asked to review a working draft of the city's NHMP, and were considered the technical advisory committee for the plan.

Emergency Preparedness Committee
The City of Seaside operates the Emergency Preparedness Committee (E-PREP) to coordinate internal hazard planning and community preparedness activities across city departments. The committee is composed of all department heads, as well as the director of the Seaside visitor's Bureau and the communication director for the Seaside Police Department. In the event of an emergency, this committee will be responsible for staffing the Seaside Emergency Operation Center (EOC) and coordinating the city's response and recovery efforts, in partnership with outside agencies as needed. The E-PREP Committee completed the City's Emergency Operation Plan in 2010. This document defines how the City of Seaside will organize and respond to incidents.[1] The E-PREP Committee served as a local stakeholder advisory group for the Seaside Addendum planning process.

City of Seaside Staff
The initial Seaside Addendum was compiled and written by City Planning Director Kevin Cupples, with assistance from RARE (Resource Assistance for Rural Environments) participants Joe Otts and Sarah Bronstein. Sarah Bronstein was contracted through the RARE program as an Emergency Preparedness Assistant for the City, a position which included coordinating school outreach and organizing the restocking of tsunami supply barrels in addition to assisting with the City's NHMP Addendum. Five year updates will be accomplished by current planning staff.

Clatsop County

This Addendum was initiated as part of a County-wide planning effort that began in 2006, when FEMA awarded Clatsop and Lincoln Counties a grant to support the development of Natural Hazard Mitigation Plans for both counties and the cities in their jurisdiction. This grant was acquired through a partnership with the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center and Oregon Emergency Management (OEM). The grant was awarded in 2006, and planning efforts began in 2007. Although Seaside was included in the initial planning process, the city's plan was not finished at that time. Since the beginning of the County-wide Natural Hazard Mitigation Planning Process in 2007, the City of Seaside's Planning Director, Kevin Cupples, and the School District Superintendent Doug Dougherty, have been members of Clatsop County's NHMP Steering Committee.

Seaside's plan addendum has now been completed concurrently with the County's NHMP 2013 update. This addendum is consistent with the updated county plan, and is intended to be implemented in conjunction with county-wide planning efforts. The Seaside Addendum will be updated on a five year basis by the E-PREP Committee, TAG, and planning staff to maintain consistency with the County-wide NHMP.

In addition, the city E-PREP group will continue to meet regularly to consider updates to the Seaside City Addendum. Any formal updates generated at these meetings will be presented to the city council on an annual basis for review and adoption.

1.2 Planning Timeline

June – October, 2012: Background Research

- Gather data and background information, including city history, local hazard maps, and census data. Review existing plans and policies.

December, 2012: Plan and Guideline Review

- Review adopted plans for the neighboring jurisdictions of Astoria, Cannon Beach and Gearhart.
- Refine plan outline based on these examples.
- Review FEMA's Local Plan Review Guide for guidance.

January 1-10th, 2013: Assemble Stakeholders

- Alert all stakeholder groups (TAG, E-PREP, OEM and OPDR) of pending rough draft and timeline for review and comments. Solicit components of plan from specific groups.
- January 8th 2013: City Department Heads Meeting. Planning Director Kevin Cupples alerted E-PREP members of the timeline for the plan.

- January 10th, 2013: Tsunami Advisory Group Meeting. City planning staff attends to provide the timeline for the plan and solicit plan components regarding recommended infrastructure improvements for tsunami hazard mitigation.

January, 2013: Rough Draft Development

- Identify elements of TAG Strategic Investment Plan and any additional projects and/or mitigation measures to include in the plan.
- Include tsunami debris component (modeled after County's draft language).
- Prepare a school campus relocation component with input from School District.

Seaside NHMP Rough Draft Comment Period: January 25th – February 6th, 2013

- Consolidate all updated information into working draft and submit draft to TAG, County Emergency Management, E-PREP, OPDR and Seaside Public School District for review and comment.
- Submit amended plan draft to E-PREP for final comment.

February, 2013: Public Review and Plan Adoption

- City Planning Department submits final draft to City Council for review, February 7th, 2013.
- Plan is presented to City Council, Monday, February 11th, 2013. Opportunity for public comment and recommendation by the Council on plan submittal. Council approves draft for submittal pending FEMA approval.
- Forward plan to County Emergency Manager Director & State Emergency Management Director for final review & submittal to FEMA.
- Once FEMA has approved the plan, submit to City Council for final adoption.

Clatsop County NHMP Steering Committee Meetings & Coordination

- **Clatsop County Emergency Management conduct county wide steering committee meetings to discuss NHMP update process. These activities are documented in the County Plan**
- **County provides draft city addendum with comments from OEM.**
- **May 27, 2014, review update drafts, discuss FEMA approval process and future plans for the committee.**
- **October 31, 2014: City draft addendum addressing OEM comments is submitted to Clatsop County for final inclusion into the county plan for FEMA review**

Plan Adoption

The Seaside City Council adopted the final City of Seaside Addendum to the Clatsop County Natural Hazard Mitigation Plan by the adoption of ##-#### on Insert Date, Year.

Section 2
Community Profile

The following section describes the City of Seaside 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 populations that may be impacted by natural hazards. 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, directives, plans, policies, and programs). The information in this section represents a snapshot in time of the current sensitivity and resilience factors in the City when the plan was developed. The information documented below, along with the risk assessment, should be used as the local level rationale for the risk reduction actions identified in this addendum. The identification of actions that reduce the City's sensitivity and increase its resilience assist in reducing overall risk.

2.1 Geography & Climate

The City of Seaside is located on the Oregon Coast at the southern end of the Clatsop Plains and about 18 miles south of the mouth of the Columbia River (Figure 2.1). The Necanicum River bisects the town and flows out to the ocean at the northern edge of town.

The City of Seaside's climate is considered moderate. Summer temperatures average in the 50's and 60's, while winter temperatures range from the high 30's to 40s, respectively (see Table 2.1). But while the temperatures are mild year round due to the city's proximity to the ocean, the city also experiences high levels of precipitation and occasional high winds. The city receives approximately 75.74 inches of precipitation annually (see Table 2.2).[ii] Winter storms are of particular concern to the city because of the potential damage caused by strong winds accompanied by heavy rainfall.

Table 2.1 Normal Temperatures in Seaside, OR

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max °F	51.6	54	55.8	58.4	61.9	64.8	67.7	69	69.6	63.6	55.7	51.6	60.3
Mean °F	45.1	46.7	48	50.4	54.2	57.5	60.3	61.2	59.8	54.6	48.7	45	52.6
Min °F	38.5	39.4	40.2	42.4	46.5	50.2	52.9	53.3	50	45.5	41.7	38.4	44.9

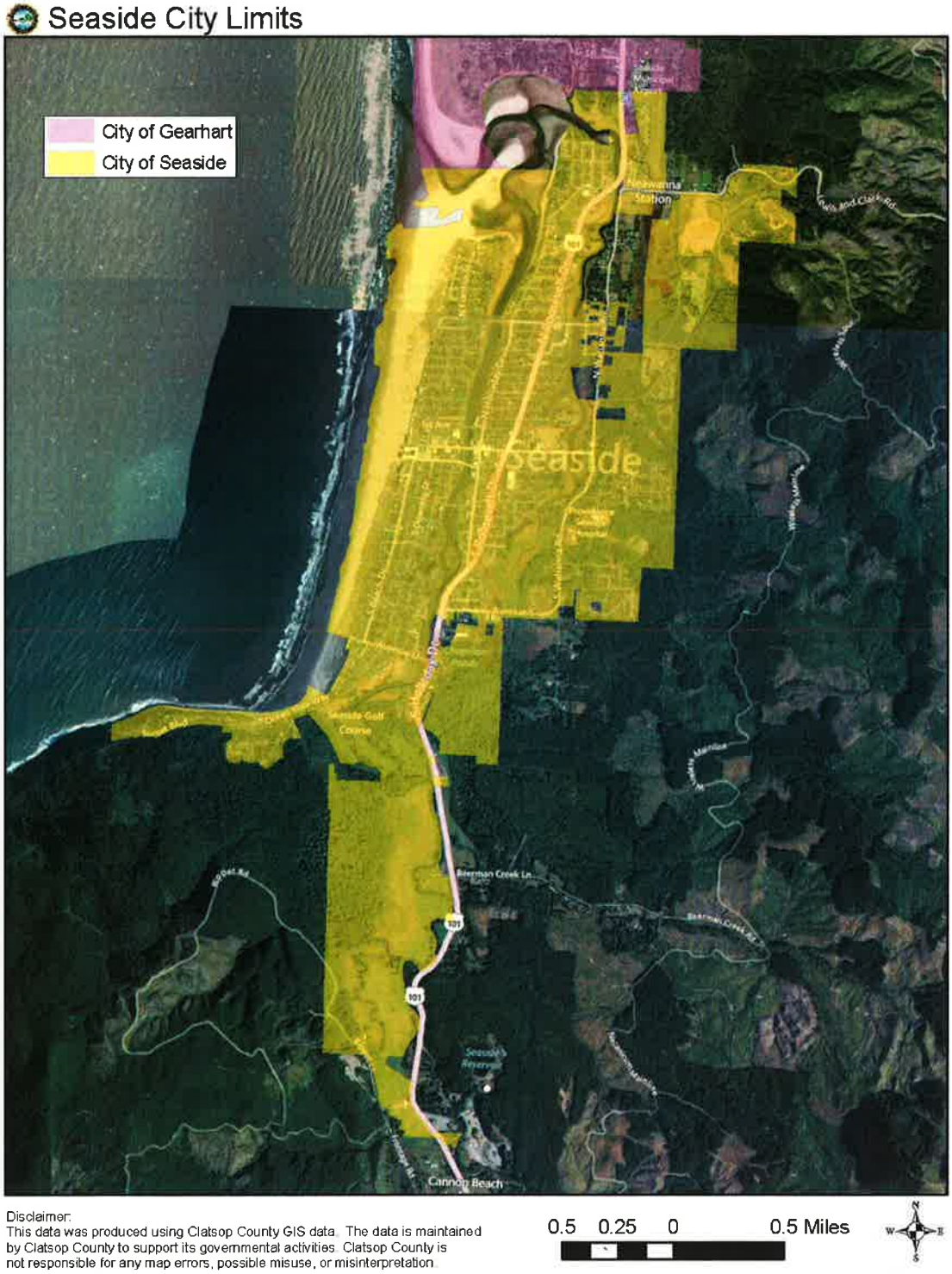
Source: NOAA

Table 2.2 Average Precipitation in Seaside, OR

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Inch	10.3	9.57	8.44	5.74	3.96	3	1.63	1.34	3	6.07	11.38	11.34	75.74

Source: NOAA

Figure 2.1 Map of Seaside



Source: Clatsop County

2.2 Population & Demographics

Seaside sits at the mouth of three primary rivers that combine to form a tidally influenced estuary: the Necanicum River, Neawanna Creek and Neacoxie Creek. This site was once populated by three villages of the Clatsop Tribe of Native Americans, who relied heavily on salmon and shellfish for their diet. The tribe dwindled following the arrival of Lewis and Clark's party in 1805 and the subsequent western settlement of the area, with most members moving to the Grand Ronde Reservation by the late1800's. In 1852, two entrepreneurs purchased 6,112 acres and constructed a summer boarding house, establishing Seaside as a summer tourism destination for Portland residents. By 1900 Seaside – named after one of the first established "summer houses," the Seaside House, – had evolved into two separate towns, Seaside and West Seaside, on separate sides of the Necanicum River. By 1902 the combined population was 500 and during the summer, populations would rise to 5,500-10,500. The two cities, Seaside and West Seaside (incorporated in 1899 and 1905, respectively), merged in 1913.[iii]

Table 2-3 shows population trends between 1980 and 2010 for Seaside, Clatsop County, and the State of Oregon. Seaside grew by 1,264 persons or 24.3% between 1980 and 2010. Little growth occurred in Seaside during the 1980s. Seaside grew at an average annual rate of 1.0% from 1990 to 2000. This growth rate is lower than Oregon's 2.0% growth rate, but higher than the 0.7% growth rate of Clatsop County. Between 2000 and 2010, Seaside grew at an average annual rate of 0.9%, a rate more than twice that of the County but still less than the state of Oregon overall (see Table 2.3).

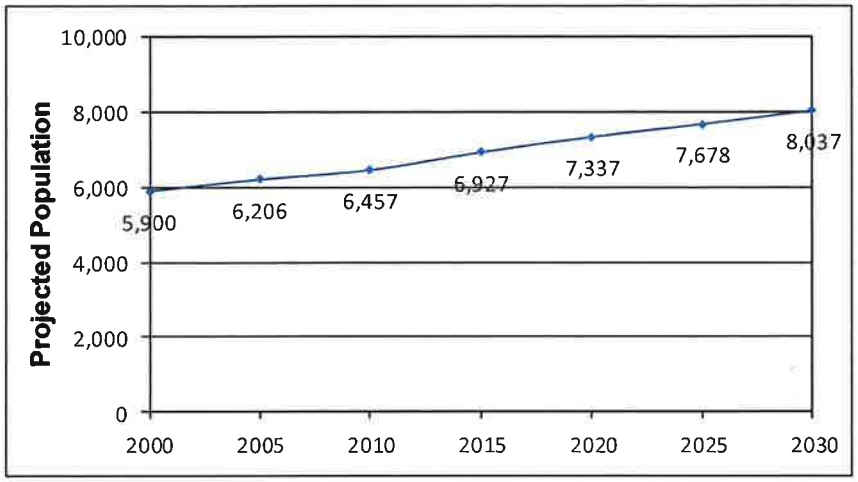
Table 2.3 Population Trends, Seaside, Clatsop County, and Oregon, 1980-2010

Year	Seaside	AAGR	Clatsop County	AAGR	Oregon	AAGR
1980	5,193		32,489		2,633,105	
1990	5,359	0.3%	33,301	0.2%	2,842,321	0.8%
2000	5,900	1.0%	35,630	0.7%	3,421,399	2.0%
2010	6,457	0.9%	37,039	0.4%	3,831,074	1.2%
Change 1980-2010						
Number	1,264		4,550		1,197,969	
Percent	24.3%		14.0%		45.5%	

Source: US Census
AAGR = Average Annual Growth Rate

The county coordinated 2030 population forecast for Seaside is 8,037 (Figure 2.2). The coordinated forecast indicates Seaside will add 1,580 persons between 2010 and 2030, an increase of nearly 25%. The forecast assumes an average annual growth rate of 1.2%--a figure slightly higher than the growth experienced between 2000 and 2010.

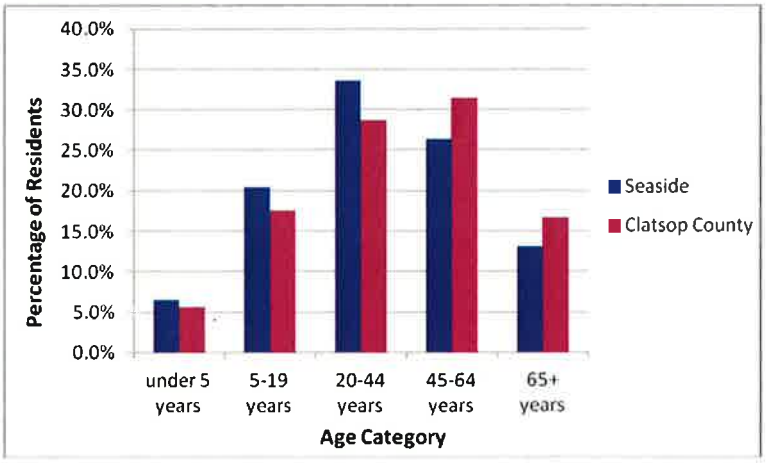
Figure 2.2 Population Forecast, Seaside UGB, 2000-2030



Source: 2000, 2010 population from US Census, 2005-2030 estimates from county coordinated population forecast.

The resiliency and recovery rates after a disaster vary among population groups, with some being more sensitive to natural hazards than others. A disproportionate burden is placed upon dependent populations, particularly children, the elderly, the disabled, minorities, and low income persons. Portions of Seaside's residents fall into these special needs populations. Over 8% of the city's households report speaking a primary language other than English at home. Between 2006 and 2010, an estimated 17.3% of all individuals and 15.2% of families in Seaside were living below the federal poverty level over at least a 12 month period.[vi] Approximately 17% of residents are over 65 years of age, and 25% are between the ages of 0 and 19 (see Figure 2.3).

Figure 2.3 Age Distribution, Seaside and Clatsop County, 2010



Source: US Census, 2010

2.3 Employment & Economics

From 2006-2010, an estimated 32.8% (1,011 individuals) of Seaside's employed population 16 years and over were working in "service occupations," 24.4% (754 individuals) in "sales and office occupations," and 26.1% (805 individuals) in "management, professional, and related occupations." An additional 9.5% (294) of the employed population were classified under "production, transportation, and material moving occupations" and 7.1% (220 individuals) under "natural resources, construction, and maintenance occupations."[iv]

Seaside's economy is heavily reliant on tourism. Currently, there are over 300 vacation rental dwellings and approximately 1,350 transient room accommodations divided up among 37 buildings within the city. In 2002, the top four employers in Seaside were the Seaside School District (187), Providence Seaside Hospital (185), Safeway (160), and the City of Seaside (80).[v] Table 2.4 shows a breakdown of employment in Seaside by industry. 3,446 employees work in tsunami prone areas within the city, and are considered an at-risk population in the event of a local tsunami incident.

Median income can be used as an indicator of the strength of the region's economic stability. From 2006-2010, the median household income in Seaside was about $36,670. This is more than $15,000 below the 2006-2010 national median household income of $51,914, and nearly $6,000 below the $42,211 median household income for Clatsop County.[vi] Although it can be used to compare areas as a whole, this number does not reflect how income is divided among area residents.

Table 2.4 Employment by Industry, City of Seaside, 2006-2010

Industry	Percent
Arts, entertainment, recreation, accommodation and food services	29.0%
Educational, health and social services	21.1%
Retail trade	16.9%
Professional, scientific, management, administrative, and waste management services	7.8%
Construction	6.6%
Finance, insurance, real estate and rental and leasing	4.4%
Manufacturing	4.1%
Transportation and warehousing, utilities	2.7%
Other services (except public administration)	2.4%
Information	2.0%
Public administration	1.7%
Agriculture, forestry, fishing and hunting, and mining	0.9%
Wholesale trade	0.4%

Source: US Census, 2006-2010 American Community Survey 5-Year Estimates

2.4 Housing

Housing type and year-built dates 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 homes. Generally older homes are not built to current building codes and pose a greater seismic risk than newer structures. In addition, FEMA began assisting communities with floodplain mapping in 1978, and communities have developed ordinances that require homes in the floodplain to be elevated to one foot above Base Flood Elevation.

In 2010, the City of Seaside had 4,638 housing units. Of those, 28.4% (1,317) were owner occupied, 35.6% (1,652) were renter occupied, and 36.0% were vacant (1,669). Of the vacant housing, 75.7% (1,264) are for seasonal, recreational, or occasional use.[vii] Around 65% of the city's housing stock was built prior to 1980, before stronger seismic building codes were put into place. Other housing characteristics for Seaside are provided in Tables 2.5 and 2.6.

Table 2.5 Housing Type, City of Seaside, 2006-2010 Estimates

Housing Type	Percentage
Single-Family and Duplexes	67.0%
Multi-Family	32.9%
Mobile Home	4.5%
Boat, RV, van, etc.	0.3%

Source: US Census, 2006-2010 American Community Survey 5-Year Estimates

Table 2.6 Housing Structure Age, City of Seaside, 2006-2010 Estimates

Year Built	Percent of Structures
1980-2009	35.4%
1960-1980	24.1%
Before 1960	40.5%

Source: US Census, 2006-2010 American Community Survey 5-Year Estimates

According to the 2010 American Community Survey 5-year estimates, the median rent in Seaside from 2006-2010 is estimated at $741/month, and the average home value is estimated at $263,600.

Of all developed land in the City of Seaside, 87% lies within DOGAMI's estimated local tsunami inundation zone. This area includes 4,790 residents.[viii]

2.5 Land Use & Development

Development in Seaside is mostly on a two-mile strip between the Pacific Ocean and Neawanna Creek (see Figure 2.4). The city's central core has undergone revitalization and new construction in recent years to cater to the tourist and service industries. Although infill development continues to occur in this area, most new development occurs in the outer areas away from the central business district.

Building permits issued for new residential dwellings fluctuated between 6 and 54 per year between 2001 and 2011, with an average of 31 permits issued each year (see Table 2.7). The number of units built exceeded the number of buildings permits, indicating that some multi-family residential structures were built.

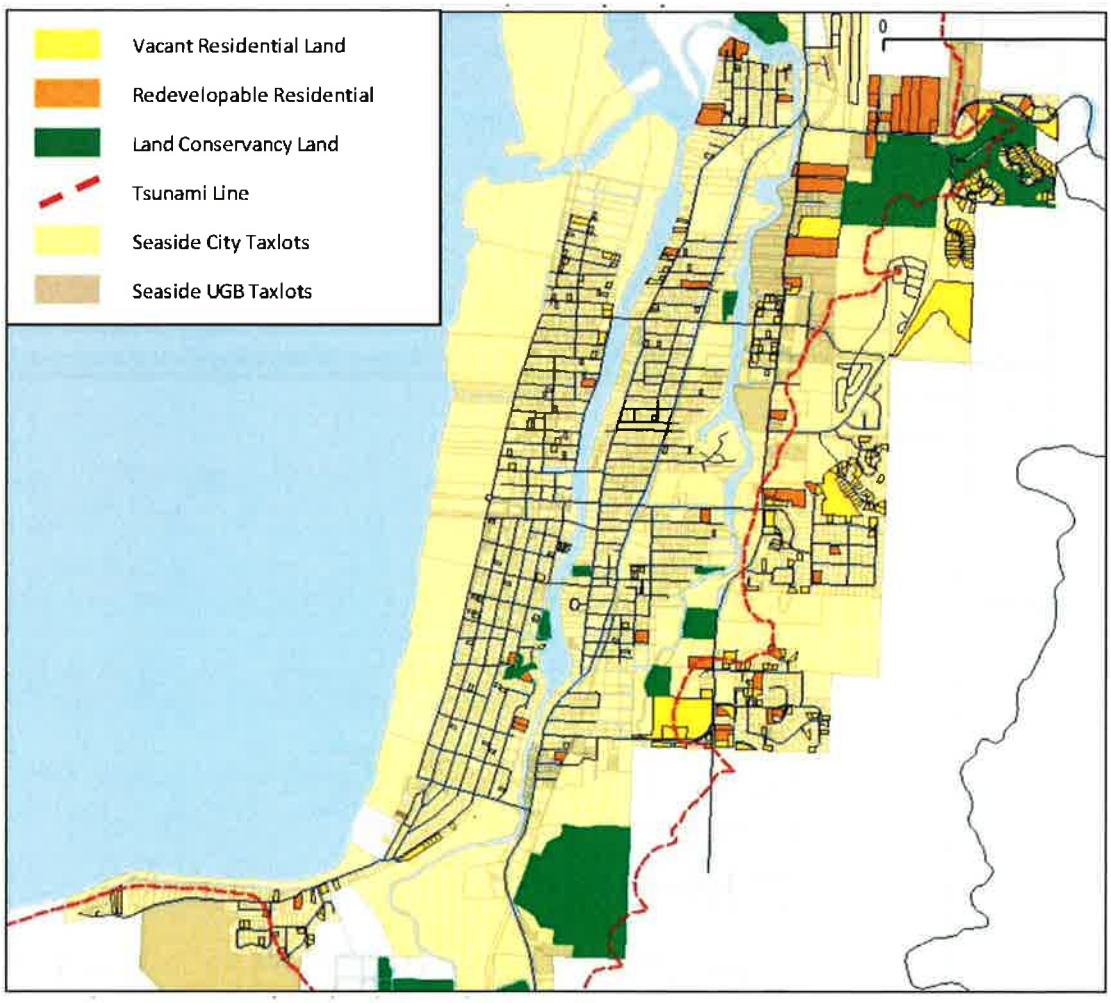
Table 2.7 Building Permits Issued in Seaside, 2001-2011

Year	Building Permits	Units Built
2001	19	19
2002	48	55
2003	35	43
2004	41	63
2005	46	47
2006	40	95
2007	54	54
2008	27	27
2009	6	6
2010	17	17
2011	10	10

Source: US Census, Current Construction Reports

Additional growth is limited by water bodies and designated rural land uses surrounding the city's Urban Growth Boundary (UGB). The city's Comprehensive Plan identifies land use needs and designations within the city and the UGB. A buildable lands assessment conducted in 2012 found that, based on current development trends, housing demand by 2032 will require the development of 1,425 new housing units, of which 61% will be ownership units and 39% will be rental units. This far exceeds current available capacity of buildable lands. (See Figure 2.4)

Figure 2.4 Residential Buildable Lands



Source: Clatsop County, City of Seaside, Johnson Reid LLC

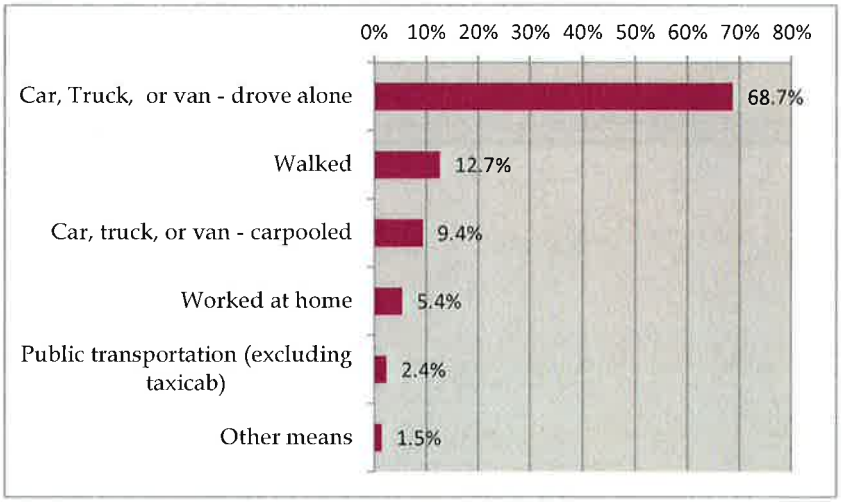
In the 2007 Study by the US Geological Survey titled *Variations in City Exposure and Sensitivity to Tsunami Hazards in Oregon*, Seaside was found to have the highest level of exposure and sensitivity to tsunami hazards of any Oregon Coast community, due to the location of both a high *number* and *percentage* of dependent population facilities, public venues, overnight tourist facilities, and vulnerable or dependent population centers within tsunami-prone areas.[ix]

2.6 Transportation

Transportation is an important consideration when planning for emergency service provisions. Growth within the city will continue to put pressure on both major and minor roads. Figure 2.6 depicts the transportation system in Seaside, as defined in the city's Transportation System Plan. Currently both residents and employees of Seaside rely heavily on U.S. Highway 101, which runs north-to-south through Seaside and is the only

major arterial road in or out of the city. The reliance on this facility makes Seaside especially vulnerable to road closures due to flooding, landslides, accidents or windfalls. Seaside is primarily dependent on private vehicles, with 68.7% of all commute trips made by single occupancy vehicle, although a significant percentage, 12.7%, walk to work (see Figure 2.5).

Figure 2.5 Transportation Type Used to Commute to Work in Seaside

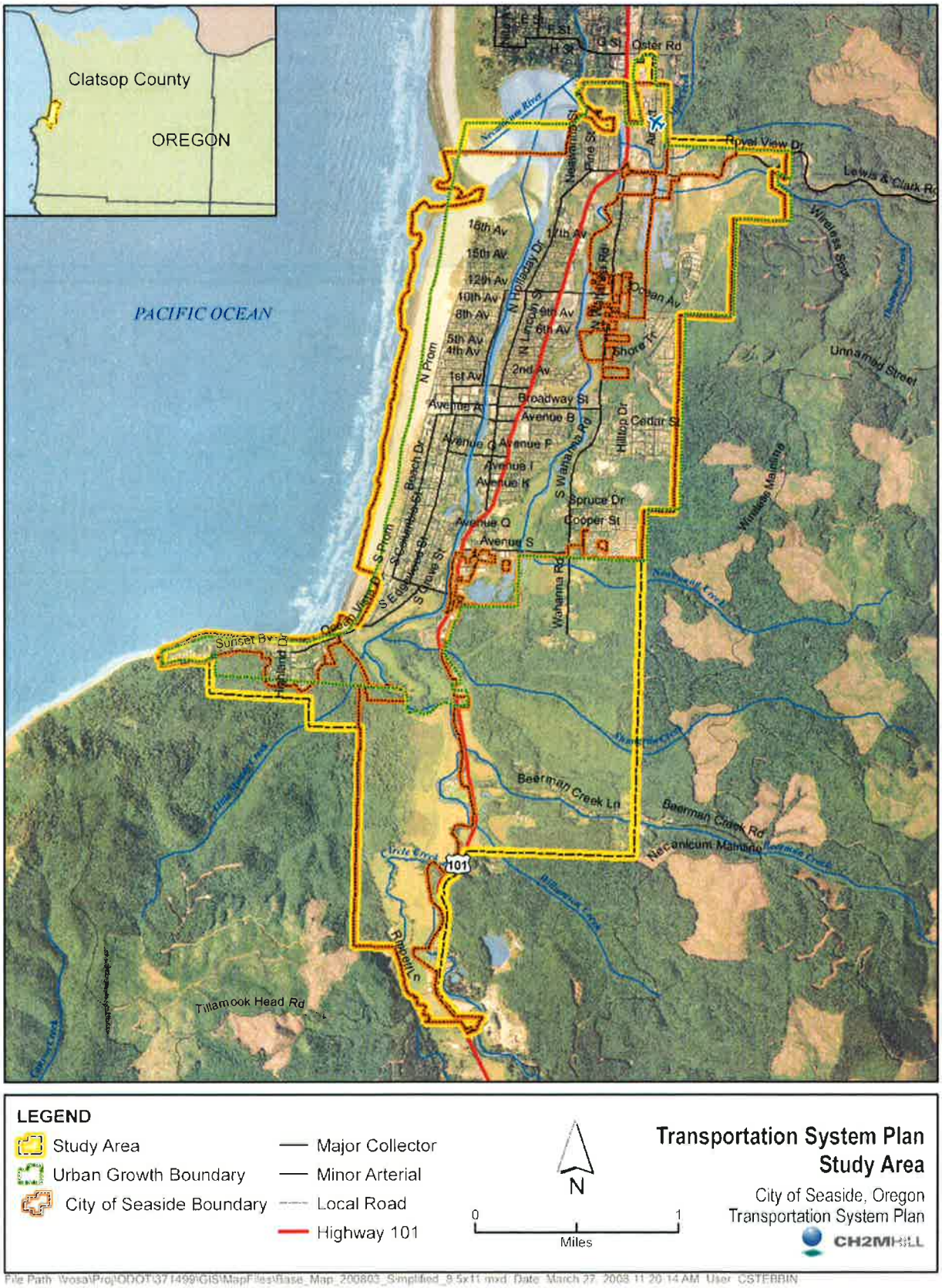


Source: US Census, 2006-2010 American Community Survey 5-Year Estimates

Currently, Seaside is served by the Sunset Empire Transportation District. The bus connects Cannon Beach, Seaside, Gearhart, Warrenton and Astoria. There are four bus stops in Seaside. Seaside maintains an airport; the airport is a small airstrip, generally useable by light single engine and twin aircraft only.[x]

Seaside has 12 major bridges within the urban growth boundary, nine of which are owned and operated by the City of Seaside. There are six bridges in Seaside crossing the Necanicum River; these bridges are located on Avenue U, Avenue G, Avenue A, Broadway (one way east to west), 1st Avenue and 12th Avenue (Figure 2.5). Four bridges cross Neawanna Creek at Avenue S, Broadway and 12th Avenue, and on highway 101 at the northern end of town. The bridge crossing the Neawanna to the north on Highway 101 and the Dooley Bridge to the south on Highway 101, are maintained by the Oregon Department of Transportation. Only four of these bridges, located at 1st and 12th Avenues over the Necanicum and at Broadway and 12th over the Neawanna, are considered seismically sound enough to withstand a significant earthquake. All other bridges may fail to some degree in an earthquake, which poses a significant risk if the earthquake is large enough to trigger a tsunami requiring immediate evacuation to high ground.

Figure 2.6 Seaside Transportation System



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2.7 Critical Facilities & Infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. The following facilities are critical systems that provide essential services to the residents of Seaside and surrounding communities. Damage to, or destruction of, these infrastructure systems would cause significant hardship to residents, and significantly hamper short and long term relief efforts after an incident.

Public Facilities

- 911 Call Center
- City Administrative Offices
- Police and Fire Stations
- Public Works Facilities
- Bridges and Roads
- Seaside Airport
- Water and Sewage Treatment Facilities
- Water Reservoirs and South Fork Diversion Supply Line
- Seaside High School, Broadway Middle School, and Seaside Heights Elementary
- Convention Center
- Community Center
- Seaside Public Library

Private Utilities and Social Services

- Natural Gas Lines (Provided by Northwest Natural Gas)
- Electric Utility Lines (provided by Pacific Power and Light)
- Providence Seaside Hospital
- Churches
- Adult Care Facilities

Transient Accommodations

- Hotels, Motels, timeshares and Bed and Breakfasts
- Vacation Rental Dwellings

2.8 Historic & 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. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

The National Register of Historic Places lists three buildings as historic sites within the City of Seaside: the William and Nellie Fullam House (781 S. Prom), the Haller-Black House (841 S. Prom), and the Charles Preston House (141 Avenue I).[xi]
Seaside is the site of the Saltworks, the western-most camp of the Lewis and Clark Expedition party. Today the approximate site of the original Saltworks has been recreated on Lewis and Clark Avenue and preserved as a National Historic Site on the Lewis and Clark Trail.

In addition to these formally recognized sites, there are a number of known archaeology sites located throughout Seaside. Most of these sites are significant Native American village sites that are protected under Oregon State Law.

Seaside is also a major tourist destination. Tourist and recreation facilities such as the Seaside Civic Convention Center, the oceanfront promenade, and the park system accommodate and support the tourist industry. Seaside hosts a number of events that take advantage of the natural environment including the Beach Volleyball Tournament, the Hood-to-Coast Relay, the Lewis and Clark Kite Exposition, the Sand Sculpture and Beach Festival, and the Lewis and Clark Saltmakers Return. Many of these events are located on the beach and "The Promenade." The Promenade is a 1.5-mile concrete walkway that parallels oceanfront beach. The Promenade runs from 12th Avenue on the north end to Avenue U on the south end.

2.9 Government Structure and Institutions

The City of Seaside currently has the following departments[xii]:

City Council: The City Councils consists of six elected members and the Mayor. Each councilperson serves a four-year term. They meet on the 2nd and 4th Monday of every month.

City Manager: The City Manager is the administrative head of the city government. In addition to the daily operation of the city, he implements policies and goals set by the City Council. In the event of an emergency, the City manager acts as the Incident Commander, as stated in the city's Emergency Operation Plan. The City Manager is responsible for preparation and monitoring of the annual budget, approval of expenditures by departments and has general supervision over all city real property. He is also responsible for enforcement of all ordinances, franchises, leases, contracts and permits of the city.

Assisting him are eight department heads: Police Chief, Planning Director, Fire Chief, Public Works Director, Human Resources Director/Assistant to the City Manager, Library Director, Convention Center Manager and Building Official.

Human Resources: Human Resources provides personnel support for all city departments with information needed to recruit and select qualified employees, address labor regulations, compensation, classification, training and personnel policies and procedures. The department also manages the City's Risk Exposure and Insurance Programs, which include property, casualty, liability, employee benefits and workers' compensation coverage.

Police Department: The Department currently has a Chief of Police, a Lieutenant, one Property/Person Crime Detective, eleven sworn Patrol Officers, a Community Service Officer, and seven full time communication personnel.

Seaside Police Department is a full service law enforcement agency with 24 hour patrol, communications coverage and 911 services. Seaside's 911/Communication Center services three law enforcement agencies, five fire agencies, four communities and rural southern Clatsop County.

A motorcycle patrol with three certified motor officers operates throughout the tourist season and during the rest of the year as needed. A Bicycle Patrol operates during the major tourist season which provides faster response time to calls in the center of town and high visibility of law enforcement in crowded areas.

Public Works: The Public Works Department is responsible for the City of Seaside's infrastructure including, water, sewer, streets, storm drainage, parks and public buildings. The staff of twenty plus employees maintains both water and wastewater treatment plants, a convention center, community center, library, police and fire stations, public works building, and city hall; as well as many miles of sanitary sewer and water lines, and streets.

Community Development: The Community Development Department consists of the Building and Planning Departments. The Building Department handles permits for mechanical, plumbing, building and demolition related work. The Planning Department works to create, maintain and implement land use ordinances and long range plans, and reviews development proposals to ensure consistency with these plans.

Convention Center: The Seaside Civic & Convention Center is a city owned and operated convention, tradeshow and multipurpose facility. When convention or trade show events are not booked, the facility schedules community, education, cultural, religious, athletic, and entertainment events.

Fire Department: The Seaside Volunteer Fire and Rescue Department was established in 1904. The department serves the city of Seaside and the surrounding rural fire protection district. In addition, a mutual aid agreement in Clatsop County allows the Department to assist all other city and rural fire departments throughout the county.

Since the department was created, it has remained an all-volunteer department, with the exception of three full time paid positions: Fire Chief, Fire Marshall, and Training Officer. Forty-two volunteers respond twenty-four hours a day to fire and EMS incidents. The department provides structure and wildland fire protection, rescue and heavy extrication, and EMS service from the first responder to the paramedic level. The Department also provides surf rescue with seasonal lifeguards. Within the County there is a hazardous materials team and high-angle rescue team to supplement Seaside's emergency response.

The Department provides education and organizational support for the Community Emergency Response Team (CERT) volunteers. This group provides assistance during emergencies and works on public outreach and preparedness activities.

City Library: The Seaside Public Library dedicates itself to collecting and distributing information and ideas in a variety of formats. The Library building also serves as a community gathering place for meetings and events. The Library is advised by a five-member appointed Board of Trustees.

Municipal Court: The Seaside municipal court handles transactions for traffic citations and tickets.

Business Office: The business office handles receivables and payables. It currently processes water and sewer bills, business licenses and transient room tax assessments.

2.10 Existing Plans & Policies

Seaside has existing plans, ordinances and technical reports that guide and influence land use, land development, and population growth. 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.

The Clatsop County multi-jurisdictional NHMP includes a range of recommended action items to reduce the city's vulnerability to natural hazards. Many of these recommendations are consistent with the goals and objectives of the county's existing plans and policies. Linking existing plans and policies to the NHMP helps identify what resources already exist that can be used to implement the action items identified in the Plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and kept up to date. Completing these action items will help maximize the efficient use of the county's resources.

Table 2.8 documents the plans and policies already in place in Seaside.

Table 2.8 Existing Plans, City of Seaside

Name	Date of Last Revision	Author/Owner	Description
City of Seaside Comprehensive Plan	Revised 10/24/96	City of Seaside	The Seaside Comprehensive Plan is an official public document that is adopted by the city as the policy guide to development decisions.
Seaside Zoning Ordinance	Updated Sept 2004	City of Seaside	The purpose of this Ordinance is to further the objectives and goals of the Comprehensive Plan and to provide the public health, safety and general welfare of the citizens of Seaside through orderly community development.
City of Seaside Emergency Operations Plan	Adopted 2010	City of Seaside	Coordinates the City's response to incidents using an Incident Command System
City of Seaside Transportation System Plan	Adopted 2010	City of Seaside	Lists transportation projects to be pursued within the next twenty years.
City of Seaside Water System Master Plan	Adopted 2005	City of Seaside	Includes a comprehensive analysis of Seaside's water distribution system. Makes recommendations for facility improvements based on current deficiencies and future needs.
City of Seaside Wastewater Engineering Report	Adopted 2006	City of Seaside	Report inventories current wastewater treatment system and sewer main system. Includes assessment of current and future needs.
City of Seaside Airport Layout Plan	Adopted 2010	City of Seaside	Documents the current layout of the Seaside Airport, and includes plans for future improvement projects.
City of Seaside Parks Master Plan	Adopted 2004	Sunset Empire Parks and Recreation District	Inventories city open space and proposes future capital improvement projects.

2.11 Community Organizations and Programs

In planning for natural hazard mitigation, it is important to know what social organizations 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 City of Seaside should use existing organizations as resources for implementing such communication-related activities because these service providers already work directly with the public on a number of issues.

The Countywide Community Organizations and Programs table can be found in Section 2: Community Overview of the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan.

Table 2.9 highlights social service organizations that are active within the community and may be potential partners for implementing mitigation actions or providing resources to citizens in the event of an emergency.

Table 2.9 Seaside Community Organizations and Programs

Name and Contact Information	Description	Notes
Community Emergency Response Team (CERT)	Volunteer citizen emergency first responder group organized by the Seaside Fire Department	Provides support to emergency response teams – often arrive at an incident before formal help can arrive. In a large scale emergency when the emergency response community is stretched thin, CERT may be the only immediate available community aid.
Elks 324 Ave A Seaside OR 97138 (503) 738-6651	Elks lodge	
Helping Hands Ministries 1530 South Roosevelt Seaside OR 97138 (503) 717-1425	Criminal and Drug Rehabilitation	Housing, emergency food and clothing, job training
Our Lady of Victory Catholic Church 120 Oceanway Seaside OR 97138 (503) 738-6161	Meal Services	Free meals on site
Our Savior's Lutheran Church 320 First Avenue Seaside OR 97138 (503) 738-6791	Food Bank	Provides emergency food
Restoration House 208 N Holladay Seaside OR 97103 (503) 717-1102	Hostel / Shelter	Men's halfway house

Seaside Chamber of Commerce 7 N. Roosevelt Seaside, OR 97138 (503) 738 6391	Professional Association promoting economic development and the business community	Can mobilize large groups of volunteers. The Ambassador program has 30+ volunteers.
Seaside Headstart 1225 2nd Ave Seaside OR 97138 (503) 738-0873	Child & Family Development Preschool program for those who meet income guidelines &/or special needs children ages 3-4.	Child and Family Services
Seaside Youth Center 1140 Broadway Seaside OR 97138 (503) 738-3311	Youth and Senior Center	Youth and senior resources
South County Food Bank 880 Avenue A Seaside OR 97138	Food Bank	Provides emergency food to local residents 5 days a week.
STARS (Seaside Tsunami Amateur Radio Society)	Ham Radio Club	Can provide emergency communication when internet and phone lines are down.

Section 3
Risk Assessment

The following hazards have been addressed in the Clatsop County NHMP. In addition to the county's assessment of natural hazards, the City of Seaside also conducted a local assessment of hazards. The results of this analysis are summarized in Table 3.1 below.

Table 3.1 City Hazard Analysis Matrix

Rating Factor: High = 10 points; Moderate = 5 points; Low = 1 point
Score Multiplied by Weight Factor (WF)

Hazard	Rating Criteria with Weight Factors												Total Score
	History [1]		(WF =2x)	Vulnerability [2]		(WF =5x)	Max Threat [3]		(WF =10x)	Probability [4]		(WF =7x)	
Severe Weather	High	10	20	High	10	50	High	10	100	High	10	70	240
Utility Failure, Resource Shortage	High	10	20	High	10	50	High	10	100	High	10	70	240
Flood	Med.	5	10	High	10	50	High	10	100	Med.	5	35	195
Tsunami	Low	1	2	High	10	50	High	10	100	Med.	5	35	187
Earthquake	Low	1	2	High	10	50	High	10	100	Med.	5	35	187
Mudslide/Landslide	Low	1	2	Med.	5	25	Med.	5	50	Low	1	7	84
Community Fire	Low	1	2	Med.	5	25	Med.	5	50	Low	1	7	84
Dam Failure	Low	1	2	Med.	5	25	Med.	5	50	Low	1	7	84
Health Epidemic	Low	1	2	Med.	5	25	Med.	5	50	Low	1	7	84
Special Event	Low	1	2	Med.	5	25	Med.	5	50	Low	1	7	84
Accidents: Transportation/ Mass Casualty	Low	1	2	Low	1	5	Med.	5	50	Low	1	7	64
Hazardous Materials Incidents	Low	1	2	Low	1	5	Med.	5	50	Low	1	7	64
Terrorism and Civil Disorder	Med.	5	10	Low	1	5	Low	1	10	Med.	5	35	60
Accidents: Industrial	Low	1	2	Low	1	5	Low	1	10	Low	1	7	24
Volcanic Activity	Low	1	2	Low	1	5	Low	1	10	Low	1	7	24

Notes:

1. History addresses the record of previous major emergencies or disasters. Weight Factor is 2. Rating factors: high=4 or more events in last 100 years; moderate=3events in last 100 years; low+1 or 0 events in last 100 years.
2. Vulnerability addresses the percentage of population or property likely to be affected by a major emergency or disaster. Weight Factor is 5. Rating factors: high=more than 10% affected; moderate=1%-10% affected; low=less than 1% affected.
3. Maximum Threat addresses the percentage of population or property that could be affected in a worst case incident. Weight Factor is 10. Rating factors: high=more than 25% could be affected; moderate=5%-25% could be affected; low=less than 5% could be affected.
4. Probability addresses the likelihood of a future major emergency or disaster within a specified period of time. Weight Factor is 7. Rating factors: high=one incident within a 10-year period; moderate=one incident within a 50-year period; low=one incident within a 100-year period."

Source: City of Seaside Emergency Operations Plan

3.1 Coastal Erosion

Much of the City's frontage on the Pacific Ocean is protected by a mixture of foredunes and manmade structures. Significant storms or rising ocean levels may reduce or remove these structures, suddenly or gradually. Additionally, the entire municipal ocean front is at high risk for coastal erosion due to its proximity to the ocean.

Clatsop County describes coastal erosion as a 'chronic' hazard along the Oregon Coast, especially on sand spits, bluffed coastline, and dune-backed beaches. Damages caused by chronic hazards are usually gradual and cumulative. As such, the County estimates a 'high' probability that coastal erosion will continue to occur along the County's coastline. The same is true for the City of Seaside.

Likewise, the County estimates a 'high' vulnerability to coastal erosion, meaning more than 10% of the population or regional assets are likely to be affected by this hazard. Due to the City's large amount of development along its coastline, Seaside estimates the same level of vulnerability. This risk poses a particular economic hazard to Seaside, since current zoning, as well as market pressure, has resulted in a concentration of tourism attractions, vacation rentals and hotels along or near the shoreline. Coastal erosion would have a high impact on the city's economic base.

Current Mitigation Activities

- The City of Seaside has an adopted Foredune Management Plan (adopted as part of the Comprehensive Land Use Plan) for the beach front that separates Seaside's developed uplands from the intertidal zone. This plan regulates activities such as dune grading and vegetative stabilization. The plan prohibits the removal of sand from the beaches (a practice that was common in Seaside's recent past) and protects the sand dunes that are underlain by a cobble beach. This plan permits foredune maintenance activities that limit the impacts from wind erosion and deposition within the developed upland areas, while also limiting the potential flooding risks resulting from winter storms. The Foredune Management Plan requires periodic updates in order to permit maintenance activities by private property owners that reduce beach erosion and impacts from winter storms.

- Much of the Promenade, the concrete boardwalk that parallels the beach, is also protected by a seawall structure and railing. This structure has been in place for decades and it provides added shore land protection from winter storm waves. This structure requires periodic maintenance in order to prevent wave run up and erosion of the developed uplands that parallel the oceanfront. Currently the Seaside Public Works Department monitors and maintains the structure.

- The mouth of the Necanicum River Estuary separates the City of Seaside from the City of Gearhart. The location of the river mouth is not static due to the dynamic forces associated with the confluence of the rivers and ocean. The City of Seaside Waste Water Treatment Plant was built at the northern end of Seaside near the river mouth to take advantage of the natural mixing zone there. At one point in 1949 the river's southern migration was threatening to erode the upland and damage the treatment plant. The U.S. Army Corp of Engineers helped establish a rip rap revetment to prevent the erosion from damaging the plant. Although the revetment is not currently exposed or threatened by erosion, a southern shift of the river channel could once again threaten the treatment plant and require additional action by the Corp of Engineers to maintain the integrity of the revetment. The City Public Works Department continues to monitor this situation for any threats.

- A narrow segment of high ground and a city street, Sunset Boulevard, provides access from the southern end of Seaside to Tillamook Head. This street provides access to the residential development in "The Cove" area, but more importantly, it is one of the designated tsunami evacuation routes leading to a high ground assembly area on Tillamook Head. Although not severe, this area has been subjected to damage from storm waves and log debris in the past. The city streets crew clears Sunset Boulevard of storm debris as needed, which maintains critical access from the southern portion of Seaside.

3.2 Drought

Clatsop County's Plan adequately describes the causes and characteristics of droughts, as well as the location and extent of a potential drought event. Clatsop County has no record of a severe drought, and the same is true for Seaside. Drought is averted as a result of the area's high rainfall, especially during winter months. Clatsop County estimates a 'low' probability that drought will occur, meaning no more than one incident is likely within a 75-100 year period. Likewise, the County estimates a 'low' vulnerability to drought hazards, meaning less than 1% of the population or regional assets would be affected by a drought. Both estimates are true for Seaside as well.

Potential drought-related community impacts are adequately described within Clatsop County's Drought Hazard Annex.

Current Mitigation Activities

- The city is fortunate that it rarely suffers from drought conditions; however, the availability of water can become limited during the late summer months when the city sees the most visitors and stream flows are lower. The city periodically reviews its water curtailment and conservation provisions to ensure they are adequate to limit the impacts from drought conditions when they occur.

3.3 Earthquake

Seaside's location along the Oregon Coast makes it susceptible to a Cascadia Subduction Zone (CSZ) earthquake. The entire community of Seaside is vulnerable to such an event, although damage from an earthquake may be more severe in the downtown area where buildings are older and sit on fill that has liquefaction potential. A severe earthquake may also trigger a tsunami – this hazard is addressed separately in Section 3.6 of this plan.

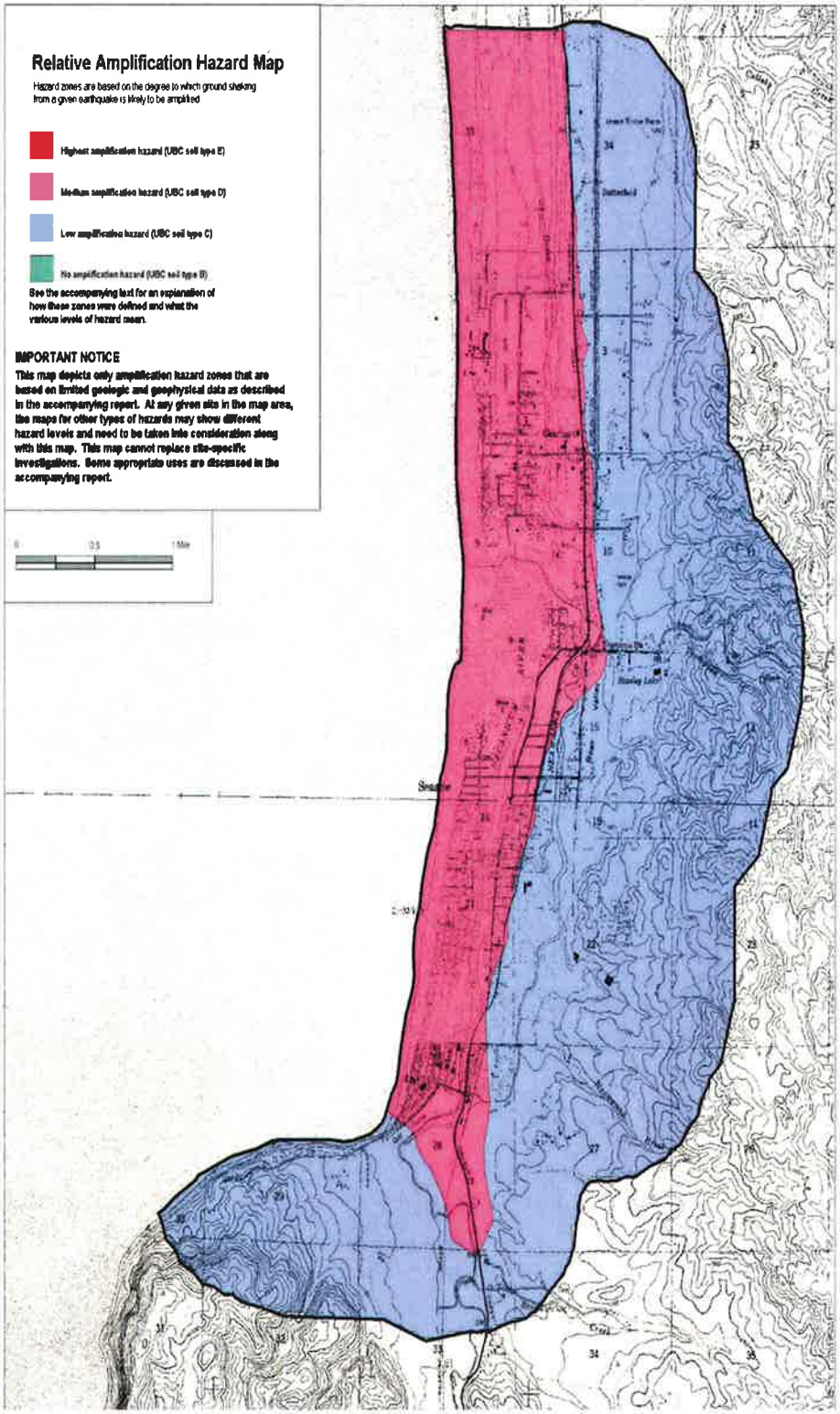
Clatsop County's Natural Hazards Mitigation Plan adequately describes the causes, characteristics, and location of earthquake hazards for the region. The County's Plan additionally identifies all previous occurrences that have affected the City. It is difficult to estimate recurrence intervals, but the state has experienced seven Cascadia Subduction Zone (CSZ) events in the last 3500 years – some of which were likely as large as magnitude (M) 9. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1000 years. The last CSZ event occurred approximately 300 years ago, in1700. Based on this information, Clatsop County estimates a 'high' probability that an earthquake will occur in the future. Seaside agrees.

The earthquake hazard maps in figures 3.1 – 3.4 were developed by the Department of Geology and Mineral Industries. The figures illustrate the location of the amplification, liquefaction, earthquake induced landslide, and relative earthquake hazards in Seaside.

Clatsop County estimates a 'high' vulnerability to earthquake hazards, meaning more than 10% of the population or regional assets would be affected by a major emergency or disaster. As shown by the figures below, the City has a moderate risk of amplification, and a very high risk of liquefaction. The majority of the City's developed lands are located in Zone A – the highest hazard area for earthquakes. Additionally, as described in Section 2.4, about 65% of the City's housing stock was built prior to 1980, before stronger seismic building codes were put into place. The combination of these hazards makes Seaside extremely vulnerable to high magnitude earthquake events.

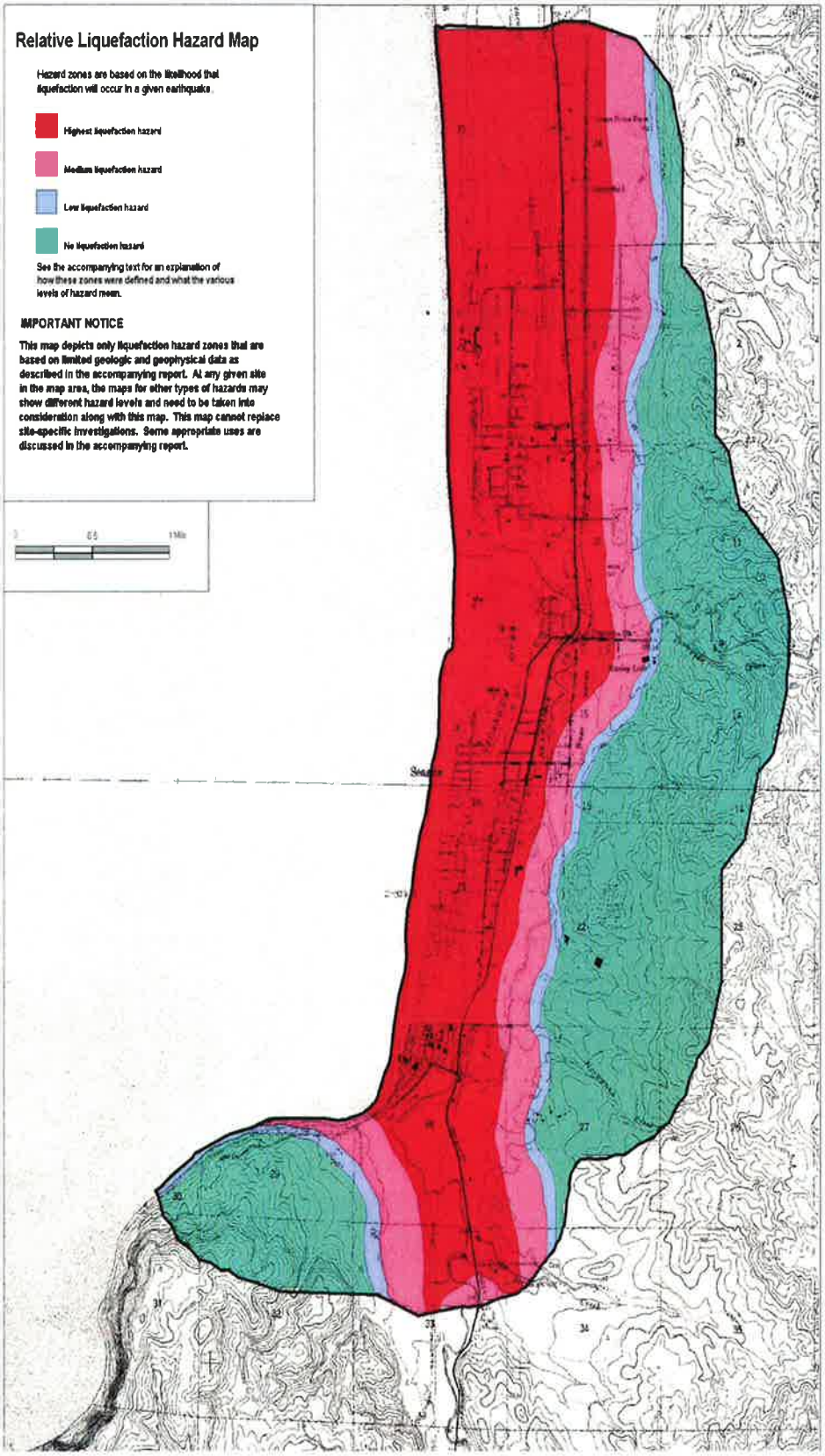
Figure 3.1 Relative Amplification Hazard Map

The majority of the city's built lands are located in areas of medium amplification hazards.



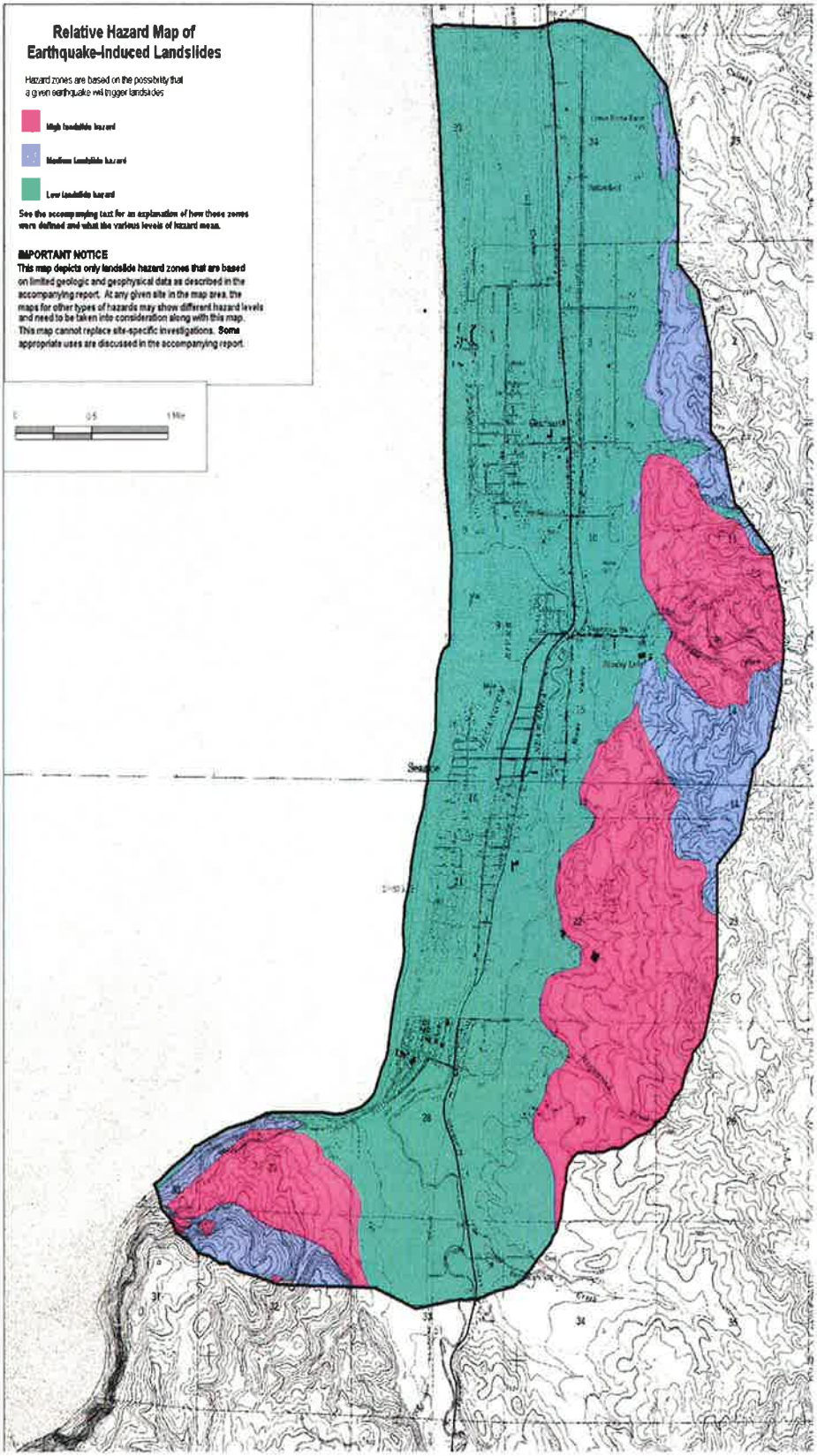
Source: Oregon Department of Geology and Mineral Industries

Figure 3.2 Relative Liquefaction Hazard Map



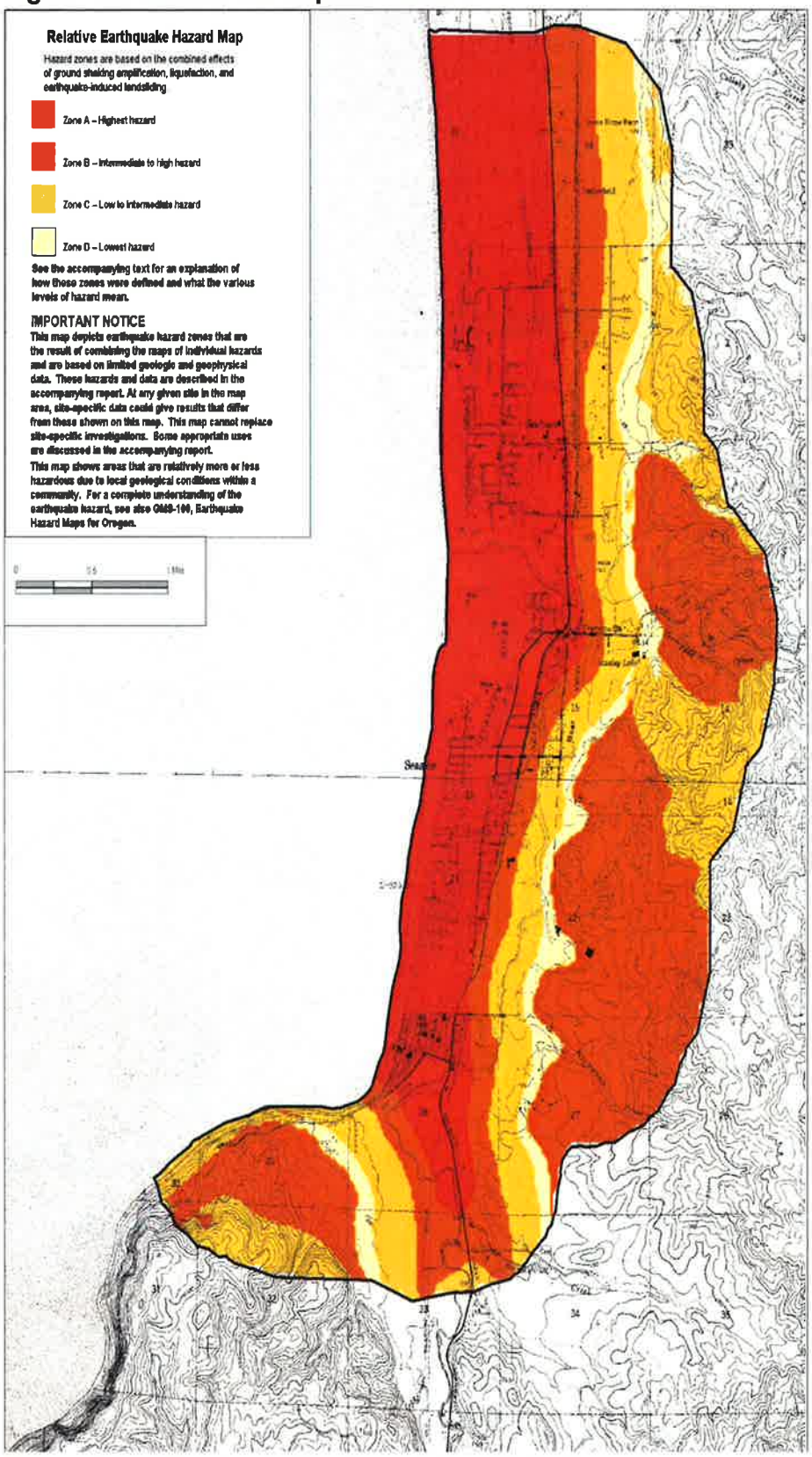
Source: Oregon Department of Geology and Mineral Industries

Figure 3.3 Earthquake-Induced Landslides



Source: Oregon Department of Geology and Mineral Industries

Figure 3.4 Relative Earthquake Hazard



Source: Oregon Department of Geology and Mineral Industries

In 2006, DOGAMI conducted a seismic needs assessment for public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices and other law enforcement agency buildings. Buildings were ranked for the "probability of collapse," in this case meaning structural damage, due to the maximum possible earthquake for any given area. Within Seaside, the following buildings were rated as 'moderate' or 'high.' No buildings in Seaside were assigned the 'very high' rating.

- Seaside High School: *high*
- Broadway Middle School; *moderate*
- Providence Seaside Hospital: *moderate*
- Seaside Fire and Rescue: *moderate*

In addition to the structures listed above, the City's infrastructure is highly vulnerable to a severe earthquake event. Sewer lines, water lines, power lines, water tanks, reservoirs, and cell towers are vulnerable assets. The City would expect significant damage to roads and bridges following a Cascadia Subduction Zone event. The following bridges are expected to fail in a CSZ event:

- 24th Avenue at 101
- Lewis and Clark Road
- Avenue A (over the Necanicum)
- Avenue G (over the Necanicum)
- Avenue S (Over the Neawanna)
- Avenue U (Over the Necanicum)
- Dooley Bridge at 101

Bridge failure causes additional concern if the earthquake is strong enough to trigger a tsunami, as these bridges become critical elements of the city's evacuation routes to high ground. For the sake of tsunami evacuations, it is important only that the bridges be able to sustain foot traffic during the evacuation. However, structural integrity is still important, as the degree to which the bridges withstand an earthquake will influence the flow of goods and services during relief efforts after an event.

Current Mitigation Activities

- The City of Seaside currently provides building permit and inspection services in accordance with the State's adopted building code.

Recommended Action Items

- Develop a cost benefit analysis for the seismic retrofit of Seaside's bridges as part of a program to strengthen the city's evacuation route system (See Section 3.6). As part of this analysis, contract an engineering report to analyze the seismic stability and risk of collapse for each of the city's bridges.

- As part of a Community Self-Sustainability Program, promote the seven step approach to preparedness identified in the Oregon Emergency Management (OEM) Publication "Living on Shaky Ground" (or similar publications) to mitigate earthquake impacts to residents, employees and customers.

- Develop a program to provide additional seismic upgrade information for those older dwellings built prior to 1980 in an effort reduce their elevated risk of earthquake damage.

3.4 Flood

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan adequately identifies the previous occurrences of floods for the City of Seaside. The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan ranked the vulnerability of floods as moderate. The County Plan also indicates that the probability of floods is high. The City of Seaside ranked the probability of floods as moderate, and the vulnerability as high. The County's Flood Insurance Rate Map (Figure 3.5) highlights the location of the flood hazard in Seaside. The City's current effective date for the Flood Insurance Rate Maps is September 17, 2010. City Staff rated the probability of flooding as moderate and the vulnerability as high due to the large number of tax lots within the flood plain, but the low frequency (100 years and 500 years) of events that would impact these areas.

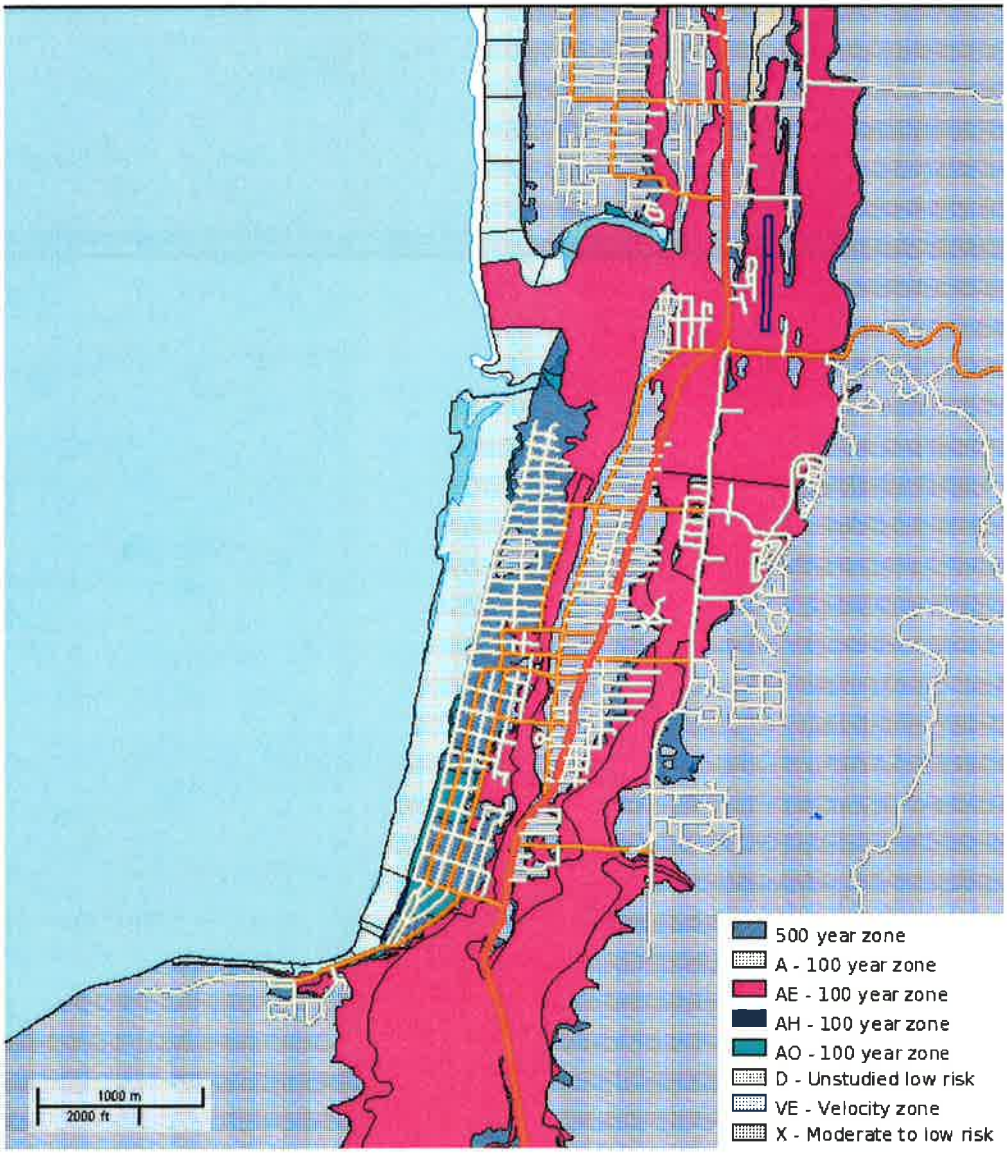
The City of Seaside is a participant in the National Flood Insurance Program. The City has a total of 948 policies under the NFIP. Half of those policies are located in the 100 year flood plain. Since the implementation of the Flood Insurance Rate Maps (FIRMs), however, there have been a total of 359 policies, and 215 of those have been in A zones (151 in A01-30&AE zones and 64 in AO zones). The total coverage for the City under the NFIP is $234,814,600. There have been 15 claims since 1978, with $72,602 paid on those claims.

Seaside is at risk of flooding from two primary sources: riverine flooding and ocean flooding. The riverine flooding generally occurs during periods of heavy rainfall that cause the streams that drain the hills east of Seaside to overflow their banks. Ocean flooding results from exceptionally high tides or tsunamis. On some occasions, high tides and riverine flooding can combine to produce flooding in the City.

A flooding hazard that frequently impacts the safety and the well-being of Seaside residents is the annual riverine flooding of Highway 101 between the south limits of the City and the junction of Highways 26 and 101. During periods of heavy rainfall each winter season, the roadway becomes impassable by floodwater from the Necanicum River, often closing the road to passenger vehicles. While the flooding causes little damage to structures, it interrupts commerce along the only North-South roadway on the Oregon Coast and one of the major transportation route between the North Oregon

Coast and the Portland-Vancouver metro area on the Interstate 5 corridor. It also impairs ambulance, police, and fire services.

Figure 3.5 FEMA Flood Map of Seaside



Source: Clatsop County Webmaps

Current Mitigation Activities

- The City of Seaside has partnered with the Cities of Cannon Beach, Gearhart, Warrenton, and Astoria, the Port of Astoria, Clatsop County, and the Oregon Department of Transportation (ODOT) to form the U.S. Highway 101 Flood Study Consortium. The group contracted a hydrology study to analyze the cause of annual flooding along Highway 101 South of Beerman Creek and make recommendations to ease the impacts of flooding on the highway. The hydrology study determined that removal of a berm to the west of the highway would reduce the frequency and

severity of highway flooding. ODOT and the Consortium worked together to remove the berm with the assistance of the North Coast Land Conservancy (NCLC). Removing the berm will reduce flooding by restoring the wetlands that the berm affected when it was constructed in the 1970's, allowing water to filter naturally away from the road and reducing flooding by 50%. Once this mitigation project is complete, local agencies will assess the effect on flood incidents and determine if future mitigation efforts are necessary.

Recommended Action Items

- The City of Seaside maintains compliance with the National Flood Insurance Program. To improve the program in the future, the City will apply for FEMA's Community Rating System[xiii] as a means to further reduce the risks from flood damage while reducing flood insurance rates.

3.5 Landslide

Clatsop County's Plan identifies a number of locations within the County that are at risk of landslides. Due to Seaside's location along the coast, landslides primarily occur during rain and/or coastal erosion events. Beyond this, regional landslides can cause regional commerce and transportation difficulties.

Clatsop County estimates a 'high' probability that landslides will occur in the future, meaning one incident is likely within a 10-35 year period, and a 'moderate' vulnerability. Seaside estimates a 'low' probability and history of such an incident, but a moderate vulnerability and threat from mud or landslides. Particular areas at risk of damage in landslides are Highway 101 south of Beerman Creek Road, and Lewis and Clark Road to the North. A landslide along Highway 101 South of Beerman Creek Road could pose a significant hardship to Seaside residents and employees, cutting off access to and from Highway 26 and communities to the south. Other potential community impacts are adequately described in Clatsop County's Landslide Hazard Annex.

Current Mitigation Activities

- In accordance with the City of Seaside Zoning Ordinance, continue to require Hazard Mitigation Plans within steep slope areas and those areas identified as having an elevated risk of geologic instability. Periodically review these provisions in an effort to improve their potential to reduce the risks posed by landslides.

3.6 Tsunami

Seaside's location along the Oregon Coast makes it susceptible to impacts from both a local tsunami (triggered by a Cascadia Subduction Zone earthquake less than 100 miles from the shoreline) and a distant tsunami (triggered by a remote earthquake event along the Pacific Rim). The Clatsop County Multi-Jurisdictional NHMP ranked the vulnerability

of the community to tsunamis as high and the probability of a tsunami as moderate. This rating is consistent for Seaside as well.

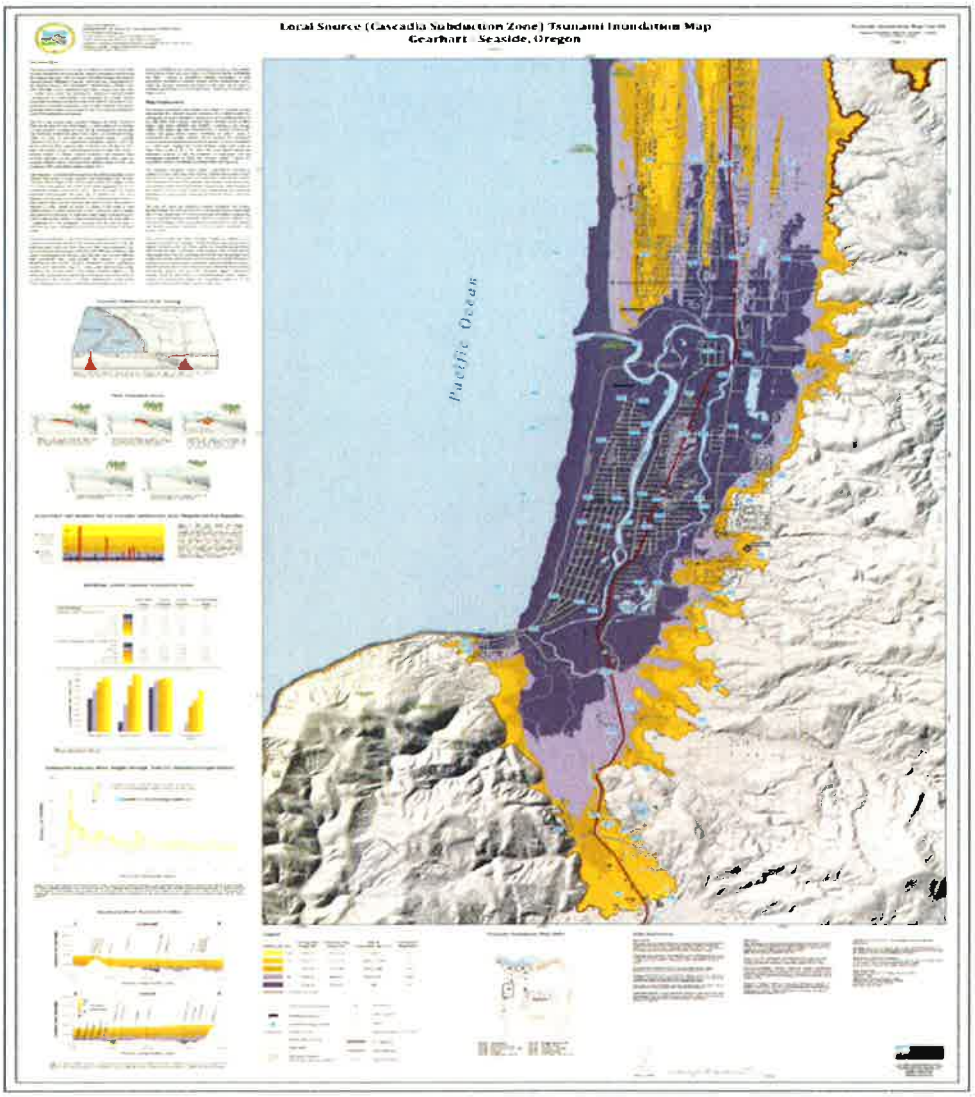
Seaside has been assessed in a report by USGS as having the highest *exposure* (the number of facilities within the hazard inundation zone) and the highest *sensitivity* (the percentage of the community's assets within the inundation zone) to tsunamis of any city on the Oregon Coast.[xiv] As shown in Figure 3.6, the inundation zone of a local tsunami very closely matches the development pattern of the city: 87 percent of the city's developed land lies in the tsunami hazard area, including most of Seaside's residential areas, civic and public infrastructure, and businesses. Typical local tsunami wave heights occurring in the Pacific Ocean have been 20 to 65 feet at the shoreline. However, due to local conditions, a few waves have been much higher – as much as 100 feet.[xv] A distant tsunami would have a far lesser impact and would result in much smaller waves, achieving at most about half the height of a local event.

Figure 3.6 Tsunami Inundation Zone in Seaside

Source: Department of Oregon Geological and Mineral Industries

The Oregon Department of Geology and Mineral Industry published new Cascadia Tsunami Inundation Zone map for the Seaside area in the summer of 2013. As depicated in Figure 3.7, the map displays the output of computer models representing five selected tsunami scenarios, all of which include the earthquake-produced subsidence and the tsunami-amplifying effects of the splay fault. Each scenario assumes that a tsunami occurs at Mean Higher High Water (MHHW). To make it easier to understand this scientific material and to enhance the educational aspects of hazard mitigation and response, the five scenarios are labeled as "T-shirt sizes" ranging from Small, Medium, Large, Extra Large, to Extra Extra Large (S, M, L, XL, XXL). The map legend depicts the respective amounts of slip, the frequency of occurrence, and the earthquake magnitude for these five scenarios. Although the likelihood of the XXL scenario is very low, each scenarios provides valuable information that can be used for mitigation planning.

Figure 3.7 Tsunami Inundation Zone in Seaside



Source: Department of Oregon Geological and Mineral Industries

Of particular concern to the city is the location of Seaside's schools within hazard prone areas. Table 3.2 illustrates the number of students and staff at each building in the district.

Table 3.2 Staff and Students at Seaside School District Buildings

School	Number of Students	Number of Staff (FTE)
Cannon Beach Elementary	80	19 (10.11)
Gearhart Elementary	315	35 (27.63)
Seaside Heights Elementary	360	49 (38.98)
Broadway Middle School	340	36 (30.57)
Seaside High School	470	57 (50.24)
District Office		12 (12)
Total	**1565**	**208 (169.53)**

Source: Seaside School District, 2013

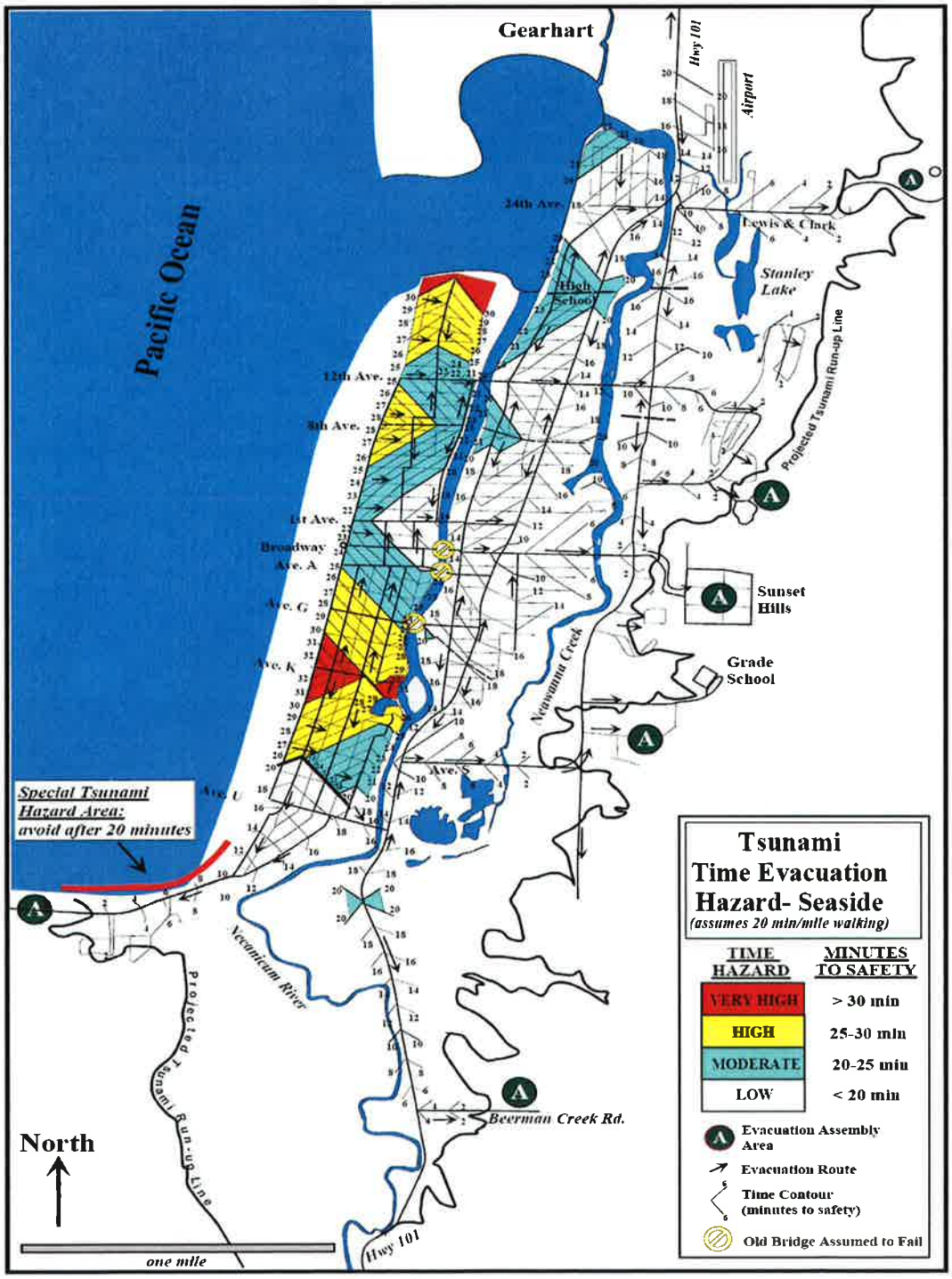
Studies indicate that when a Subduction Zone Earthquake occurs, a tsunami would likely strike the coast in Seaside within 15-20 minutes. The students and staff at Gearhart Elementary School must evacuate on foot three-quarters of a mile, then hope the tsunami inundation is not higher than average since they can only evacuate to an elevation of 45 feet. Broadway Middle School must hope that a retrofitted bridge is still standing in order for them to evacuate to higher ground. Cannon Beach Elementary School and Seaside High School must each evacuate on foot 1.2 miles. The students and staff of Seaside High School also need to cross a retrofitted bridge on their way out of the tsunami inundation zone. Under the best conditions, it takes the Cannon Beach Elementary School students 25 minutes to get to ground that would not be under the threat of inundation. Under the conditions they will be encountering, this simply is not enough time to evacuate an entire school safely. A Cascadia Subduction Zone event could result in many students and staff becoming casualties of collapsing buildings or incapacitated by the tsunami.

Evacuation from most developed regions in Seaside to high ground requires passage over Neawanna Creek and the Necanicum River. Currently, only four bridges in Seaside, located at 1st and 12th Avenues over the Necanicum and at Broadway and 12th over Neawanna Creek, are considered seismically sound enough to withstand a subduction zone earthquake. This leaves regions of town underserved by evacuation routes, with walking evacuation times of 20 minutes or more to high ground, assuming a walking rate of 3 mph (See Figure 3.8).

The Tsunami Advisory Group (TAG) has developed a preliminary tool for assessing the project prioritization of bridge construction or replacement, using the number of households served as a criterion (See Table 3.3).

Seaside also faces risks associated with debris which may wash ashore after distant tsunamis. Tsunami debris can result in pollution of Seaside's public beaches as well as the potential introduction of exotic species which may harm the Pacific marine ecosystem.

Figure 3.8 Current Tsunami Evacuation Times



Source: Tom Horning, Chair, Tsunami Advisory Group

Table 3.3 Bridge Project Prioritization (based on residents served)

Present Bridges	Area Served	Total Tax Lots	Undeveloped Tax Lots	Developed Tax Lots	Residents (assuming 5/ household)	Comments:
12th Avenue West	20th to 8th Avenue	410	69	340	1700	Not all can beat the 20 minute deadline. Vertical evacuation near north Prom needed.
First Avenue	8th Avenue to Avenue K	1199	101	1098	5490	Must funnel from Avenue K; up to 13 minutes excess evac time; need footbridge Avenue S
Avenue U	Avenue K to Avenue U	394	36	358	1790	Must funnel from Avenue K; up to 13 minutes excess evac time; need footbridge Avenue S
Overland to Tillamook Head	South of Avenue U	608	86	522	2610	Provided evacuation takes less than 20 minutes, passage is secure
New Bridges	**Area Served**	**Total Tax Lots**	**Undeveloped Tax Lots**	**Developed Tax Lots**	**Residents**	
Avenue G Necanicum	Avenue C to K	284	28	256	1280	Evacuation assumes First Avenue Bridge ***has*** been replaced
Avenue G Necanicum	Broadway to K	822	61	761	3805	Evacuation assumes First Avenue Bridge ***has not*** been replaced
Avenue A Necanicum	Broadway to C	538	20	518	2590	Condos & Motels south of Turnaround primarily
Avenue S Neawanna	Dooley Br. To Avenue I	339	117	222	1110	Must use Avenue S bridge; assumed brief traverse if bridge is down; sufficient time to evac.
Avenue S Necanicum (Foot)	*Avenue G to U*	*574*	*52*	*522*	*2610*	*MOST IMPORTANT BRIDGE FOR SAVING LIVES*
Avenue F Neawanna (Foot)	*Broadway to K*	*822*	*61*	*761*	*3805*	*Needed ONLY if Avenue G Necanicum has been replaced; east Necanicum can use East Broadway Br.*
24th Avenue Hwy 101	18th to 26th Avenue	estimated 180	est. 35	145	725	
22nd Avenue Newanna (Foot)	*18th to 26th Avenue*	estimated 181	est. 36		*1250*	*Includes High School students & faculty, who also can evacuate via 12th Neawanna*

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Current Mitigation Activities

- The City operates the Emergency Preparedness Committee as an ongoing official City Committee, to oversee the city's response to emergency situations and implement the City Emergency Operations Plan as needed.

- In 2010, the City of Seaside amended their comprehensive plan in an effort to help facilitate Urban Growth Boundary (UGB) expansions above the inundation zone line. The requested amendment was initiated by Providence Seaside Hospital and establishes site criteria for relocation of public schools or hospitals above the 80 foot contour line.

- The City Planning Department has hired a temporary Emergency Preparedness and Planning Assistant through RARE (Resource Assistance for Rural Environments) to conduct natural hazard public education and outreach.

- The City collaborated with the Tsunami Advisory Group to purchase and stock 110 barrels full of emergency food, water and medical supplies. These barrels, carrying enough supplies to support 2,000 people for three days, have been stored in the private residences of volunteers in high ground areas surrounding each Tsunami Assembly Area. In the event of an emergency, it will be the responsibility of the volunteer barrel keepers to place the barrels on the sidewalk for public use.

- The City of Seaside has installed Emergency Warning Sirens throughout the city. In the event of a distant tsunami, these sirens will broadcast a message alerting people outside to the threat in both English and Spanish. This system is tested on the first Wednesday of every month from October through May.

- The city has implemented an ordinance (Seaside Code Section 150.04) that requires all new dwellings and tenant spaces to provide and maintain a public alert certified weather radio. This is to help notify residents and business occupants e ordinance is intended to residents and building occupants of potential tsunami or weather related hazards. Currently, the city purchases qualified radios and provides them to residents at a reduced cost. This program should be maintained.

- The City of Seaside has contracted with an engineering firm to conduct a feasibility study of the construction of a pedestrian bridge at one of two locations: over the Necanicum River at Avenue S, or over the Neawanna at Avenue F. Construction of the bridge would be funded through Urban Renewal district funding.

- The City conducts educational outreach events (e.g. drills, movies, preparedness fairs, newsletters) annually as part of national Earthquake and Tsunami Awareness Month.

Recommended Action Items

- Continue to pursue a proactive approach to tsunami and natural disaster preparedness through appropriate planning, education, and development of pre-disaster mitigation measures by building on existing activities and partnerships. The City will:
  - Continue to conduct evacuation drills.
  - Work collaboratively with the Seaside School District to help promote all-hazard preparedness education for students and their families.
  - Support the Seaside CERT program through continuing education, recruitment, and equipment purchase.
  - Support efforts to provide a local, regional, or countywide coordinator/education provider. This could be a RARE Student, Americorp, Grad Student Intern; private contractor; or some other form of employee or partnership with another agency like SeaGrant.
  - Adopt an event scenario that can be used to help plan for events and identify needed mitigation measures.
  - Advocate for State & Federal funding and activities that will promote emergency preparedness, hazard mitigation, & community resiliency within the City and the Coastal Region.
  - Continuing to work with other departments and community groups (E-PREP, TAG, Seaside Tsunami Amateur Radio Society [STARS], and the Community Emergency Response Team [CERT]) to plan for emergencies and promote the improvement of emergency infrastructure.

- The City of Seaside will work with Seaside Downtown Development Association, the Chamber of Commerce, and TAG to help develop a recognition program for Tsunami Ready Businesses.

- The Building and Planning Department will conduct an engineering evaluation of existing multi-story structures within the tsunami inundation zone to determine their potential to be utilized as vertical evacuation structures following a Cascadia Subduction Zone Earthquake.

- The City of Seaside will work to encourage Pacific Power Co. to underground overhead utilities along major evacuation routes leading to high ground assembly areas. This measure would facilitate rapid evacuation by eliminating the impediments created by failure of overhead utility lines and power poles along evacuation routes.

- The Planning and Public Works Departments will evaluate improved methods of marking, signing, and lighting major evacuation routes leading to high ground assembly areas and provide upgraded demarcation of select evacuation routes. This would reduce confusion and improve evacuation efficiency (especially at night)

when time to evacuate is very limited. In Seaside, this becomes even more important due to the large percentage of tourist and non-resident that are unfamiliar with appropriate evacuation routes.

- The City Planning Department will partner with Seaside Tsunami Amateur Radio Society (STARS), TAG, the county-run Radio Amateur Emergency Service (RACES), and the private club Amateur Radio Emergency Services (ARES) to establish a network of planned emergency communication stations. During evacuation drills and in the event of a tsunami, volunteer Ham radio operators will be stationed at each assembly area with an easily identified red tent to relay messages, call for help and provide communication assistance to residents.

- With two parallel river systems running the length of Seaside, the location and stability of bridge crossings will play a vital role when evacuating the inundation zone due to a local tsunami following a Cascadia Subduction Zone event. Failed bridges or indirect evacuation routes that require evacuation times that exceed 20 minutes will be life threatening. Therefore the following mitigation measures related to bridges are very important:
  - Conduct an engineering evaluation of all existing bridges along evacuation routes within the tsunami inundation zone to determine their potential to be utilized for pedestrian evacuation immediately following a Cascadia Subduction Zone Earthquake. Although many of the existing bridges may not be suitable for vehicular traffic after a subduction zone earthquake, no formal study by a qualified engineer has been done to determine the likelihood of them standing, so they could be used for evacuation immediately prior to a tsunami event.
  - Develop new earthquake resistant bike/pedestrian bridges along critical evacuation routes. These bridges will address multiple needs; however, the location and prioritization of establishing foot bridges should strongly consider the elimination of long evacuation times for the greatest number of individuals.
  - In conjunction with planning to provide new foot bridges, existing vehicular bridges along evacuation routes that are subject to failure should be upgraded to current seismic standards sufficient to withstand a Cascadia Subduction Zone Earthquake. Prioritization of bridge replacement should strongly consider the elimination of long evacuation times for the greatest number of individuals. The list of bridges in need of retrofit include (not in order of priority):
    - Avenue U
    - Avenue G
    - Avenue A
    - Avenue S
    - West Broadway
    - Lewis & Clark, Stanley Lake (controlled by Clatsop County)
    - Highway 101 Neawanna Creek Bridge (controlled by ODOT)
    - Highway 101 Dooley Bridge (currently ODOT's)

- The Seaside School District will continue to plan and work towards moving all of their school facilities above the inundation zone, combining them into a single campus that would also be capable of providing an assembly and shelter facility well above the elevation of a likely tsunami inundation. This facility would also provide a site that would accommodate additional supply cache storage for evacuees.

- The City will work with Red Cross to secure additional Red Cross disaster relief trailers and recruit local volunteers willing to be trained in their deployment and use. The city has five distinctive evacuation assembly areas but it only has one disaster relief trailer. Additional trailers are needed to supply each of the assembly areas and trained volunteers to oversee their use.

3.7 Volcano

The Clatsop County Natural Hazard Mitigation Plan adequately describes the City's risk to volcanic events. Generally, a volcanic event that affects the County is likely to affect Seaside as well. The causes and characteristics of a volcanic event are appropriately described within the County's Plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the County's Plan, and the community impacts described by the County would generally be the same for Seaside as well. Seaside is very unlikely to experience anything more than a small amount of volcanic ash during a volcanic event. The County estimates a 'low' probability of future volcanic events and a 'low' vulnerability to future eruptions. The County's probability and vulnerability estimates are accurate for Seaside as well. Ash cleanup is the only potential impact identified for this risk category. At this time, city staff estimate that it is unlikely that ash from a volcanic eruption in the Cascade Range will be transported to Seaside based on prevailing wind patterns.

3.8 Wildfire

The Clatsop County Natural Hazard Mitigation Plan adequately describes the causes and characteristics of wildfires, as well as the County and City's history of wildfire events. Seaside has no recorded history of wildfire, and County wildfires are mostly related to debris burns. Clatsop County has completed a Community Wildfire Protection Plan (CWPP) to be included in the Clatsop County Hazard Mitigation Plan. Seaside Fire Marshall Chris Dugan served on the steering committee for the CWPP. The Seaside Fire Department works in collaboration with the fire departments of neighboring cities and the Oregon Department of Forestry through a mutual aid agreement. According to this agreement, the Oregon Department of Forestry may be dispatched for wildland fires in Seaside by request.

Clatsop County estimates a high probability that wildfires will occur in the future. Seaside, however, has wildfires as having a low probability of occurrence, based on a low history of such incidents in the past.

Clatsop County estimates a moderate vulnerability to wildfire events, meaning 1-10% of the population of regional assets are likely to be affected by a major event. Wildfires are most likely to occur in wildland-urban interface areas.[xvi] The properties bounded on the east by commercial forest land and those bordered on the south by forested state parks (Ecola State Park) are interface areas at risk of wildfires. Within these interface areas, the city infrastructure most at risk is the city water treatment plant located at Peterson Point. Additionally, there are numerous wooded areas throughout the community, making the spread of fire from one area of the City to another a possibility. The natural mitigation factor is the maritime climate which reduces the rate at which vegetation dries during the summer months. Potential community impacts are adequately described in Clatsop County's Wildfire Hazard Annex.

Current Mitigation Activities

- The City of Seaside Fire Department continues to collaborate with the County to ensure compliance with the Clatsop County Wildfire Prevention Plan.

- The City will continue to promote fire safety through the issuance of burn permits, and actively enforces the prohibition of recreational fires in beach grass or driftwood piles.

- The Seaside Fire Department operates a wildland firefighter training certification program.

Recommended Future Actions

- Implement a fuel reduction program around the water treatment plant to minimize risk of wildfire damage.

3.9 Wind and Winter Storms

The Clatsop County NHMP adequately describes the causes and characteristics of wind and winter storms, as well as the location and extent of wind and winter storm hazards. The region's (and City's) history of events are adequately described within the County's Plan as well. Because coastal wind storms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow. More than likely, however, the coast's winter will just be windy, cold, and wet.

The County estimates a 'high' probability that wind and winter storms will occur in the future. Windstorms occur yearly, and the more destructive storms occur once or twice per decade. The County additionally estimates a 'high' vulnerability to windstorms, meaning more than 10% of the population or regional assets would be affected by a major windstorm event. Both estimates are true for the City as well.

Seaside's long, narrow configuration on the Pacific shoreline makes it very vulnerable to windstorms blowing in from the ocean. Winter storms with snow and ice that are severe in nature are relatively uncommon along the coastal strip. Because of the infrequent nature, many drivers lack necessary skills and equipment to continue routine travel, and many homes are not constructed to adequately protect their plumbing systems from freezing. Additionally, roughly 26.5% of the homes in the community are for vacation use and not occupied year-round.[xvii] During prolonged periods of freezing weather, it is common to find water pipes broken with water running unchecked into homes and onto the ground. When this becomes widespread, the public water reservoirs drain with resultant loss of flow needed for fire protection and public health.

Current Mitigation Activities

- The City has installed a generator at the City offices to supply power for daily operations during severe storms. A generator was installed at the convention center following the winter storms of 2007. With this back-up energy supply, the convention center may be used as a community shelter during a prolonged power outage. This would not be a viable shelter following a tsunami. See section 3.10 (All Hazards) for further discussion concerning actions intended to address prolonged power outages.

- The City currently negotiates with Pacific Power Co. and private developers to install underground utilities in conjunction with street improvement projects whenever practical.

- The City Building and Planning Departments provide building permit and inspection services in accordance with the State's adopted building code. This code provides standards for construction based on wind loads.

3.10 All Hazards

Some Mitigation strategies are effective for multiple hazards. What follows are the City's recommended actions which will address risks posed by multiple hazards.

Recommended Future Actions

- Review, revise, and make necessary updates to the City of Seaside Natural Hazard Mitigation Plan by resolution not less than one time each year, and participate with Clatsop County's and multi-jurisdiction plan adoption not less than one time each five years based on the dates of plan adoption.

- Ensure the use of a cost-benefit analysis to ensure that mitigation action items are cost effective and meet mitigation criteria.

- Evaluate City Ordinances and Capitol Improvement Plans not less than one time each five years to determine if reasonable modifications can be made to support mitigation efforts that would reduce the potential risk from natural hazards.

- Evaluate critical facilities and structures exposure to natural hazards and consider practical mitigation measures, up to and including relocation, in an effort to minimize their exposure risk.

- Provide preparedness information on the city's web site.

- Provide backup generator power capabilities and fuel sources for critical infrastructure, emergency equipment, and public utilities for use during disaster events.

- Designate a hazard debris management site for the interim storage of debris following a winter storm or distant tsunami, and develop a Hazard Debris Management Plan.

- Prepare and implement a community disaster preparedness program.
  - Develop a Community Self-Sustainability Program to prepare food, shelter, hygiene, water, communication, and assistance in the event of a disaster. Follow a "map your neighborhood" approach to identify those with special skills, special equipment, resources and special medical or mobility needs.
  - Identify leaders in designated areas who will implement a neighborhood based approach to community resiliency. Encourage each community member to have adequate supplies and personal plans that will raise their level of all hazard preparedness.

- Educate the community about hazard risks and hazard mitigation. Encourage participation in mitigation and community sustainability programs by holding a periodic outreach event such as national night out and preparedness workshops.

- Continue to support the Seaside CERT team with training and supplies. Support the launch of a TeenCERT program at Seaside High School to educate youth and their families about preparing for disasters, and train youth to be the first responders for their school in the event of an emergency.

Section 4
Action Items

The City of Seaside addendum includes action items that, when implemented, will reduce the city's vulnerability to natural hazards. These recommendations are consistent with the goals and objectives of the city's existing plans and policies. Action items are listed in the Recommendation Table below, and are organized by hazard.

Recommended Action	Priority (ST = short term, LT = long term, OG = ongoing)	Lead Department
ALL HAZARDS		
Provide preparedness information on city's website.	OG	Planning Department
Periodically update Seaside Addendum.	OG	E-PREP
Evaluate City Ordinances and Capital Improvement Plans not less than one time each five years to support hazard mitigation efforts.	OG	E-PREP, Planning Department, Public Works
Designate a hazard debris management site/Develop a Hazard Debris management Plan.	ST/LT	Public Works Department
Provide back-up generator power capabilities and fuel sources to critical facilities and disaster gathering sites.	ST	Public Works Department
Implement a community disaster preparedness program, including neighborhood resource mapping, and establishment of neighborhood leaders to conduct ongoing outreach.	LT	Planning Department, TAG
Conduct National Night Out events or other community resiliency events and conduct preparedness workshops.	LT	Planning Department
Provide ongoing support for Seaside CERT program and development of a Seaside TeenCERT program.	OG	Seaside Fire Department, Seaside High School
EARTHQUAKE		
Develop a cost-benefit analysis for bridge seismic retrofits and engineering report of current bridge stability.	ST	Public Works Department

Promote a "seven step" approach to preparedness.	OG	Planning Department
Develop a program to provide seismic upgrade information to property owners and encourage upgrades.	LT	Building and Planning Departments
FLOOD		
Apply for FEMA's National Flood Insurance Program Community Rating System.	ST	Planning Department
TSUNAMI		
Conduct school education and outreach.	OG	School District
Support efforts to provide a local, regional or county-wide outreach coordinator	ST	Planning Department, TAG
Adopt an event scenario.	ST	TAG, City Council, Planning Department
Continue to conduct evacuation drills.	OG	TAG, E-PREP, STARS
Develop a Tsunami Ready Business certification program.	ST	Planning Department, Seaside Downtown Development Association, Chamber of Commerce.
Conduct an engineering evaluation of existing multi-story buildings within the inundation zone to be utilized as vertical evacuation structures.	LT	Building and Planning Department.
Upgrade symbols, markings and signage along select evacuation routes.	LT	Public Works and Planning Department
Develop emergency communication stations at assembly areas.	ST	STARS, Planning Department
Construct new pedestrian evacuation bridges along critical evacuation routes.	LT	Public Works Department
Reconstruct existing bridges along evacuation routes that are projected to fail in an earthquake.	LT	Public Works Department
Relocate public school buildings to one consolidated campus on high ground.	LT	School District
Secure trailers to store disaster relief supplies out of inundation zone.	LT	Planning Department, E-PREP, TAG

WILDFIRE		
Implement a fuel reduction plan around water treatment plant.	OG	Fire Department

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[vii] United States Census Bureau. 2010. *Seaside City, Oregon.* Retrieved from: http://factfinder2.census.gov.

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[xvi] Federal Register: August 17, 2001. V.66, N.160.

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"Making a difference through excellence of service"

CITY OF WARRENTON

City of Warrenton

Natural Hazards Mitigation Plan Addendum

Prepared for
City of Warrenton
225 S. Main Avenue
Warrenton, Or 97146

In cooperation with

Columbia River Estuary Study Taskforce (CREST)
750 Commercial Street, Room 205
Astoria, OR 97103
Adopted by the Warrenton City Commission on January 26, 2010

Re-adopted by the Warrenton City Commission, (date)

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Volume III: City Addendum

City of Warrenton

Overview

The city of Warrenton developed this addendum to the Clatsop County Multi-jurisdictional Natural Hazards Mitigation Plan in an effort to increase the community's resilience to natural hazards. The addendum focuses on the natural hazards that could affect Warrenton, Oregon, which include coastal erosion, drought, earthquake, flood, landslide, tsunami, volcano, wildfire, wind storm, and winter storm. It is impossible to predict exactly when disasters may occur, or the extent to which they will affect the city. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from natural hazards.

The addendum provides a set of actions that aim to reduce the risks posed by natural hazards through education and outreach programs, the development of partnerships, and the implementation of preventative activities such as land use or watershed management programs. The actions described in the addendum are intended to be implemented through existing plans and programs within the city.

The addendum is comprised of the following sections: 1) How was the Addendum Developed? 2) Community Profile; 3) Risk Assessment; 4) Mission, Goals, and Action Items; and 5) Plan Implementation and Maintenance.

How was the Addendum Developed?

In the fall of 2006, the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center partnered with Oregon Emergency Management (OEM) and Clatsop and Lincoln Counties to develop a Pre-Disaster Mitigation Planning Grant proposal. Each county joined The Partnership by signing (through their County Commissions) a Memorandum of Understanding for this project. FEMA awarded the Oregon Coast Region a grant to support the development of multi-jurisdictional natural hazard mitigation plans for the two counties and the cities therein. The Partnership, OEM, and the participating communities were awarded the grant in the fall of 2006 and Clatsop County's multi-jurisdictional planning efforts began in the fall of 2007.

The Columbia River Estuary Studies Taskforce (CREST) led the development of Clatsop County's multi-jurisdictional plan. A graduate student with OPDR assisted CREST with data collection and plan writing to support the development of the county's community overview and risk assessment as well as similar components for the city addendums. The Countywide Steering Committee—composed of various county stakeholders and representatives from each city—guided development of Clatsop County's Natural Hazards Mitigation Plan. Warrenton's

planner, Pamela Alegria, represented Warrenton on the Countywide Steering Committee.

CREST and Warrenton's planner worked together to develop Warrenton's addendum to the Clatsop County Natural Hazards Mitigation Plan, with assistance from OPDR. Warrenton's planner wrote the mitigation plan, while CREST edited plan drafts and provided general plan development guidance. OPDR provided a plan template and researched and wrote the addendum's community profile.

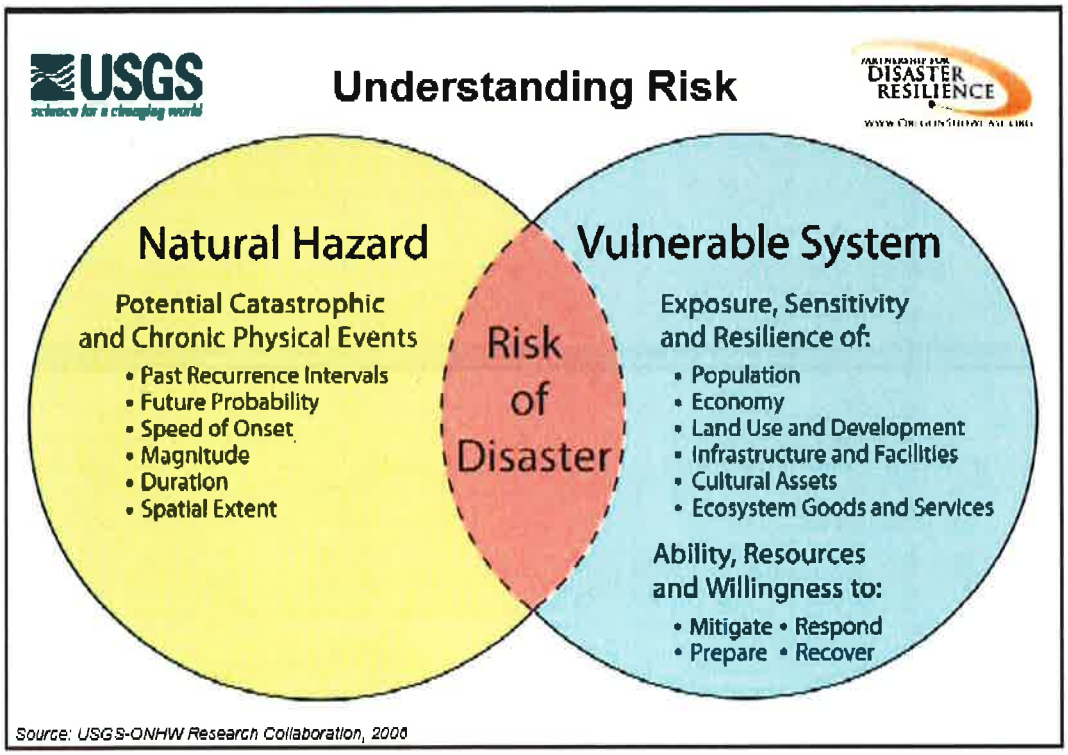
Between November 2007 and June 2009, the planner worked with CREST to write the risk assessment and action item portions of the addendum. To accomplish this, the planner held individual meetings with several key community stakeholders, which included the Warrenton public works director, the wastewater treatment plant superintendent, the Warrenton planning director, and the Warrenton city manager. The planner also reviewed and incorporated information from community plans and technical reports, such as the Warrenton Stormwater Management Plan, into the plan's risk assessment. While developing the addendum, Warrenton participated in the county's public involvement process to develop a plan that addresses local needs (Please see pages 1-7 to 1-8 of the Clatsop County Mitigation Plan and Appendix B). Finally, between June and October, 2009, OPDR conducted a final review of Warrenton's addendum and made edits to the plan in collaboration with the Warrenton planning director.

The City of Warrenton adopted Warrenton's Addendum to the Clatsop County Natural Hazards Mitigation Plan via resolution on January 26, 2010. This update reflects changes in demographics of the city based on the 2010 census and project completions since the original adoption. Additional public input will be sought through the combined public outreach effort conducted cooperatively through Clatsop County.

Community Profile

The following section describes the city of Warrenton from a number of perspectives 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 in this section represents a snapshot in time of the current sensitivity and resilience factors in the city when the plan was developed. The information documented below, along with the hazard assessments located in the risk assessment, should be used as the local level rationale for the risk reduction actions. The identification of actions that reduce the city's sensitivity and increase its resilience assist in reducing overall risk, or the area of overlap in Figure 1 below.

Figure 1. Understanding Risk



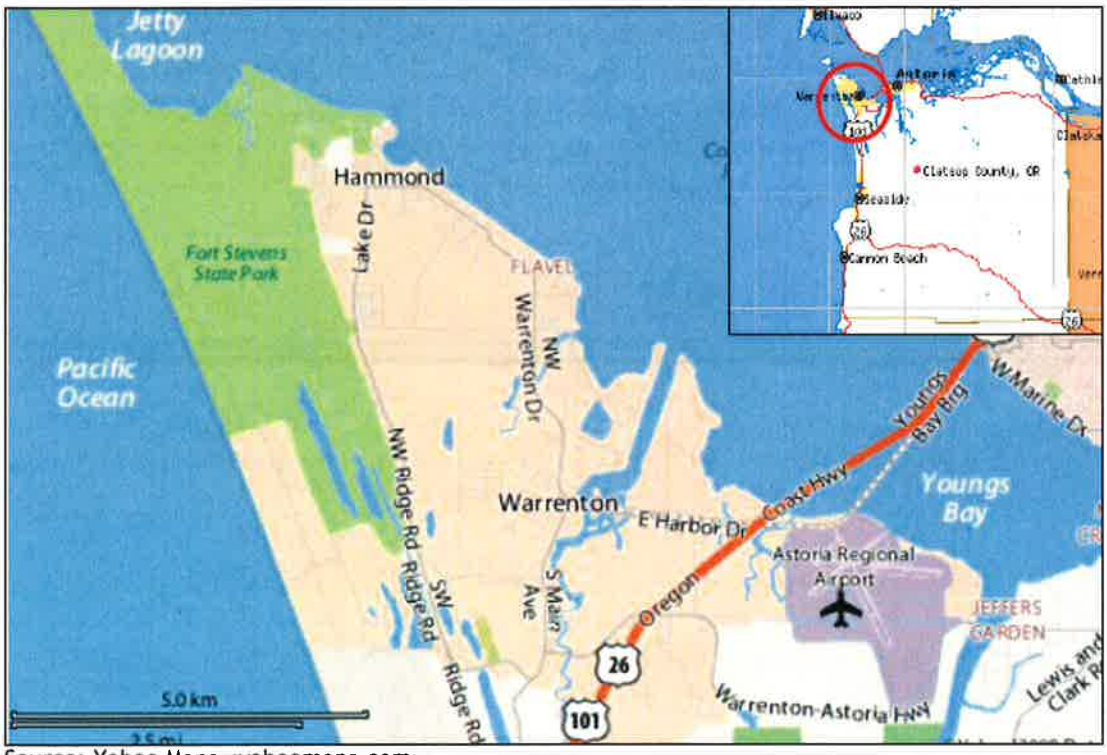
Source: USGS - Partnership for Disaster Resilience Research Collaborative, 2006

Geography & Climate

Warrenton is located at the mouth of the Columbia River in the northwestern corner of Clatsop County. It is bordered by water on three sides: the Pacific Ocean to the west, the Columbia River to the north and Young's Bay to the east (see Figure 2 below). The climate is moderate. The monthly average temperatures range from highs around 69 degrees and lows around 60 degrees in July and August, to highs around 48 degrees and lows around 36 degrees in December and January. Warrenton receives approximately 66 inches of rain annually. Monthly precipitation averages range from 10 inches during the wetter months of November through January, to approximately one inch during the drier summer months of June through August.[1]

[1] National Weather Forecast 2007

Figure 2. Map of the City of Warrenton



Source: Yahoo Maps <yahoomaps.com>

Knowledge of geographic factors like soil types can help identify areas vulnerable to natural hazards, specifically landslides and earthquake related hazards such as liquefaction, and can assist in mitigation planning. The primary types of soil found in the city of Warrenton are Coquille-Clatsop (C-C), Grindbrook-Walluski-Hebo (G-W-H), and Waldport-Gearhart-Brailler (W-G-B).

Population & Demographics

Lewis and Clark's expedition, the Corps of Discovery, arrived near present-day Warrenton in the winter of 1805-06. Lexington, as Warrenton was then known, was the Clatsop County seat and emerged as a bustling fishing and logging hub bordered by the Pacific Ocean, the Columbia River and Young's Bay. Warrenton was incorporated as a city in 1899 and annexed the former community of Hammond in 1992.

In 2000, the city had a population of 4,096 permanent residents, which comprised approximately 11% of Clatsop County's total population. Among Clatsop County's cities between 1980 and 2000, Warrenton grew at the fastest rate, with a growth of 26%, in part due to the annexation of Hammond in 1991. Table 1 shows the

city's population growth between 1980 and 2000. In 2013, the population of Warrenton is estimated to be 5,135.[2]

Table 1. Population Growth, City of Warrenton, 1980-2010

Census	Population	Percent Change
1980	3,009	-
1990	3,270	8.70%
2000	4,096	25.30%
2010	4,989	22.07%

Source: US Census, 2010

The impact 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 Warrenton's residents fall into these special needs populations.

Nearly 5% of the city's population speaks a language other than English as their primary language. In 2000, 14% of all individuals and 15% of families in Warrenton were living below the federal poverty level.[3] More information on special needs populations is shown in Tables 2 through 4.

Table 2. Population by Age, City of Warrenton, 2000

Age Range	Percent of Population
Under 5 years	7.4%
5 to 9 years	7.1%
10 to 14 years	7.2%
15 to 19 years	7.4%
20 to 24 years	5.7%
25 to 34 years	12.5%
35 to 44 years	17.2%
45 to 54 years	12.3%
55 to 59 years	5.3%
60 to 64 years	4.8%
65 to 74 years	7.3%
75 to 84 years	4.5%
85 years +	1.3%

Source: US Census, 2000

[2] Portland State University Population Research Center, "Table 4. Population Estimates for Oregon and its Counties and Incorporated Cities: April 1, 1990-July 1, 2008," *2008 Oregon Population Report,* March 2009.

[3] US Census 2000

Table 3. Poverty Distribution by Age Group, City of Warrenton, 2000

Age	Percent of Population
Under 5 years	2.31%
5-11 years	1.56%
12-17 years	1.44%
18-64 years	7.40%
65 to 74 years	0.94%
75 years and over	0.55%

Source: US Census, 2000

Table 4. Disabled Population, City of Warrenton, 2000

Age	Percentage of Population
5-15 years	1.9%
16-64 years	29.0%
65 years and over	8.9%
Total	**39.7%**

Source: US Census, 2000

Employment & Economics

Education, health, social services and retail trade are the largest employment industries in Warrenton, as shown in Table 5 below. In addition, of the total employed civilian population 16 years and older, 14.2% are paid by local, state, or federal government.[4] Only 3.6% of the population was employed by natural resource jobs including agriculture, forestry, and fishing. This percentage does not include the self employed population such as those in the fishing industry. A breakdown of Warrenton's employment by industry is shown below in Table 5.

[4] U.S. Census Bureau, "Profile of Selected Economic Characteristics 2000, Warrenton, Oregon/ 'Class of Worker,'" www.census.gov.

Table 5. Employment by Industry, City of Warrenton, 2000

Industry	Percent
Educational, health and social services:	20.5%
Retail trade	19.7%
Construction	13.0%
Arts, entertainment, recreation, accommodation and food services:	12.6%
Manufacturing	9.7%
Public administration	5.9%
Finance, insurance, real estate and rental and leasing:	4.5%
Professional, scientific, management, administrative, and waste management services:	4.2%
Agriculture, forestry, fishing and hunting, and mining:	3.6%
Transportation and warehousing, and utilities:	2.7%
Information	1.9%
Wholesale trade	1.5%

Source: US Census, 2000

In 2004, the largest employers in Warrenton were Fred Meyer (retail-220 employees), Weyerhaeuser Co. (lumber-155 employees), Pacific Coast Seafood Co. (fish processing-125 employees), Costco (retail-120 employees) and Warrenton School District (education-100 employees).[5]

Median income can be used as an indicator of the strength of the region's economic stability. In 1999, the median household income in Warrenton was $33,472, according to the 2000 US Census Bureau. This is approximately $8,000 below the 1999 national median household income of $41,994, and almost $3,000 below the $36,301 median household income for Clatsop County. Although it can be used to compare areas as a whole, this number does not reflect how income is distributed among Warrenton's residents.

Housing

Housing type and year-built dates 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 homes. Generally the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed following improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest and California use earthquake resistant designs and

[5] Infrastructure Finance Authority, "5 Largest Employers, Public and Private as of August, 2004" http://www.orinfrastructure.org/profiles/Warrenton/, accessed November 4, 2009.

construction techniques. In addition, FEMA began assisting communities with floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to at least one foot above Base Flood Elevation.

In 2000, Warrenton had 1,621 housing units. Of those, 65.3% (1,059) were owner occupied, 34.7% (562) were renter occupied, and 9.9% were vacant. Nearly 57% of the city's housing stock was built prior to 1980 before stronger seismic building codes were put into place. Other housing characteristics for Warrenton are provided in Tables 6 and 7.

Table 6. Housing Type, City of Warrenton, 2000

Housing Type	Percentage
Single-Family	65.7%
Multi-Family	20.5%
Mobile home	13.8%
Boat, RV, van, etc.	0.0%

Source: US Census, 2000

Table 7. Housing Structure Age, City of Warrenton, 2000

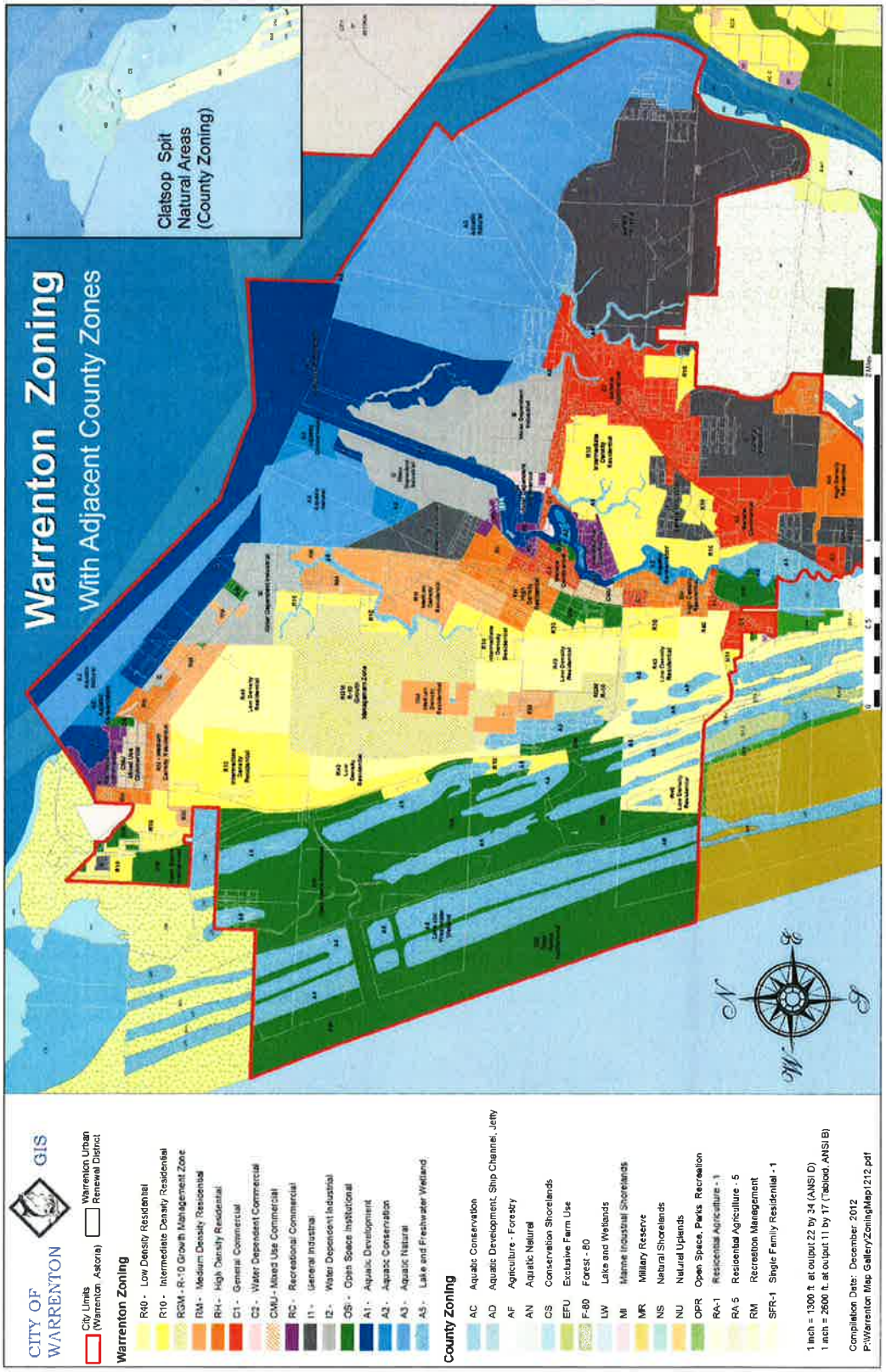
Year Built	Percent of Structures
1980-2000	43.3%
1960-1980	31.4%
Before 1960	25.4%

Source: US Census, 2000

Land Use & Development

Commercial development in Warrenton is located on East Harbor Drive, Highway 101 and the downtown area on Main Avenue. Industrial areas are located in the North Coast Business Park east of the developing North Coast Retail Center at the intersection of Highway 101 and Ensign Lane ; east of Highway 101 and south of Highway 101 Business; at Tansey Point and at the Hampton lumbermill and North Coast seafood processing plants located along the Skipanon River. There are also two other seafood processing facilities along Pacific Drive east of Hammond. Figure 3 shows the zoning of land in Warrenton.

Figure 3. Warrenton Zoning.



Recently the city has created an urban renewal district for future development which extends approximately from Skipanon Drive to the north, the city's limits to the south, Alder Avenue to the west, and Heron Avenue to the east. The urban renewal district encompasses 928 acres including existing public right-of-ways and waterways.[6]

In 2007, Cogan Owens Cogan conducted a buildable lands inventory for Warrenton. This report stated that there are approximately 949 acres of buildable land within the Urban Growth Boundary. More than 467 acres of this land is zoned for business development. Of this, 288 acres are zoned for industrial uses and approximately 157 acres are allocated for commercial lands. The city has 481 acres of land available for various residential densities.[7]

Transportation & Commuting Patterns

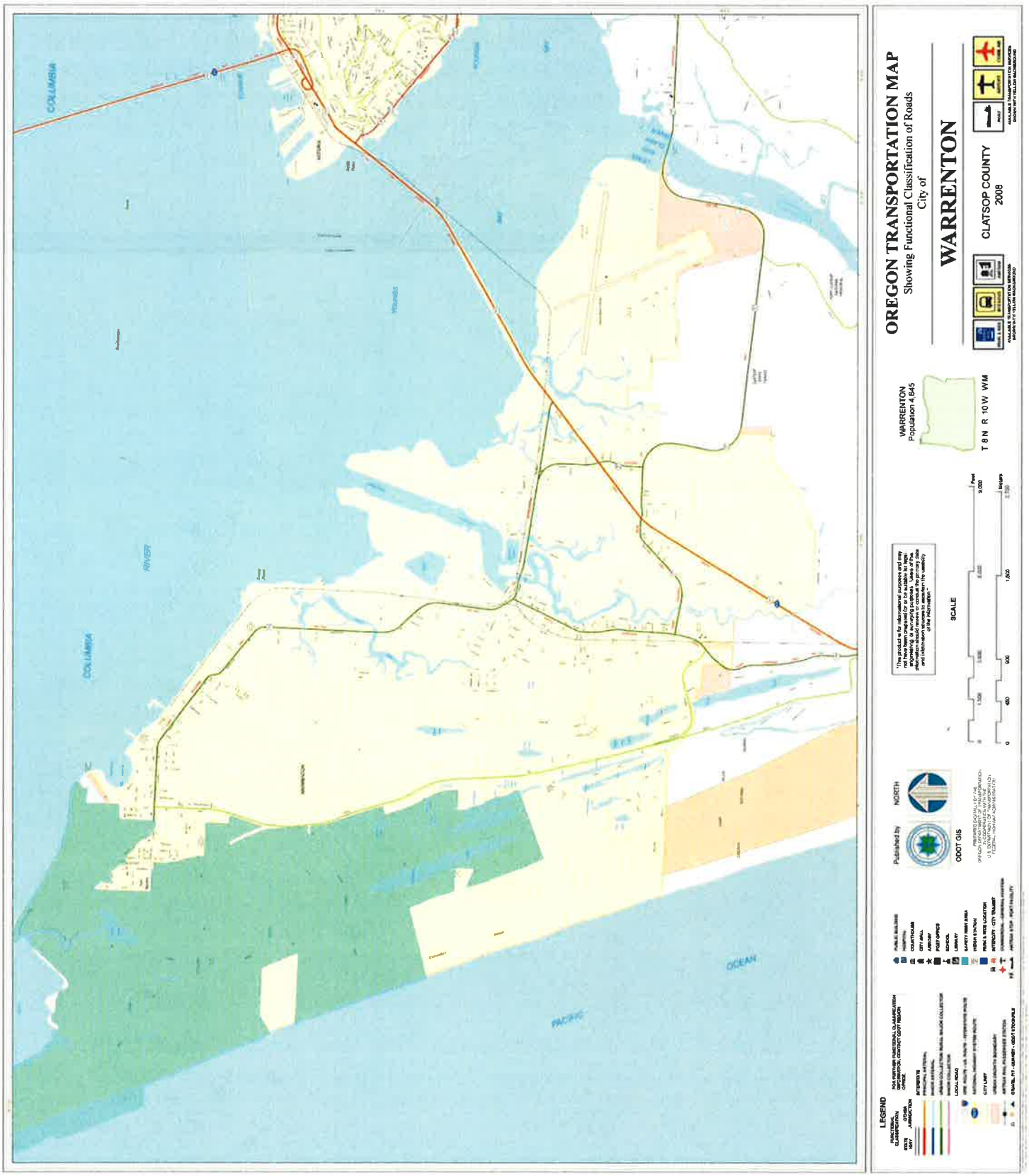
Warrenton is connected to US 101 by secondary roads: East Harbor Drive running east to west and South Main Avenue running north and south. US Highway 101 connects Warrenton with Seaside to the south and Astoria to the north (see Figure 4 Warrenton Transportation Map).

Transportation is an important consideration when planning for emergency service provisions. Growth within the city will put pressure on both major and minor roads, especially if the main mode of travel is by single occupancy vehicles. How people travel to work is indicative of the prevalence of single occupancy vehicle travel, and can help predict the amount of traffic congestion and the potential for accidents. According to the 2000 US Census, over 75% of Warrenton's employed population drove to work alone.

[6] Warrenton Urban Renewal District Plan Part 1 of 2, p. 10

[7] Buildable Lands Inventory, pp.8-9.

Figure 4. Warrenton Transportation Map.



Critical Facilities & Infrastructure

Critical facilities are those that support government and first responders' ability to take action in an emergency. They are a top priority in any comprehensive hazard mitigation plan. Individual communities should inventory their critical facilities to include locally designated shelters and other essential assets, such as fire stations, and water and wastewater treatment facilities.

There is one public elementary school and one public high school in the Warrenton-Hammond School District 30 school system. One private school, Coryell's Crossing, is located on Marlin Avenue.

Warrenton has two fire stations with three paid staff and approximately 27 volunteers. Additionally, the city has one police station that is located in City Hall. The nearest hospital is Columbia Memorial Hospital (CMH) in Astoria; CMH recently opned an urgent care clinic in the developing Warrenton Highlands shopping center. Medix Ambulance, located on SE Dolphin Avenue, serves the North Coast. The water treatment plant is located at 88650 Lewis and Clark Road in Clatsop County. The wastewater treatment plant is located at 105 NE 5th Street in Warrenton.

The New Young's Bay Bridge connects Warrenton to the communities of Astoria, Jewell, Olney and Clatsop County as well as the route to Highway 30.

The northern portion of Warrenton is home to three marinas, which are the city-run Hammond Marina and Warrenton Mooring Basin, and the privately run Skipanon Marina.

Historic & 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. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

The National Register of Historic Places lists the Daniel Knight Warren House as an historic site. Other historic structures include the Munson House, the Peace House, the Coast Guard Lifesaving Station, and the Hammond Town Hall. Fort Stevens State Park, located northwest of Warrenton is a historic military fort that was in use from the Civil War until the Second World War. The fort contains several historic military sites and draws approximately one million visitors a year. One significant historic site is Battery Russell Park which is surrounded by historic residences including the Officers Bed and Breakfast. Fort Stevens State Park also contains a stretch of beach where the wreck of the Peter Iredale, which ran aground in 1906, is located.

Governmental Structure

The Warrenton City Commission is the policy making body for Warrenton. The city commissioners are elected at large. The mayor is appointed by the Commission each January and serves a one year term. The Commission appoints the city manager and the city manager hires all other city employees.

Under the general direction of the Warrenton City Commission, the city manager directs and coordinates the activities of all the city's departments and implements policy as established by the City Commission. The city manager is the administrative head of Warrenton who meets with representatives of other cities, Clatsop County, and other governmental agencies on issues involved with the coordination of city services and agreements with other governmental units. Warrenton currently has the following departments:

Administration

The city recorder/assistant to the city manager serves as the city's official records custodian, clerk of the City Commission, and assistant election officer. Additionally, the city recorder provides website maintenance. The city recorder coordinates with other city departments in the preparation of contracts, leases, deeds, easements, ordinances, and resolutions, and ensures compliance with laws governing public meetings, records, contracts, and elections.

Finance Department

The Finance Department maintains the financial records of the city's activities and prepares the annual budget.

Planning/Building Department

The Planning and Building Department consist of two divisions: (1) Planning Division, which is responsible for all long-range planning, current land use review and permitting, and economic development; and (2) Building division, which reviews construction plans and issues all permits for structural, plumbing, and mechanical improvements.

Fire Department

The Fire Department provides the following services: wildland fire suppression, basic and intermediate life support, fire prevention, emergency medical services, hazardous materials response, rescue, and public fire prevention and education, fire investigations, and training. The intermediate life support includes the ability to administer intravenous therapy, cardiac monitoring, cardiac medications, respiratory or bronchodilator, and to insert PEAD airways.

Municipal Court

The Warrenton Municipal Court processes traffic violations, misdemeanor crimes, and violations of city ordinances. Other crimes are handled by the District Court in Astoria. Typically court is held twice each month. The staff includes a half-time clerk and a judge.

Police Department

The Warrenton Police Department has nine patrol officers, with one additional hire pending, and the chief of police. Support staff consists of one half-time secretary. Presently, the department has four reserve officers who serve in a variety of support functions.

Public Works

The Public Works Department maintains and operates the water distribution system, the water treatment plant, the sewer treatment plant, and the city's storm water system. In addition, the department maintains, repairs, and replaces all the tide gates in the city. Public Works also takes care of the city's parks and other public facilities, and Public Works' Sanitation Division picks up the city's refuse. Warrenton contracts its recycling program with Western Oregon Waste. Finally, the department reviews water, sewer, street and stormwater plans for private development, maintains an operating budget, and completes minor street repairs.

Existing Plans & Policies

Communities throughout Oregon have plans and policies that guide and influence land use, development, infrastructure, and population growth. Such existing plans and policies can include comprehensive plans, zoning ordinances, and technical reports or studies. These plans have been developed with the participation of local residents, businesses and policy makers. Many land use, comprehensive, and strategic plans get updated regularly, and can easily adapt to changing conditions and needs.

The city of Warrenton's addendum to the Clatsop County Multi-jurisdictional Natural Hazards Mitigation Plan 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 county's existing plans and policies. Linking existing plans and policies to the natural hazards mitigation plan helps identify what resources already exist that can be used to implement the action items identified in the plan. Implementing the natural hazards mitigation plan's action items through existing plans and policies increases their likelihood of being supported and becoming updated, and maximizes the city's resources.

The following are the existing plans and policies for the city of Warrenton:

- 2010 Oregon Structural Specialty Code
- 2010 Oregon Mechanicl Specialty Code

- 2011 Oregon Residential Specialty Code
- 2011 Oregon Plumbing Specialty code
- 2010 Oregon Fire Code
- July 2010 City of Warrenton Emergency Operations Plan
- Warrenton Buildable Lands Inventory, Cogan Owens Cogan, Adopted Sept. 25, 2007

- Warrenton Fire Department Evaluation, Jan. 2007 by Emergency Services Consulting Inc.
- Hammond Marina Master Plan, adopted 2009
- Warrenton Comprehensive Plan, October 2008 last amended January 2011

  Section 4.320 Flood Hazards-Flood conditions shall be reduced by requiring buildings in flood hazard areas to be properly elevated or flood proof. The city will work to maintain and improve the system of dikes to help prevent flooding in Warrenton, including possible construction of new pump stations and more efficient tidegates.
- Warrenton Development Code, October 2008

  Chapter 2.17-Flood Hazard Overlay-This chapter contains standards for residential and non-residential construction; description of required construction materials and methods; requirements for subdivisions, manufactured homes, and utilities.
- Warrenton Stormwater Master Plan, HLB/Otak, October 2009.

  This document describes the city's watersheds and methodology for developing the stormwater management plan. The Stormwater Master Plan includes recommendations for existing facility maintenance, repairs and replacements, and a Capital Improvement Plan. The stormwater management strategy focuses on conveyance and flooding issues.
- Warrenton Transportation System Plan, Prepared by CH2M Hill and Angelo Eaton, February 2004, Amended November, 2009.
- Wastewater Master Plan, HLB & Associates, Inc. & H.R. Engineering, adopted 2009.

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

The Countywide Community Organizations and Programs table can be found in Appendix F of the Clatsop County Natural Hazards Mitigation Plan. The table highlights organizations that are active within the county and may be potential partners for implementing mitigation actions.

Existing Mitigation Activities

Existing mitigation activities include current mitigation programs and activities that are being implemented by the community in an effort to reduce the community's overall risk to natural hazards. Documenting these efforts can assist participating jurisdictions to better understand the risks and can assist in documenting successes.

Coastal Erosion

- The South Jetty at the mouth of the Columbia River is eroding and is gradually being repaired. This repair will continue for several more years before completion.
- Along the Columbia River, most of the zoning is Aquatic, and consists of three zones: A-1, A-2, A-3. The aquatic zones help to regulate land uses that contribute to, or are affected by, coastal erosion. Aquatic Development (A-1) Zone provides for navigation and water-dependent uses. Aquatic Conservation Zone (A-2) conserves designated areas for long-term uses of renewable resources that do not require major alterations of the estuary, except for the purpose of restoration. Aquatic Natural Zone (A-3) assures protection of significant fish and wildlife habitats.

Earthquake

- Buildings are constructed to current seismic standards as defined by the International Building Code. In addition, a brochure on Tsunami evacuation includes information on what to do when an earthquake occurs. This brochure is available to citizens of Warrenton and can be found in the Fire Department and the Planning and Building Department. Warrenton S.T.E.P. (Storm, Tsunami, Earthquake Preparedness) has distributed these brochures as part of an emergency disaster packet to approximately 1,200 houses.
- The New Northwest Broadcasters (NNB) Radio Station has been built to current seismic standards.

Flood

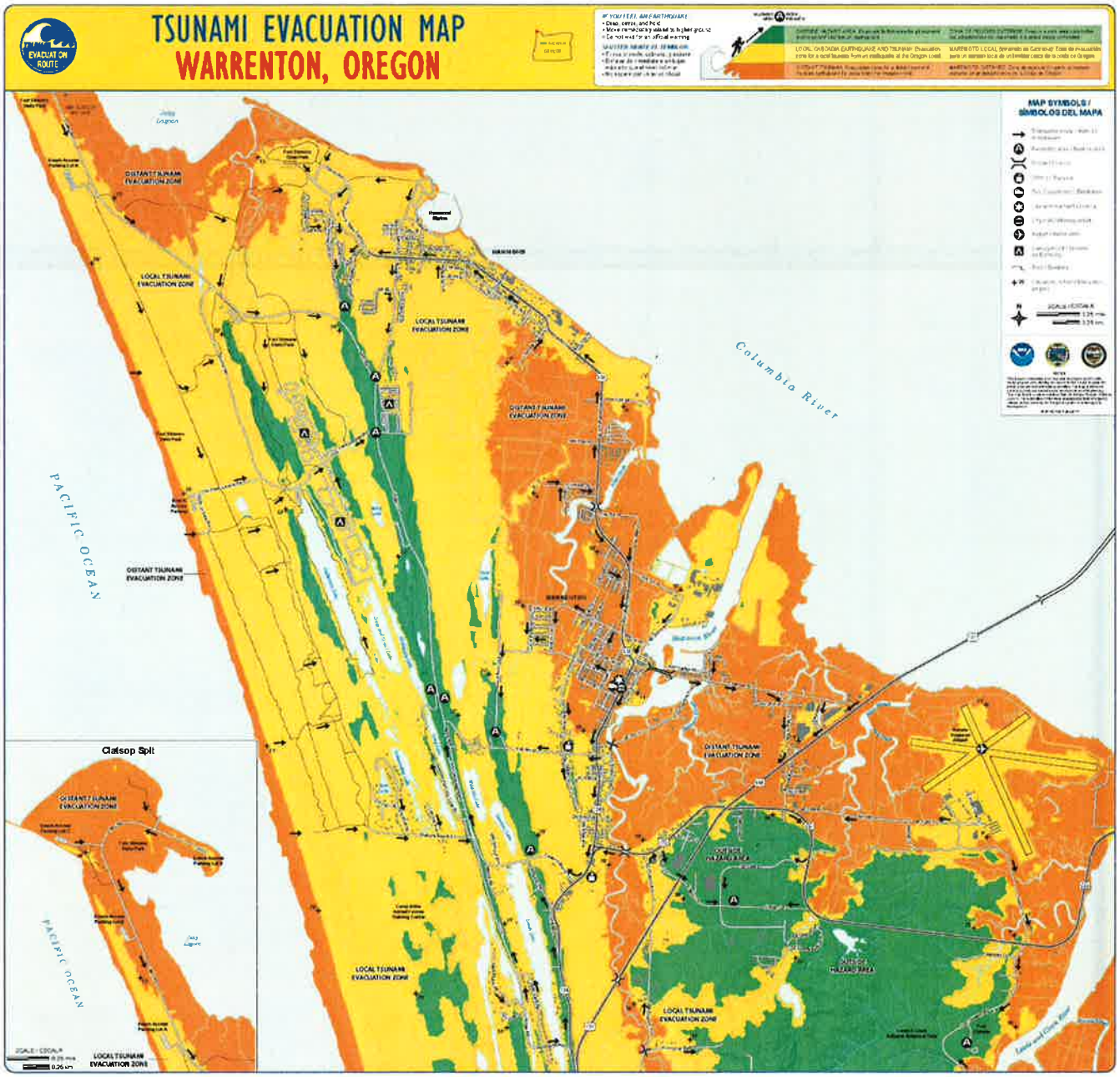
- The city of Warrenton is a member of the National Flood Insurance Program. All properties located in a flood zone are required to build to flood zone standards and to submit pre-elevation and post-elevation certificates from a certified surveyor or engineer.
- If a basement is proposed for a development in Warrenton, the construction plans must be engineered or designed to accommodate periodic high water table flooding conditions.
- A levee system with culverts and tidegates protects the city from flood waters and is maintained by the Public Works Department.
- A Wetland Ordinance has been adopted that protects wetlands and riparian corridors. This enhances the city's ability to naturally mitigate floods.

- In the early 1960s, the 8th Street Dam was built across the Skipanon River to alleviate flooding upstream during high tide. CREST is conducting a feasibility analysis for the Skipanon Water Control District for the removal of this facility and replacement with a bridge.
- In the early 1970s, two pump stations were built in downtown Warrenton to facilitate drainage during high tides in the Skipanon and Columbia Rivers. The 1st Street pump station was recently rebuilt; the other facility is scheduled to be replaced in the next year.
- Removal or fill of 50 cubic yards in waters of the state requires a permit from the Department of State Lands and the Army Corps of Engineers.
- The city repaired West Hammond Marina tidegate in 2009.

Tsunami

- A Tsunami Evacuation brochure (see Figure 5 below) with a map and an explanation on "what to know and what to do" was recently updated by the Oregon Department of Geology and Mineral Industries (DOGAMI). It represents a worst-case scenario for a tsunami caused by an undersea earthquake. This brochure is available to citizens of Warrenton at the Fire Department and the Planning and Building Department. DOGAMI hosted a series of workshops on the North Coast to make people aware of the new hazards and the evacuation routes to high ground emergency assembly areas.

Figure 5. Warrenton Tsunami Evacuation Map.



Wildfire

- The city of Warrenton is a participant in the Community Wildfire Protection Plan. This committee has met on February 25 and March 31, 2008.

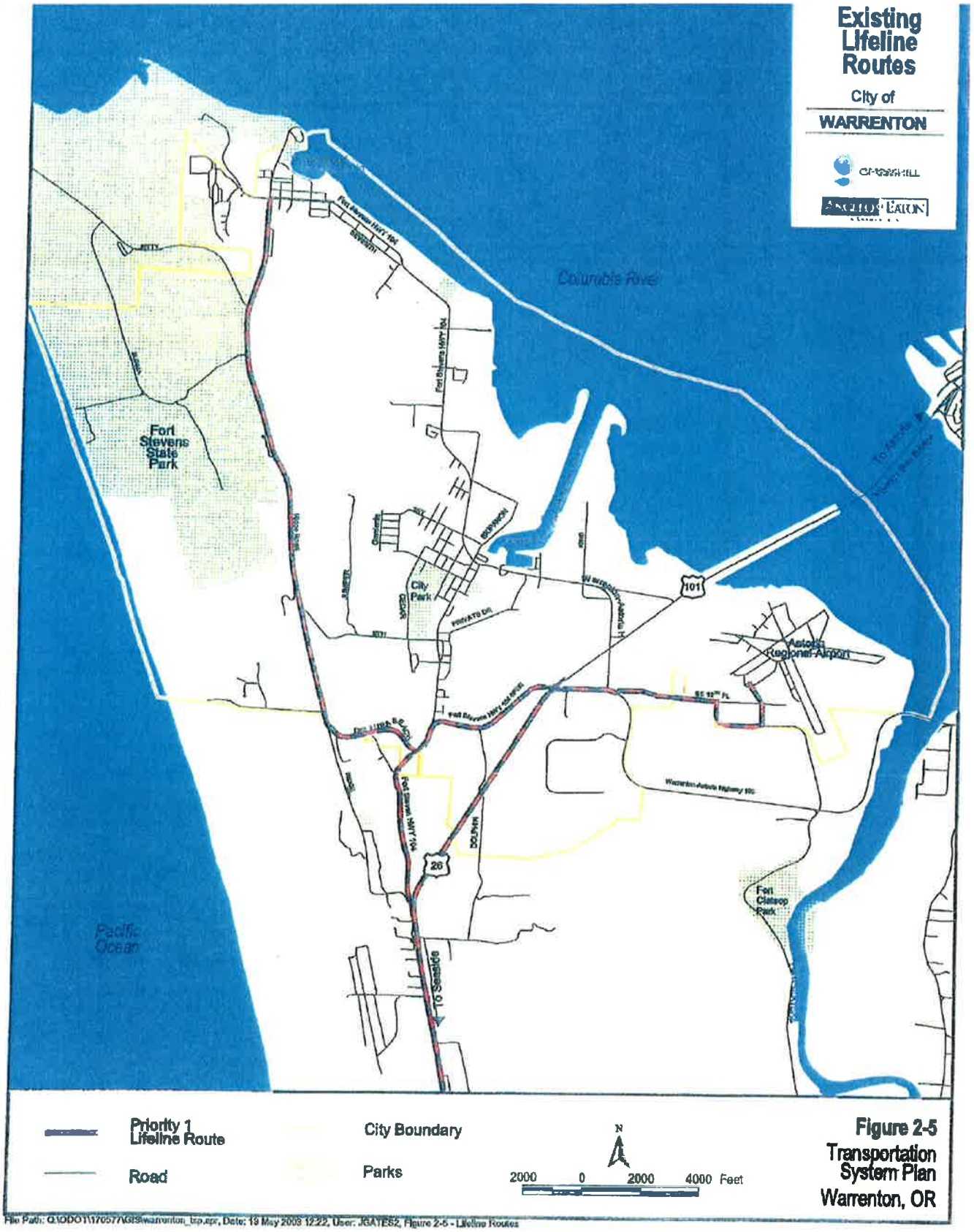
Windstorm

- The Warrenton Development Code requires subdivisions to build utilities underground.
- Qwest has moved lines to prevent the failure of communications that occurred during the Great Coastal Gale in December 2007.
- If there is a power outage and communications are lost, the waste water treatment plant has a generator and radios.
- The city has a generator to run the police and fire operations, and a portion of City Hall.
- The Public Works Department has three 50 kilowatt generators for operating the sewer pump stations during an outage.
- Trees have been cut to ensure that the water treatment plant does not sustain damage in severe windstorms and that access to the treatment plant is unimpeded.

Multi-Hazard

- The city of Warrenton has adopted the International Code Council for building codes requirements for wind, flood, earthquake, and snow.
- A Red Cross trailer with supplies is located in the public works yard.
- Warrenton has established a volunteer citizen's emergency preparedness committee.
- Warrenton contracted with the Oregon Emergency-Preparedness Outreach and hired an Outreach Coordinator.
- Warrenton launched a pilot program to help citizens become prepared for storms, tsunamis, and earthquakes (Warrenton S.T.E.P.).
- Life line routes are designated for emergency responses in the first 72 hours after an incident (see Figure 6). Warrenton's lifeline routes are:
  - US 101 south of Fort Stevens Highway 104 Spur
  - Ridge Road between Hammond and DeLaura Beach Lane
  - DeLaura Beach Lane between Ridge Road and Fort Stevens Highway 104
  - Fort Stevens Highway 104 between DeLaura Beach Lane and US 101
  - Fort Stevens Highway 104 Spur
  - SE 12th Place/Airport Road

Figure 6. Warrenton Existing Lifeline Routes.



Risk Assessment

This section expands on Clatsop County's Natural Hazards Mitigation Plan by addressing Warrenton's unique risks to the following natural hazards: coastal erosion, drought, earthquake, flood, landslide, tsunami, volcano, wildfire, and wind/winter storm. The information in this section was paired with information from the community profile during the planning process to identify issues and develop actions aimed at reducing overall risk.

The following hazard assessments describe each hazard's probability of future occurrence within Warrenton, as well as the city's overall vulnerability to each hazard. Probability and vulnerability estimates were determined based on the following definitions:

> **Probability** scores address the likelihood of a future major emergency or disaster within a specific period of time as follows:
>
> *High* = One incident likely within a 10-35 year period
> *Moderate* = One incident likely within a 35-75 year period
> *Low* = One incident likely within a 75-100 year period
>
> **Vulnerability** scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:
>
> *High* = More than 10% affected
> *Moderate* = 1-10% affected
> *Low* = Less than 1% affected

Coastal Erosion

The Coastal Erosion Hazard Annex of the Clatsop County Natural Hazards Mitigation Plan adequately describes the causes, characteristics, and history of coastal erosion in Warrenton. Warrenton is surrounded by three bodies of water whose wave actions cause erosion along the shores. The Pacific Ocean is located west of the city, the Columbia River is to the north, and Youngs Bay is to the east. Coastal erosion is primarily located along the riverbanks of the Columbia River and along the shore of the Pacific Ocean. The extent of the hazard depends largely on the local geography and weather conditions. While erosion along coastal areas may be gradual over long periods of time, storms that produce large winter waves, heavy rainfall and/or high winds may also result in very rapid erosion or other damage that can affect properties and infrastructure within a matter of hours. In fact, Warrenton's coastal beach and sand dunes west of Ridge Road are the result of 4,000 years of erosion activity. Beach and dune shorelands in Warrenton are characterized by a series of sand ridges that parallel the Pacific Ocean's shoreline, and are separated by low-lying interdune areas. These shorelands were formed over thousands of years by Columbia River sediments, off-shore currents, and local winds. Until the 1930s, a significant portion of the shorelands consisted of wind-

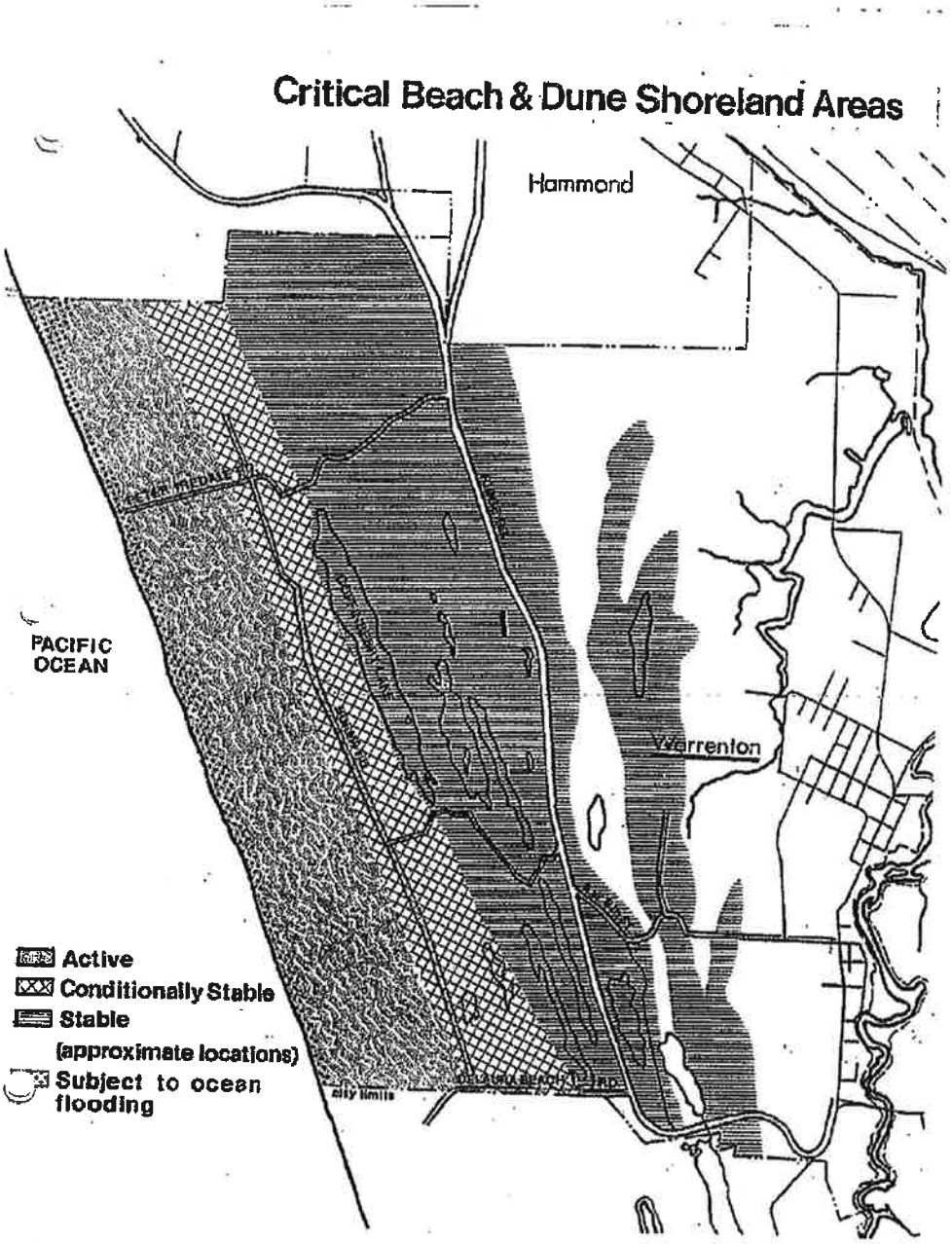
drifted sand. The dunes were then stabilized with fences and vegetation.[8] A map of the critical beach and dune shoreland areas is shown in Figure 7.

A number of natural and regulatory amenities protect Warrenton from coastal erosion. Fort Stevens State Park borders the Pacific Ocean northwest of the city and serves as a natural buffer from coastal erosion. The city of Warrenton also has a beach and dune overlay which extends from the Pacific Ocean low water line to the west of Warrenton Drive/Highway 104. The overlay regulates activities in beach, active dune, recently and older stabilized dune, and interdune areas. The intent is to protect the fragile nature of the landscape by ensuring that development is consistent with the natural capabilities of the beach and dune land forms.

The Clatsop County Mitigation Plan ranks the probability of coastal erosion, especially along sand pits, bluff coastline, and dune-backed beaches, as high. Given Warrenton's location along the Columbia River, the Pacific Ocean, and Young's Bay, Warrenton also has a high probability of experiencing coastal erosion. In addition, the Clatsop County Mitigation Plan ranks the county's vulnerability of coastal erosion as high. Warrenton's vulnerability to coastal erosion is high along the Columbia River. Developments along the river include the Desdemona Sands Subdivision, Pacific Seafood, Nygaard's Logging, Warrenton Fiber, Hammond Marina, Eben Carruthers Park, Waterfront Park, and a dike located along the Columbia River. For more information regarding the impacts of coastal erosion, please see the Coastal Erosion Annex to the Clatsop County Natural Hazards Mitigation Plan.

[8] Warrenton Comprehensive Plan, p. 121

Figure 7. Critical Beach and Dune Shoreland Areas.



From Comprehensive Plan October 2008

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Drought

The Clatsop County Natural Hazards Mitigation Plan adequately describes the causes and characteristics of droughts, as well as the location and extent of a potential drought event. Clatsop County has no record of a severe drought affecting the county, and the same is true for Warrenton. Drought is averted as a result of the area's high rainfall, especially during winter months. Clatsop County estimates a 'low' probability that drought will occur, meaning no more than one incident is likely within a 75-100 year period. Likewise, the county estimates a 'low' vulnerability to drought hazards, meaning less than 1% of the population or regional assets would be affected by a drought. Both estimates are true for Warrenton as well.

Potential drought-related community impacts are adequately described within Clatsop County Mitigation Plan's Drought Hazard Annex.

Earthquake

Clatsop County's Natural Hazards Mitigation Plan adequately describes the causes, characteristics, history, and location of earthquake hazards for the region. Warrenton's location along the Oregon coast makes it susceptible to earthquakes, especially a Cascadia Subduction Zone (CSZ) earthquake. The state has experienced seven CSZ events in the last 3,500 years - some of which were probably as large as magnitude (M)9. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1,000 years. The last CSZ event occurred approximately 300 years ago. Scientists estimate that there is a 10-20% probability that a subduction zone earthquake will occur within the next 50 years.[9] Based on this information, Clatsop County estimates a 'high' probability than an earthquake will occur in the future. This high probability estimate is true for Warrenton as well.

The extent of the earthquake hazard depends on a number of factors. These include: 1) the distance from the quake's source (or epicenter); 2) the ability of the soil and rock to conduct the quake's seismic energy; 3) the degree (i.e., angle) of slope materials; 4) the composition of slope materials; 5) the magnitude of the earthquake; and 6) the type of earthquake. Figures 8 to 11, developed by the Department of Geology and Mineral Industries (DOGAMI), further illustrate the extent and location of the earthquake hazard, and show the amplification, liquefaction, earthquake induced landslide, and relative earthquake hazards for Warrenton and Astoria.

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[9] Geologic Hazards on the Oregon Coast. Oregon Department of Geology and Mineral Industries.
http://www.oregongeology.com/sub/earthquakes/Coastal/OrGeoEqNTsu.htm

Figure 8. Relative Earthquake Amplification Map.

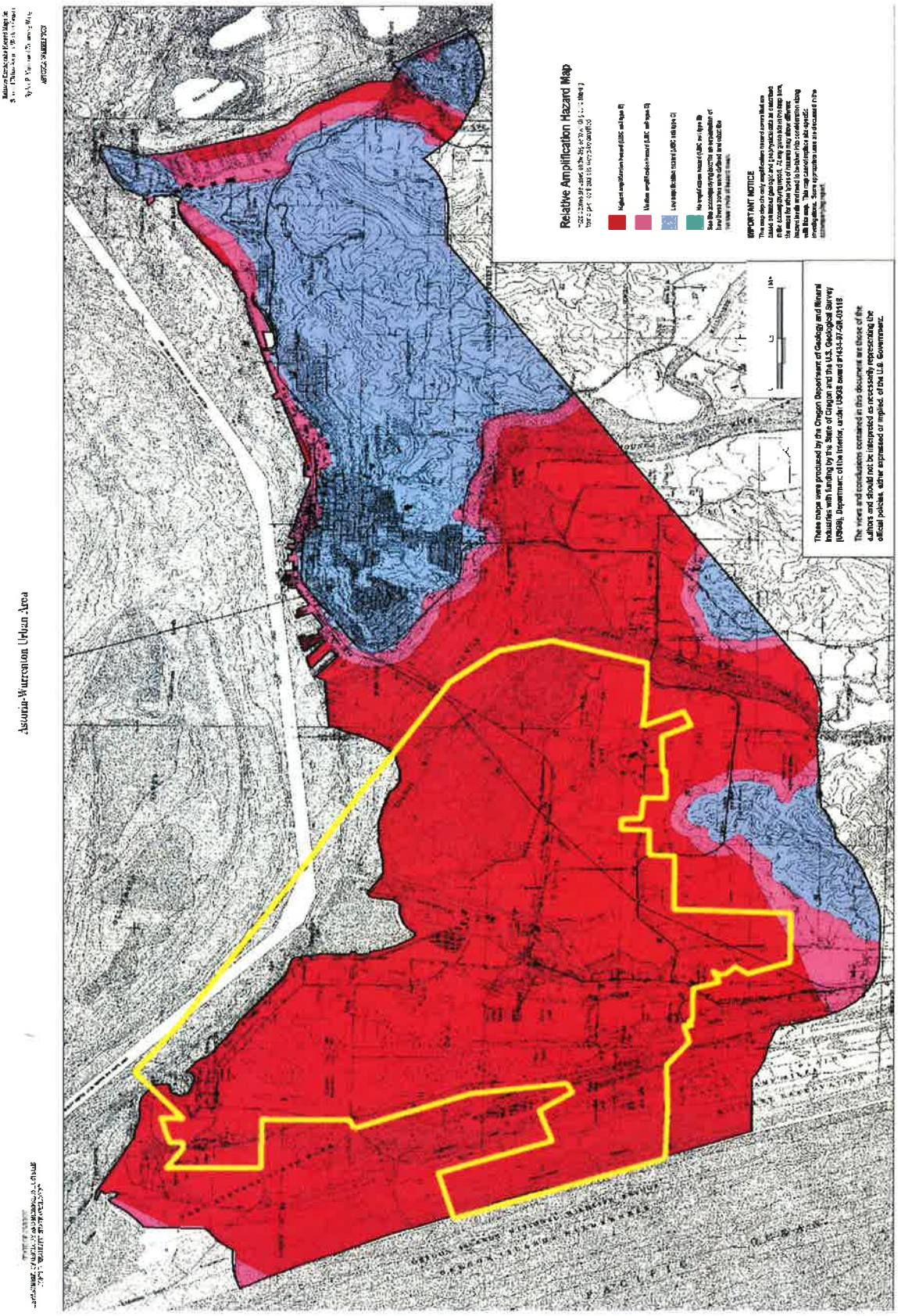


Figure 9. Relative Earthquake Liquefaction map.

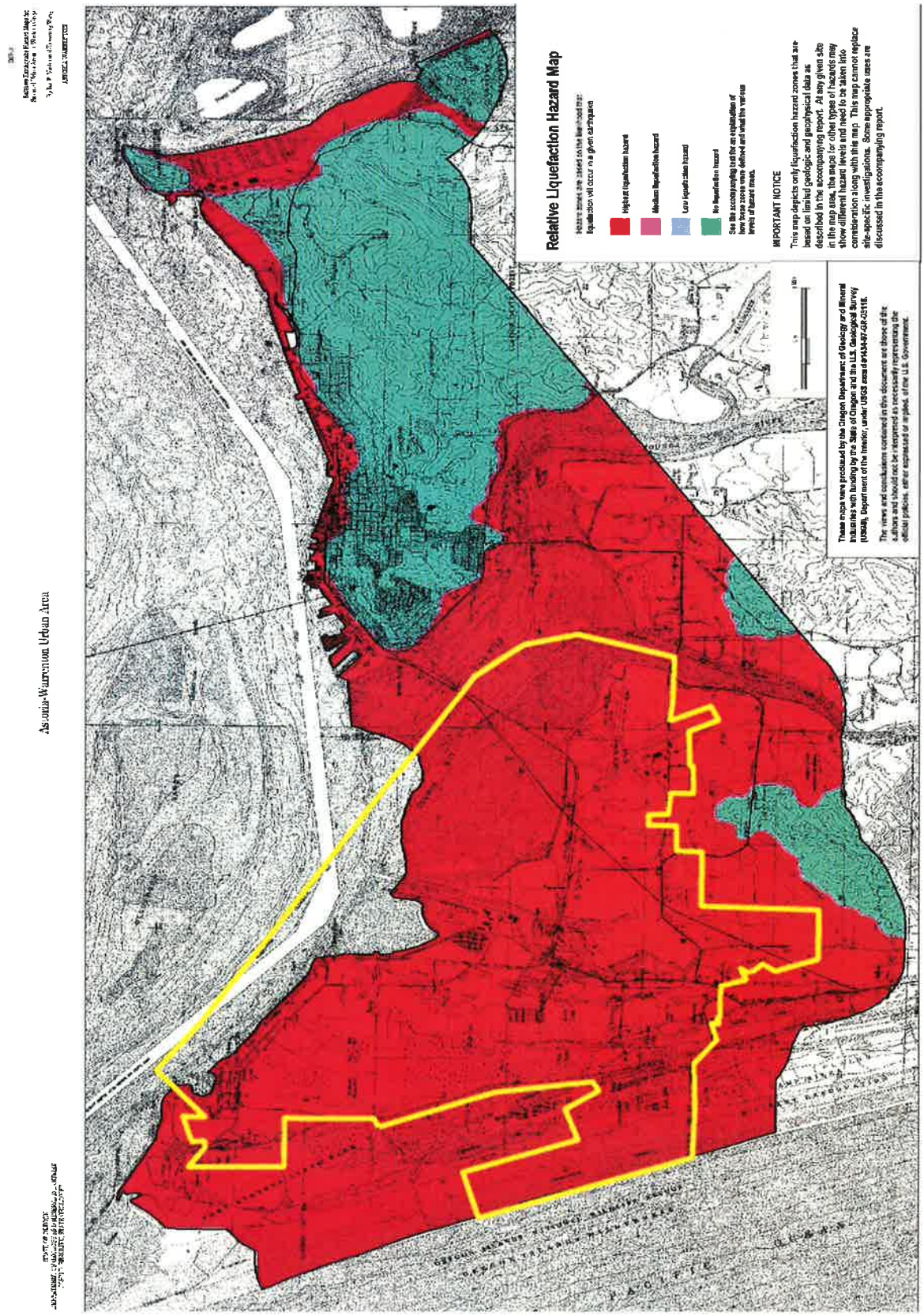


Figure 10. Relative Earthquake-Induced Landslide Hazard Map.

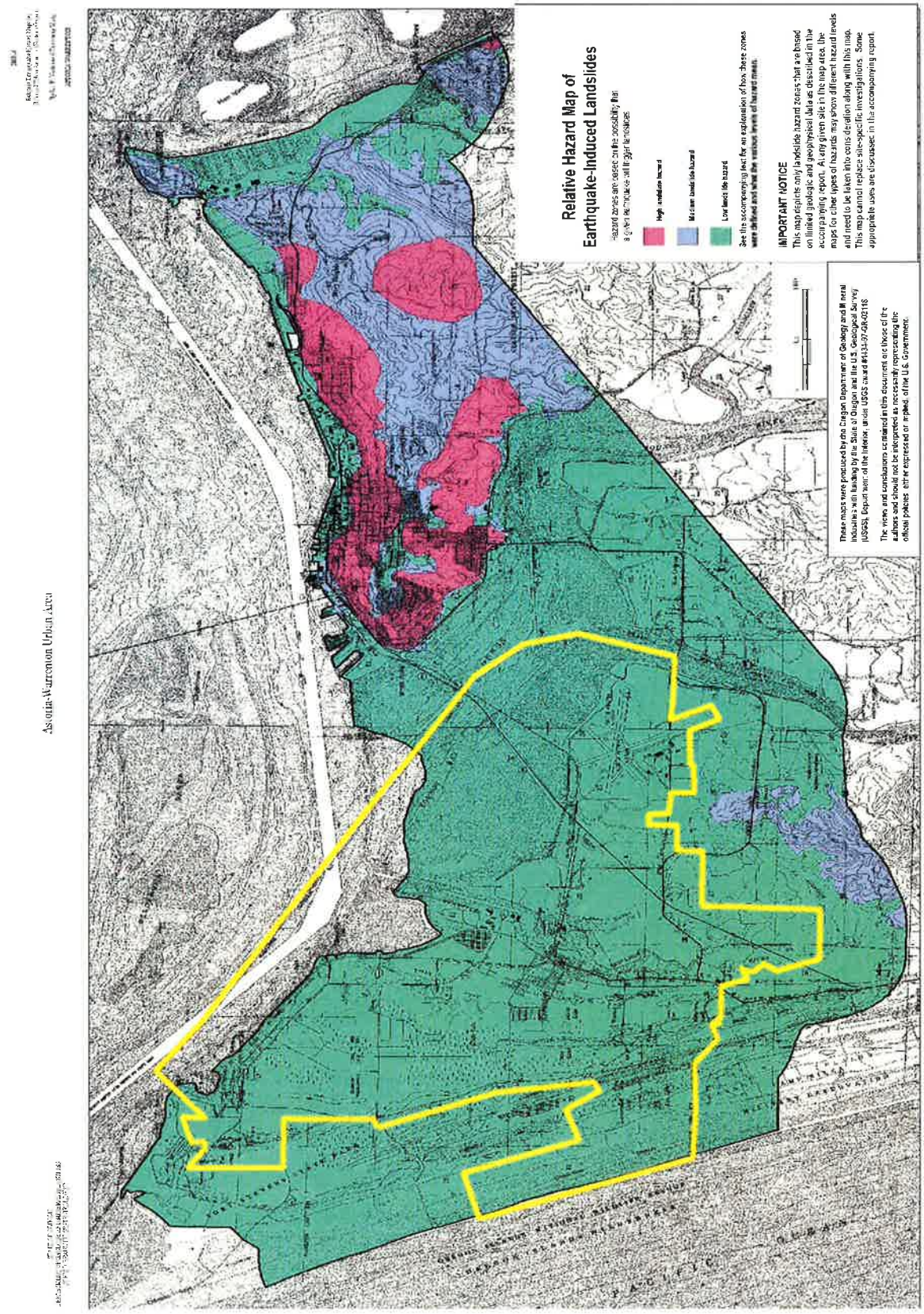
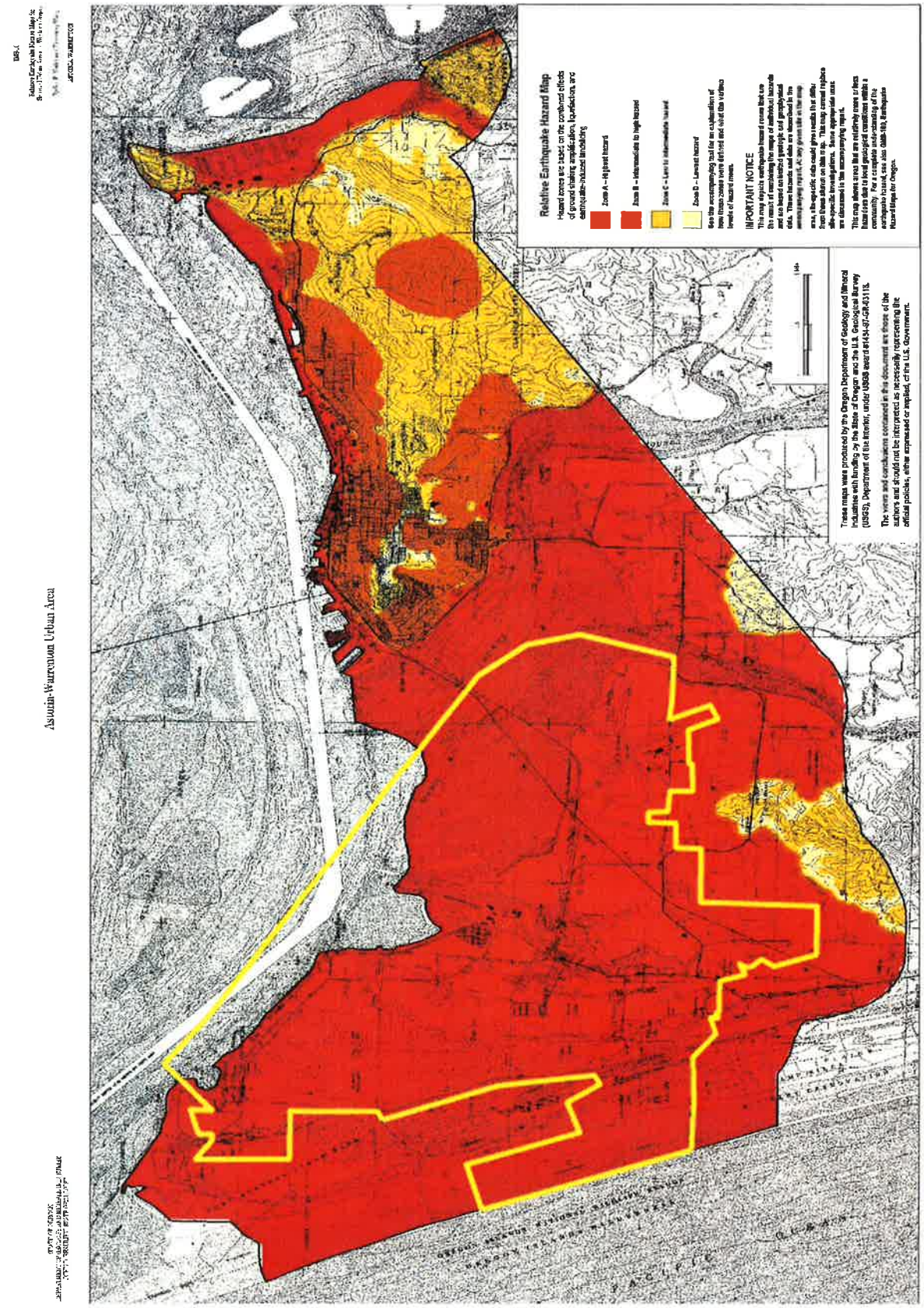


Figure 11. Relative Earthquake Hazard Map.



Clatsop County estimates a 'high' vulnerability to earthquake hazards, meaning more than 10% of the population or regional assets would be affected by a major emergency or disaster. As shown by the figures above, Warrenton has a very high risk of experiencing amplification and liquefaction. All of Warrenton's developed lands are located in Zone A—the highest hazard area for earthquakes. Additionally, as described in Table 7, about 57% of the city's housing stock was built prior to 1980, before stronger seismic building codes were put into place. The combination of these hazards makes Warrenton highly vulnerable to high magnitude earthquake events.

In 2007, DOGAMI completed a seismic needs assessment for public school buildings, acute inpatient care facilities, fire and police stations, sheriffs' offices, and other law enforcement agency buildings. Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. Within Warrenton, the Warrenton High School was given a 'high' collapse potential. No buildings in Warrenton were assigned the 'very high' rating.

The city's infrastructure is also highly vulnerable to a severe earthquake event which could have significant impacts within the city. The city is served by water through an 18 inch water main 8 miles to the south of Warrenton. Any disruption of this line could stop water flows and could lead to water contamination. In addition, if the dike along the waste water treatment plant is breached, sewage could be discharged into the Columbia River. Other vulnerable assets in Warrenton include sewer lines going to the sewage treatment plant, power lines, water tanks, and cell towers.

The city would also expect significant damage to roads and bridges following a Cascadia Subduction Zone event, as well as deaths and severe injuries region-wide. Earthquake damage to the New Young's Bay Bridge on Highway 101 would isolate the community from Astoria, and damage to the Skipanon Bridge and Alder Bridge could limit access to parts of Warrenton. Additional community impacts are described within the Clatsop County Mitigation Plan Earthquake Hazard Annex.

Flood

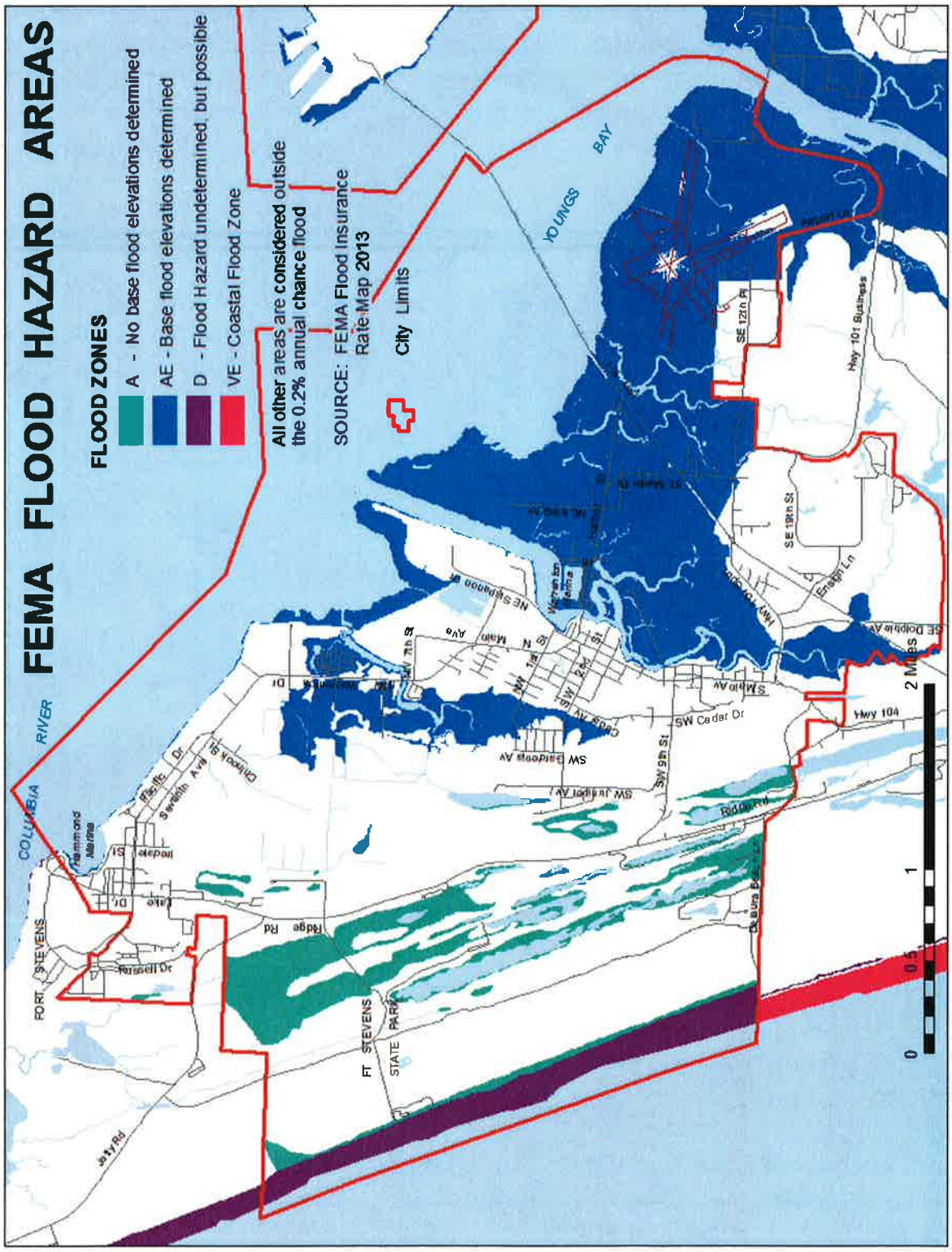
The Flood Annex of the Clatsop County Natural Hazards Mitigation Plan adequately describes the causes and characteristics of the flood hazard in Warrenton. Warrenton is at risk of flooding from two primary sources: riverine flooding and ocean flooding. Riverine flooding could occur during periods of heavy rainfall that may cause the streams that drain areas south of Warrenton, such as the Skipanon River, Alder Creek, and the Lewis and Clark River, to overflow their banks. In addition, parts of the city are vulnerable to flooding from the Columbia River and Youngs Bay which define the north and eastern boundary of the city. Warrenton is protected from the Columbia River and Youngs Bay by existing levees.

Ocean flooding results from exceptionally high tides or tsunamis. On some occasions, high tides and riverine flooding can combine to produce flooding in Warrenton. Warrenton is particularly vulnerable to high tides due to the city's flat

terrain and low elevation. Warrenton is protected from the Columbia River and Youngs Bay by existing levees. The Clatsop County Natural Hazards Mitigation Plan adequately describes the history of flooding that has occurred in Clatsop County and in Warrenton.

The location of Warrenton's flood hazard is best described with the city's 100-year Flood Insurance Rate Maps (FIRMs), which have been digitized into the city's GIS system and are shown below in Figure 12

Figure 12. Warrenton/Hammond Floodplain



Warrenton has been a participant in the National Flood Insurance Program (NFIP) since 1978. The FIRMs for Warrenton are current as of September 17, 2010.
As of April 30, 2009, there are a total of 177 national flood insurance policy holders in the city, with a total of $40,412,900 in coverage. In addition, there have been a total of three losses in Warrenton between 1978 and April 30, 2009. Two of those losses closed with a total payment of $11,478.15, and one loss closed without payment. There have been no repetitive flood losses within Warrenton. A total of 16 letter of map changes have occurred, and Warrenton's last Community Assistance Visit (CAV) occurred on April 25, 2000. Warrenton is not a participant in the Community Rating System (CRS).

As shown in the figures above, large portions of the city are in the 100-year floodplain (Zone A), but the majority of Warrenton's built environment is out of the floodplain (Zone X). This includes downtown Warrenton, the Hammond area, the Astoria-Warrenton Airport, and a new 690 unit subdivision, called Forest Rim, currently being built in the southeastern section of the city. These areas are further protected by an 11 miles system of dikes. Built areas located in the flood zone are the Premarq Center, Walgreens shopping center on Highway 101, and businesses along Harbor Drive and Marlin Avenue. Access roads leading to the airport are also in the floodplain (Zone A2).

Warrenton is protected from floods by a flood control system comprised of dikes, ditches, storm pipes, pump stations, and culvert crossings with tidegates. Through passive conveyance or pump stations, this system is designed to move river and stormwater out of several sub-basins within the city, while also preventing flooding from the Columbia River during high tides. Major sub-basins within the city include the East Hammond and Enterprise Ditch sub-basins that drain almost 600 acres in the Hammond area; the west Hammond sub-basin which drains approximately 316 acres; and two downtown sub-basins which drain 94 acres and 186 acres each. Much of the city's conveyance system is comprised of open channel ditches that move water out of the city. Pump stations on NE 1st Street and SE 3rd/4th Street drain water out of the downtown area. Twenty-three tide gates located throughout the city regulate the flow of water, allowing storm and river water to flow out, while preventing water from high tides to enter. The majority of the city's tidegates are older structures made of cast iron and doors hinged at the top (see figure 18), while newer tidegates are concrete box culverts or corrugated metal pipes. This flood control system is maintained by the city, but regulated by the Army Corps of Engineers who review the dikes every year for the city.

Figure 18. Galena Road Tidegate

Source: Skipanon River Watershed Council.

The extent of the flooding hazard in Warrenton primarily depends on precipitation levels, tidal fluctuations, and the strength of the city's storm levee system. Heavy storms combined with high tides could lead to more flooding events in Warrenton especially if a portion of the levee system malfunctions.

The Clatsop County Natural Hazards Mitigation Plan ranks the probability of flooding in Clatsop County as high. However, Warrenton ranks the flooding hazard as moderate because the levee system protects the city to a higher level than the rest of the county.

The Clatsop County Mitigation Plan ranks the vulnerability of flooding in the county as moderate, and this ranking applies to Warrenton as well. While Warrenton's levee system has never been breached, the culverts and tidegates included in the system are vulnerable to failure. If the levees are breached, Warrenton's flat topography and soils can facilitate widespread flooding in the city. In addition, if there is a power failure, the sewer pump stations may fail and sewage could be washed out from the wastewater treatment plant and cause contamination in the area. Warrenton's stormwater conveyance system also has little or no slope, resulting in ponding and localized flooding.

The Warrenton's Stormwater Management Plan identified several issues in its flood control system that makes it vulnerable to flooding (listed below). All of these issues are addressed in Warrenton's Stormwater Management Plan as separate action items.

- Many of the older cast iron tidegates have corroded. A 1999 survey by the Skipanon River Watershed Council showed that 6 of the 23 tidegates were in need of repair.
- The pump station on SE 3rd/4th Street is vulnerable because if a storm event occurs, a power outage would make the station inoperable. This

station was installed in 1975 and drains an area of 186 acres including most of downtown.

- The west Hammond sub-basin flood system is near capacity and is undersized to handle an increase in flows. The system needs larger culverts and the ditches need to be cleaned and re-graded to increase the slope.

- The Enterprise Ditch tidegate suffers from frequent sedimentation. Many of the conveyance channels that drain to these tidegates are choked with vegetation and sediments prevent areas from draining properly. A single pump station could be constructed to benefit both sub-basins. As a result of these impediments, ponding occurs along Pacific Drive between King Salmon Street and Iredale Drive near the intersection of 7th Avenue and Hecta Avenue and along Pacific Drive in the vicinity of Chinook Street.

- The East Hammond sub-basin tidegate is corroded and needs replacing. The tidegate on the eastern side of the Hammond Marina drains approximately 147 acres that includes a portion of Hammond and some undeveloped areas west of Ridge Road. In 2007, the corroded culvert, 1,000 feet in length with at least one bend, was temporarily repaired, but it needs to be replaced to eliminate unwanted bi-directional flows during high tide.

Finally, Warrenton's bridges provide critical links in the city's transportation system. New Young's Bay Bridge on Highway 101 is a major route for the north. Evacuation of people or deliveries of supplies will be limited if the New Young's Bay Bridge is not operational. Other bridges in Warrenton include the Skipanon Bridge and Alder Bridge. If either flooded this could preclude access of people and supplies as well.

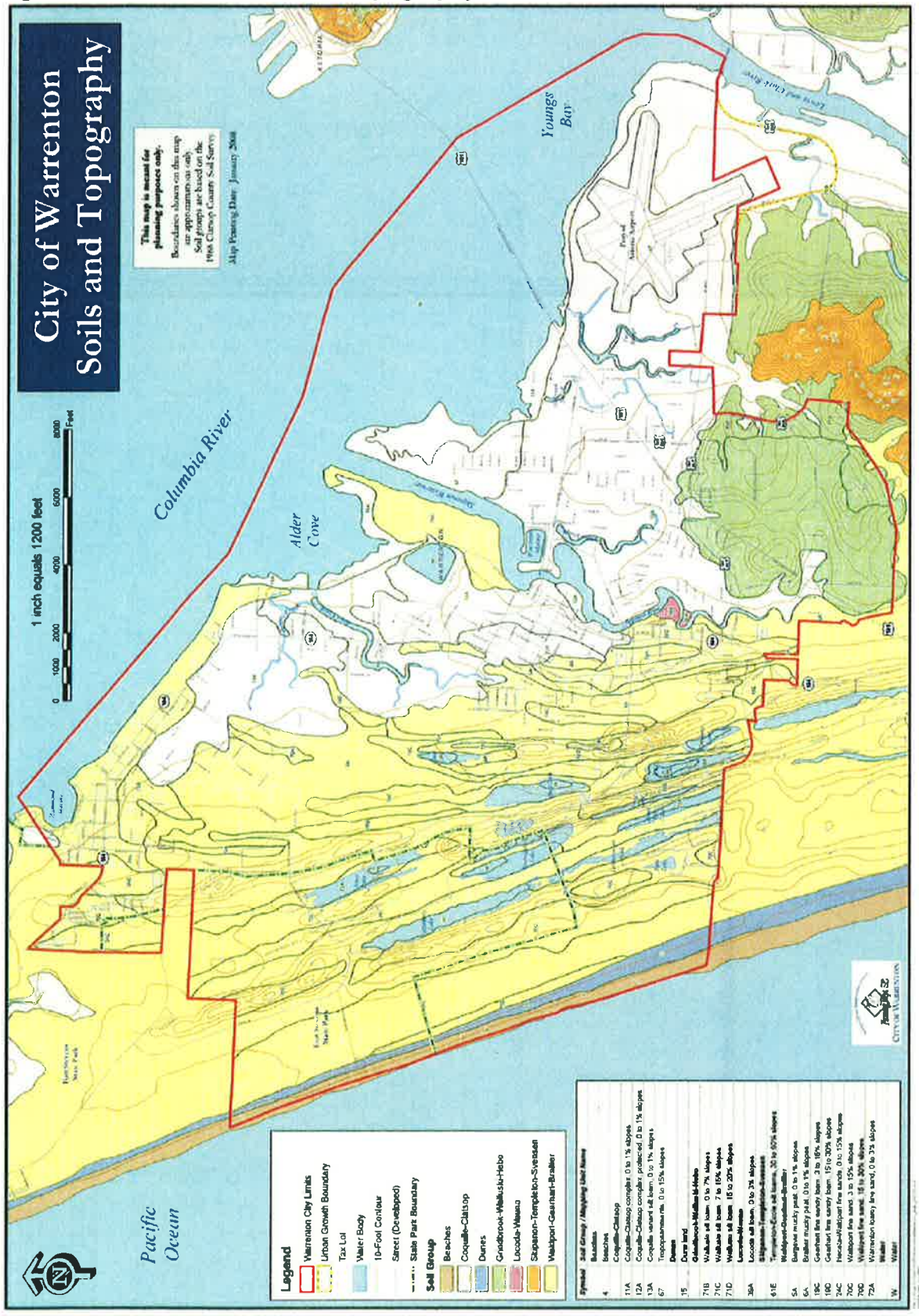
Landslide

The Landslide Annex in the Clatsop County Natural Hazards Mitigation Plan adequately describes the causes and characteristics of the landslide hazard in Warrenton. The Landslide Annex also adequately describes the history of landslide events in the county, and no landslides have occurred in Warrenton.

Warrenton's topography is generally flat, with sand dunes being the highest topographical feature. As such, the city does not have any areas that are vulnerable to landslides. As shown in Figure 19, Warrenton's likelihood of experiencing an earthquake-induced landslide is none to very low. As such, the city does not consider the hazard to be a threat and therefore, the vulnerability and probability of landslides in Warrenton both rank as low. This is in contrast to the county, which ranks the probability to landslides as high and the vulnerability as moderate.

While landslides are not a particular concern for Warrenton, there are landslide hazard areas in Clatsop County that can impact the city. During the December 2007 windstorm, a landslide in Woodson on the border of Clatsop and Columbia Counties blocked off Highway 30, one of two primary state highways in Clatsop County connecting the region with the Willamette Valley. In addition, areas along Highway 26 are vulnerable to landslides. Landslide events that block highway access to the Willamette Valley can disrupt the transport of goods and services to Warrenton and can impact the city's economy.

Figure 19. Warrenton Soils and Topography



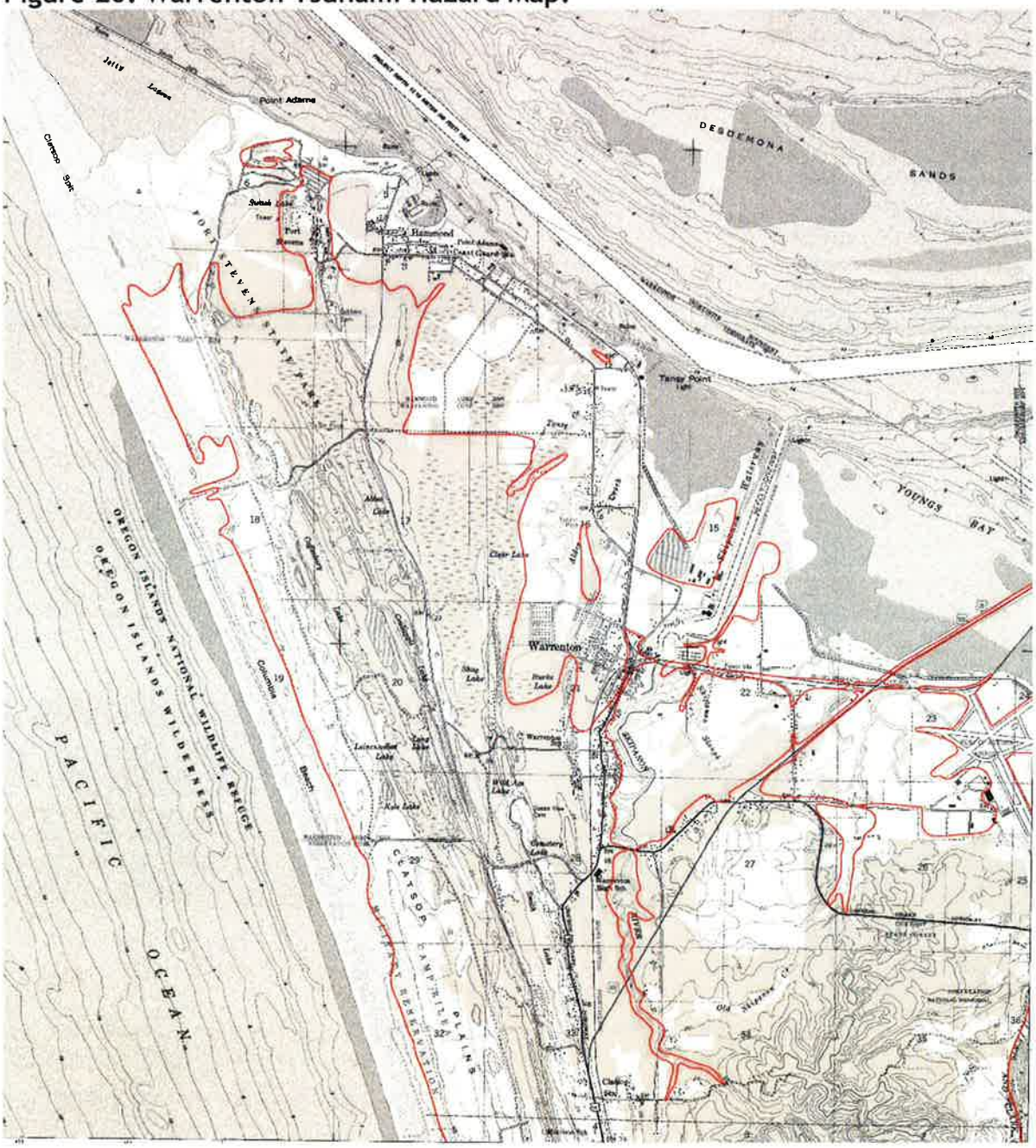
Tsunami

The Tsunami Annex in the Clatsop County Natural Hazards Mitigation Plan adequately describes the causes and characteristics of the tsunami hazard along the Oregon coast. In most cases, tsunamis are induced hazards created by events occurring under the ocean. A tsunami, often incorrectly referred to as a "tidal wave," is a series of waves that can travel great distances from the earthquake's origin and can cause serious flooding and damage to coastal communities. Tsunamis can be generated from local or distant earthquake events. While tsunami events in Oregon are rare, past events have been destructive along the Oregon coast. The most recent event occurred in 1964 and caused widespread damage in Oregon coastal communities. The history of the tsunami hazard is further described in the Tsunami Annex of the Clatsop County Mitigation Plan.

In 1995, The Department of Geology and Mineral Industries (DOGAMI) conducted an analysis resulting in extensive mapping along the Oregon coast. The maps depict the expected inundation for tsunamis produced by a magnitude 8.8 to 8.9 undersea earthquake. The tsunami maps were produced to help implement Senate Bill 379 (SB 379), which was passed during the 1995 regular session of the Oregon Legislature. SB 379, implemented as Oregon Revised Statutes (ORS) 455.446 and 455.447, and Oregon Administrative Rules (OAR) 632-005, limit construction of new essential facilities and special occupancy structures in tsunami flooding zones. The general location of the tsunami hazard in Warrenton for a large earthquake event is shown in DOGAMI's tsunami inundation map in Figure 20 below.[10]

[10] Note: the tsunami inundation line presented here is a composite line based on an averaging of earthquake and tsunami scenarios using best available data. The line is not fixed nor should the reader assume it represents a worst case scenario; rather it is meant to show areas most vulnerable to the tsunami hazard.

Figure 20. Warrenton Tsunami Hazard Map.



As shown in Figure 20, a tsunami could reach Fort Stevens Park northwest of the city, downtown Warrenton, all of the Hammond area, and the Skipanon River. The extent of a tsunami event in Warrenton will depend on where the tsunami originated and the size of the earthquake that produced the tsunami.

The Tsunami Annex in the Clatsop County Natural Hazards Mitigation Plan ranks the probability of a tsunami event as moderate. This rating is accurate for Warrenton as well. Geologists predict a 10-14% chance that a Cascadia tsunami

will be triggered by a shallow, undersea earthquake offshore Oregon in the next 50 years. The forecast comes from evidence for large but infrequent earthquakes and tsunamis that have occurred on the Oregon coast every 500 years, on average.[11]

The county estimates a 'high' vulnerability to tsunami hazards, which indicates that at least 10% of the county's population and regional assets are likely to be affected by a tsunami event. This rating appropriately describes Warrenton's vulnerability as well. A U.S. Geological Survey report written in 2007 found that Warrenton ranks as the third most vulnerable Oregon coastal city to tsunami hazards, behind Seaside and Gearhart.[12] Approximately 50% of Warrenton's developed land is within the mapped tsunami inundation zone, which includes 2,500 people (over 60% of Warrenton's population) and approximately 1,750 employees.[13] A large part of Fort Stevens Park, a popular tourist and camping destination that attracts over 900,000 visitors annually, is also in the tsunami inundation zone. Economic assets vulnerable to a tsunami include the Warrenton Fiber and Point Adams Packing Company located along the Columbia River, and Weyerhaeuser and the city's two shopping centers which are located along the Skipanon River and its sloughs. Finally important facilities such as the Warrenton Civic Center—which houses the City Hall, Police, and Fire Departments—the Public Works Department, and the Warrenton High School are located in the inundation zone as well. Additional potential tsunami-related impacts are adequately described in the Tsunami Hazard Annex in the Clatsop County Natural Hazards Mitigation Plan.

Volcano

The Clatsop County Natural Hazard Mitigation Plan adequately describes Warrenton's risk to volcanic events. Generally, an event that affects the county is likely to affect Warrenton as well. The causes and characteristics of a volcanic event are appropriately described within the Clatsop County Mitigation Plan, as well as the location and extent of potential hazards. Previous occurrences are well-documented within the Clatsop County Mitigation Plan, and the community impacts described by the county would generally be the same for Warrenton as well. Warrenton is very unlikely to experience anything more than a small amount of volcanic ash during a volcanic event. The county estimates a 'low' probability of future volcanic events and a 'low' vulnerability to future eruptions. The county's probability and vulnerability estimates are accurate of Warrenton's as well.

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[11] Oregon Geology Fact Sheet, Tsunami Hazards in Oregon. Department of Geology and Mineral Industries. http://www.oregongeology.com/sub/publications/tsunami-factsheet_onscreen.pdf

[12] Nathan Wood, Variations in City Exposure and Sensitivity to Tsunami Hazards in Oregon, USGS, Scientific Investigations Report 2007-5283.

[13] Ibid., 10, 13, 17.

Wildfire

The Wildfire Annex in the Clatsop County Natural Hazards Mitigation Plan adequately describes the causes, characteristics, and history of the wildfire hazard in Clatsop County and Warrenton. Warrenton has no recorded history of wildfire, and the county's recent wildfires are mostly related to debris burns. However, the potential for large wildfires does exist in Clatsop County as evidenced by a 1939 wildfire that burned 207,000 acres near Saddle Mountain. Clatsop County and its cities are currently developing a county-wide Community Wildfire Protection Plan (CWPP) which will become part of the Clatsop County Natural Hazards Mitigation Plan when it is completed. Warrenton is participating in this effort as well.

Clatsop County estimates a high probability that wildfires will occur in the future. Most wildfires can be linked to human carelessness. This rating is true for Warrenton as well.

Clatsop County estimates a moderate vulnerability to wildfire events, meaning 1-10% of the population or regional assets are likely to be affected by a major event. Damaging wildfires are most likely to occur in wildland-urban interface areas where wildland fuels are adjacent to urban or residential structures. While Warrenton is not identified as an interface community in the Clatsop County Natural Hazards Mitigation Plan, the Warrenton Fire Department considers Warrenton an interface community, and therefore considers Warrenton's vulnerability to wildfires as high. The wildland-urban interface boundaries are located in forested areas along Ridge Road, DeLaura Beach Road, the Skipanon River between Alternate 104 and Harbor Drive, and Alternate 101 along the Forest Rim Subdivision where 690 units are to be built in three phases. The natural mitigation factor is the maritime climate which reduces the rate at which vegetation dries during the summer months. The extent of the wildfire hazard largely depends on climatic conditions such as winds and precipitation, and the availability of fuels in the path of the wildfire. Potential wildfire-related impacts are adequately described in Clatsop County Mitigation Plan's Wildfire Hazard Annex.

Windstorm/Winter Storm

The Clatsop County Natural Hazards Mitigation Plan adequately describes the causes and characteristics of wind and winter storms, as well as the location and extent of wind and winter storm hazards. Coastal wind storms typically occur during winter months, and they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow. Typically, however, the Oregon coast's winters are windy, cold, and wet.

The region's (and Warrenton's) history of events are adequately described within the Clatsop County Mitigation Plan as well. Notable events that occurred in

Warrenton include the December 1995 wind storm that incurred damages to the sewer lift station, pump motors, pilings and docks, and the city's water chlorination building. Debris accumulated behind dams and docks and pump motors had to be replaced.[14] In a December 2007 wind storm, trees blocked access to the Water Treatment Plant and power lines and phone lines were blown down. In December 2008, the city experienced 6 inches of snow at sea level and several days below freezing. This caused roads to become impassible, curtailing travel and delivery of food and other essential items.

The county estimates a high probability that wind and winter storms will occur in the future. Windstorms occur yearly, and the more destructive storms occur once or twice per decade. The county additionally estimates a high vulnerability to windstorms, meaning more than 10% of the population or regional assets would be affected by a major windstorm event. Both estimates are true for Warrenton as well. Potential wind/winter storm impacts are adequately described in the Wind and Winter Storm Annex of the Clatsop County Natural Hazards Mitigation Plan.

[14] Public Works File on FEMA 1995

Mission, Goals, and Action Items

The city of Warrenton adopts the mission and goals found in the Clatsop County Natural Hazards Mitigation Plan for the Warrenton Plan Addendum. In addition, the Warrenton Addendum includes 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. Implementing the addendum's action items through existing plans and policies increases their likelihood of being supported and getting updated, and maximizes the city's resources.

Short and long-term action items identified through the planning process are an important part of the mitigation plan. Action items are detailed recommendations for activities that local departments, citizens and others could engage in to reduce risk.

Earthquake

1. Coordinate with the Warrenton-Hammond School District to seek funding to assess and seismically retrofit the Warrenton High School.

Flood

1. Continue regular maintenance of dikes/levees and seek their accreditation.
2. Implement the Stormwater Management Plan action items relating to the flooding and stormwater issues in Warrenton.
3. Develop a plan if the bridges in Warrenton collapse.
4. Develop a plan to minimize possible flooding of Alder Creek.

Tsunami

1. Move City Hall which contains the Police, Fire, and Public Works Department out of the tsunami inundation zone.
2. Relocate the high school to higher ground out of the tsunami inundation zone.

Wildfire

1. Apply for wildfire grants to implement action items in the Community Wildfire Protection Plan, now being developed, as they pertain to the city of Warrenton.
2. Upgrade the size of and loop water lines to improve firefighting capabilities.

Winter Storm/Wind Storm

1. Develop a plan for removal of trees.
2. Place existing utilities underground to avoid damage in wind/winter storm events.

Multi-Hazard

1. Develop educational outreach materials for all of Warrenton's natural hazards.
2. Establish and furnish the Community Center as an emergency shelter and develop a list of additional community shelters such as churches or schools.
3. Establish a list of vulnerable persons that need to be monitored during and after a disaster to ensure their safety.
4. Identify areas/facilities to establish a temporary medical facility after a disaster occurs.
5. Establish a partnership with Sunset Empire Transportation to help people seek shelter, obtain supplies, or travel for other needs after a natural disaster.
6. Develop a public notification system.
7. Conduct an inventory of generators and fuel supplies for use in an emergency.

   Note: Warrenton does not believe that implementing landslide or volcano-related mitigation activities will be cost-effective at this time. As such, the city has not identified landslide or volcanic-related mitigation action items. Warrenton will partner with Clatsop County, however, on the implementation of mitigation strategies that benefit both jurisdictions.

See the full list of action item forms at the end of this plan for more detailed information regarding implementation.

Plan Implementation & Maintenance

The city will utilize the same prioritization and plan maintenance process as identified in the Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan [See Section 4: Plan Implementation and Maintenance and Appendix D: Economic Analysis of Natural Hazard Mitigation Projects of the Clatsop County Mitigation Plan].

A representative from the Warrenton Planning Department will serve as the convener for the Warrenton's Natural Hazards Mitigation Plan Addendum. The convener will participate in all Clatsop County plan maintenance meetings which happen on a semi-annual basis as outlined in the Clatsop County Natural Hazards Mitigation Plan. In addition, the convener will be responsible for maintaining Warrenton's Addendum and convening a plan committee on an annual basis to identify new risk assessment information, review the status of mitigation actions, identify new actions, and seek funding to implement mitigation activities. Additionally, the city of Warrenton currently addresses statewide planning goals and legislative requirements through its Comprehensive Plan, Development Code, Transportation System Plan, and Wastewater Master Plan. To the extent possible, Warrenton will work to incorporate the recommended mitigation action items into these existing plans, programs and policies. Implementing the addendum's actions items through existing plans, programs and policies increases the likelihood that actions will be supported and implemented. Where possible, opportunities for cross-plan implementation are noted in the full action item worksheets below.

The city of Warrenton's Addendum will be updated every five years in conjunction with the Clatsop County Mitigation Plan's update schedule. Finally, Warrenton will coordinate continued public involvement activities with the activities listed in the Clatsop County Multi-Jurisdiction Natural Hazards Mitigation Plan.

Appendix A:
Action Item Proposal Forms

Warrenton Action Items

Earthquake # 1

Proposed Action Item:	Alignment with Plan Goals
Construct a $3.5 million gallon water tank to provide an emergency water supply.	Protect Life Minimize Damage to public and private buildings and infrastructure Decrease disruption to critical services

Rationale for Proposed Action Item:

The city of Warrenton relies on an 18 inch water main 8 miles south of the city for its water supply. The water main is not seismically stable, and travels through soils that are vulnerable to earthquake liquefaction and amplification. As such, seismically retrofitting the water main may be difficult. Constructing a $3.5 million gallon water tank will provide another source of water in case the 18 inch water main 8 miles to the south of Warrenton is disrupted

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Constructing a $3.5 million gallon water tank will provide Warrenton with a reliable water supply in the event of an earthquake and make the community more resilient to earthquake hazards.

Ideas for Implementation:

Incorporate construction of a water tank into Warrenton's Capital Improvements Plan.

Seek funding sources for constructing a water tank.

Combine construction of the water tank with seismic improvements to Warrenton's water main where possible.

Coordinating Organization:	Warrenton Public Works
Internal Partners:	**External Partners:**
Planning Department	Clatsop County, FEMA, OEM
Timeline:	**If available, estimated cost:**
Short Term (0-2 years) / Long Term (2-4 or more years)	
Long Term	
Form Submitted by:	City of Warrenton
Action Item Status	Completed

Earthquake # 2

Proposed Action Item:	Alignment with Plan Goals
Coordinate with the Warrenton-Hammond School District to seek funding to assess and seismically retrofit the Warrenton High School.	Protect Life Minimize Damage to public and private buildings and infrastructure Decrease disruption to critical services

Rationale for Proposed Action Item:

In 2007, the Department of Geology and Mineral Industries (DOGAMI) conducted a seismic needs assessment for public school buildings, acute inpatient care facilities, fire stations, police stations, sheriffs' offices, and other law enforcement agency buildings.[15] Buildings were ranked for the "probability of collapse" due to the maximum possible earthquake for any given area. Within the city of Warrenton, the Warrenton High School received a high probability of collapse rating. Further assessing Warrenton's "probability of collapse" and conducting seismic retrofits will reduce the building's vulnerability by preventing damage to life and property.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Assessing the "probability of collapse" for Warrenton High School and seismically retrofitting it will reduce its vulnerability by preventing damage to life and property.

Ideas for Implementation:

Further assess those buildings rated at a "high" risk of collapse. Prioritize any actions that need to be taken to address any seismic concerns and coordinate with Warrenton-Hammond School District and OEM seismic grants coordinator to find appropriate funding sources.

Publicize and improve awareness of the earthquake risk using existing education and outreach efforts.

Use FEMA's procedures document for developing scopes of work for seismic structural and non-structural retrofit projects.

Coordinating Organization:	Warrenton-Hammond School District
Internal Partners:	**External Partners:**
Warrenton Building Inspector	Clatsop County, FEMA, OEM, DOGAMI
Timeline:	**If available, estimated cost:**
Short Term (0-2 years) / Long Term (2-4 or more years)	
Long Term	
Form Submitted by:	City of Warrenton
Action Item Status	Continuing Action Item

[15] McConnell, Vicki S. Department of Geology and Mineral Industries. *Statewide Seismic Needs Assessment: Implementation of Oregon 2005 Senate Bill 2 Relating to Public Safety, Earthquakes, and Seismic Rehabilitation of Public Buildings."* 2007. http://www.oregongeology.com/sub/projects/rvs/OFR-O07-02-SNAA-onscreen.pdf.

Flood # 1

Proposed Action Item:	Alignment with Plan Goals
Coordinate with FEMA on issues surrounding recently proposed revisions to the Flood Insurance Rate Maps to account for protection provided by Warrenton's dikes.	Minimize damage to public and private buildings and infrastructure

Rationale for Proposed Action Item:

FEMA is currently developing new FIRM maps for Warrenton, which were last updated in 1978. FEMA remapped the area approximately 2 years ago, but the maps did not account for Warrenton's dike system because the dikes had not been certified. However, Warrenton lacks the funds to certify the dikes but has maintained them. Warrenton is currently working with FEMA to resolve these issues and develop FIRM maps that accurately address the flood hazard in Warrenton.

FIRM maps show areas subject to flooding in a community and is based on historic, meteorological, hydrologic, and hydraulic data, as well as open space conditions, flood-control works, and development. FIRM maps are the primary tool that state and local governments can use to mitigate against floods. Coordinating with FEMA on revisions to FIRMs will help to reduce the impact of flooding on Warrenton for new and existing developments.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Coordinating with FEMA to develop FIRMs that accurately reflect Warrenton's flood hazard are necessary to protect new development and existing buildings.

Ideas for Implementation:

Continue to work with FEMA on issues surrounding revisions to Warrenton's Flood Insurance Rate Maps.

Educate FIRM policy holders and other stakeholders that may be impacted by any changes about the proposed revisions.

New FIRMS were adopted in 2010.

Coordinating Organization:	Planning Department

Internal Partners:	External Partners:
Public Works, Administration	FEMA, OEM,

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 year		

Form Submitted by:	City of Warrenton
Action Item Status	Completed

Flood # 2

Proposed Action Item:	Alignment with Plan Goals
Once issues related to Warrenton's Flood Insurance Rate Maps (FIRMs) have been resolved, review Warrenton's floodplain ordinance to ensure it meets current National Flood Insurance Program (NFIP) standards and reflects the new FIRMs.	Minimize damage to public and private buildings and infrastructure

Rationale for Proposed Action Item:

FEMA is currently developing new FIRM maps for Warrenton, which were last updated in 1978. FEMA remapped the area approximately 2 years ago, but the maps did not account for Warrenton's dike system because the dikes had not been certified. However, Warrenton lacks the funds to certify the dikes but has maintained them. Warrenton is currently working with FEMA to resolve these issues and develop FIRM maps that accurately address the flood hazard in Warrenton. Once issues related to the FIRM maps have been resolved, Warrenton should review its floodplain ordinance to ensure it meets current National Flood Insurance Program (NFIP) standards and reflects the new FIRMs.

Participation in the NFIP requires that communities maintain and update a floodplain management ordinance that addresses development within the floodplain and that meets current NFIP program requirements. In 2009 Warrenton reviewed its floodplain ordinance to comply with NFIP regulations, however the issues surrounding the FIRM maps had not yet been resolved. Once the issues relating to Warrenton's FIRM maps have been resolved, Warrenton should review and update its floodplain ordinance to ensure that the ordinance meets current NFIP standards and reflects information in Warrenton's FIRMs.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Reviewing Warrenton's floodplain ordinance once FIRMs have been developed will ensure that Warrenton is in compliance with current NFIP standards and that new development will be protected from floods.

Ideas for Implementation:

Continue to work with FEMA on issues surrounding revisions to Warrenton's Flood Insurance Rate Maps.

Coordinate efforts between the Planning and Public Works Departments to review Warrenton's floodplain ordinance and the new FIRMs to determine which changes should be made.

Coordinating Organization:	Public Works and City Engineer

Internal Partners:	External Partners:
Public Works, Administration	FEMA, OEM,

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 years		

Form Submitted by:	City of Warrenton
Action Item Status	Completed

Flood # 3

Proposed Action Item:	Alignment with Plan Goals
Conduct a public outreach campaign with citizens of Warrenton to review any changes to FIRMs, increase knowledge of the local flood risk, and review any changes to Warrenton's floodplain ordinance.	Minimize damage to public and private buildings and infrastructure

Rationale for Proposed Action Item:

FEMA is currently developing new FIRM maps for Warrenton, which were last updated in 1978. FEMA remapped the area approximately 2 years ago, but the maps did not account for Warrenton's dike system because the dikes had not been certified. However, Warrenton lacks the funds to certify the dikes but has maintained them. Warrenton is currently working with FEMA to resolve these issues and develop FIRM maps that accurately address the flood hazard in Warrenton. Once issues related to the FIRM maps have been resolved, Warrenton should conduct a public outreach campaign with citizens to review any changes to the FIRMs, increase knowledge of the local flood risk, and review any changes made to Warrenton's floodplain ordinance. This public outreach campaign could target audiences such as local building officials, elected officials, NFIP policy holders, business organizations, or the general public.

Community outreach that teaches citizens, businesses, and local officials about Warrenton's NFIP program, FIRMs, and the city's floodplain ordinance can help increase the number of NFIP policies, promote NFIP services, or increase the knowledge about a community's local flood risk. Once the issues surrounding the FIRMs have been resolved, conducting a public outreach campaign can improve the efficacy of Warrenton's floodplain management program.

Ideas for Implementation:

Consider different methods for public outreach, such as an open house, informational brochures, posting information on the city website, combining efforts or combining efforts with other jurisdictions such as Clatsop County, Astoria, or Seaside.

Coordinating Organization:	Planning Department

Internal Partners:	External Partners:
Public Works, Administration	FEMA, OEM,

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 year		

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Flood # 4

Proposed Action Item:	Alignment with Plan Goals
Continue regular maintenance of dikes/levees and seek their certification.	Protect life Minimize damage to public and private buildings and infrastructure Reduce economic loss Decrease disruption to critical services

Rationale for Proposed Action Item:

The city of Warrenton is protected from riverine floods by a system of dikes, ditches, storm pipes, pump stations, and culvert crossings with tidegates. Regular maintenance of the dikes and the flood system are needed to continue protecting the city from floods. The city of Warrenton owns and maintains the dikes, and the Army Corps of Engineers reviews them annually for the city. The city of Warrenton is also responsible for obtaining certification of the dikes that the city maintains and owns. Certified dikes are dikes that can contain the 1% annual chance exceedance flood and can influence flood insurance premiums under the National Flood Insurance Program for properties protected by the dikes.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Maintenance of levees and receiving certification by the Corps of Engineers will sustain this critical infrastructure and prevent floods from damaging the city of Warrenton.

Ideas for Implementation:

Develop a maintenance plan and schedule for Warrenton's dike system.

Seek funding for the certification of dikes.

Historically, the USACE has found the city's flood protection levee system adequate. Presently, the city is working with USACE to achieve certification.

Coordinating Organization:	Warrenton Public Works

Internal Partners:	External Partners:
City Administration	FEMA, Army Corps of Engineers, Clatsop County

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	Ongoing	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Flood # 5

Proposed Action Item:	Alignment with Plan Goals
Implement the Stormwater Management Plan action items relating to the flooding and stormwater issues in Warrenton.	Reduce economic loss. Minimize damage to public & private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

Warrenton is protected from floods by a flood control system comprised of dikes, ditches, storm pipes, pump stations, and culvert crossings with tidegates. This system is designed to move river and stormwater out of several sub-basins within the city, either through passive conveyance or pump stations, while preventing water from the Columbia River during high tides or floods from entering. Tidegates located throughout the city regulate the flow of water, allowing storm and river water to flow out, while preventing water from high tides to enter. However, many of the flood control structures are aging and in need of repair, and a failure in the dike system could incur significant damage to property. To address Warrenton's stormwater needs, the city adopted a *Stormwater Management Plan* in October 2009 that took a comprehensive look at Warrenton's stormwater system and provided prioritized capital improvement project recommendations. Implementing the stormwater plan's action items will significantly reduce the probability and vulnerability of flood events in the city. The specific action items are listed in the ideas for implementation below.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Implementing the stormwater plan's action items will improve the critical flood control infrastructure which will protect existing and future developments in Warrenton.

Ideas for Implementation:

Stormwater Management Plan Action Items (details found on pp. 62-87 of the stormwater plan):
CIP # 1: Repair/Refurbish West Hammond Marina Tidegate
CIP # 2: Repair/Refurbish East Hammond Marina Tidegate
CIP # 3: Tidegate Repair & Replacement Plan
CIP # 4: Evaluate and upgrade existing pump station adjacent to SE 3rd/4th St.
CIP # 5: Refurbish existing pump station adjacent to NE 1st St. Completed
CCIP # 6: Upsize storm system in west portion of Hammond Marina sub-basin
CIP # 7: Relieve stormwater drainage issue in the East Hammond/Brailler-Enterprise Ditch area completed
CIP # 8: Obtain programmatic permit to allow O&M routine maintenance of city drainage ditches, if such a permit is necessary
CIP # 9: Create and implement Monitoring Plan for city of Warrenton
CIP # 10: Upgrade downtown conveyance system and create definitive connection between north and south downtown pump stations
CIP # 11: Sanitary sewer inflow/infiltration study
CIP # 12: Stormwater rate study

Coordinating Organization:	City of Warrenton Administration

Internal Partners:	External Partners:
Public Works Department, Planning	US Corps of Engineers, Oregon Department of State

Department		Lands
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	$115,050
2 years		
Form Submitted by:	City of Warrenton	
Action Item Status	Portions completed; ongoing Action Item	

Flood # 6

Proposed Action Item:	Alignment with Plan Goals
Develop plan if the bridges in Warrenton collapse.	Protect life. Reduce economic loss. Decrease disruption to critical services.

Rationale for Proposed Action Item:

The city of Warrenton has several bridges that serve to connect various sections of the city. These bridges include the New Young's Bay Bridge, Alder Creek Bridge, Skipanon Bridge, and the Alternate Highway 101 Skipanon Bridge. If either of these bridges collapse, people will be isolated from necessary services such as food and medical services. Developing an emergency preparedness/response plan in the event of a bridge collapse will help the community prepare for a potential disaster.

Analysis of the risk of damage from an earthquake or tsunami to the Alder Creek Bridge, Harbor Drive Skipanon Bridge, and Alt 101 Skipanon bridge is to be included in the 2014/15 transportation system plan update.

Ideas for Implementation:

Establish a partnership with the Coast Guard located in Warrenton.
Partner with the Oregon Department of Transportation, emergency services, Warrenton Public Works Department, and surrounding cities and Clatsop County.

Coordinating Organization:	Oregon Department of Transportation

Internal Partners:	External Partners:
Public Works	FEMA, Clatsop County PW, ODOT, Medics, Columbia River Hospital and Providence Hospital

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	Warrenton Steering Committee
Action Item Status	Ongoing action item.

Flood # 7

Proposed Action Item:	Alignment with Plan Goals
Develop a plan to minimize possible flooding of Alder Creek.	Protect Life Minimize damage to public & private buildings & infrastructure

Rationale for Proposed Action Item:

Alder Creek is prone to high waters and if it flooded would create an impasse on Warrenton Drive, one of the major roads in the city. Developing a plan to minimize possible flooding of Alder Creek will reduce the likelihood that the road will be damaged by flood events.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Developing a plan to minimize possible flooding of Alder Creek would protect Warrenton Drive and prevent isolation between the north and southern portions of the city.

Ideas for Implementation:

Conduct a study of Alder Creek to determine flood issues and potential solutions for preventing future floods of Alder Creek.

The Oregon Department of Transportation (ODOT) is responsible for maintaining Warrenton Drive. Warrenton should coordinate with ODOT in developing strategies for mitigation hazards along Warrenton Dr

Coordinating Organization:	City of Warrenton Public Works

Internal Partners:	External Partners:
Planning Department	FEMA, ODOT

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Tsunami # 1

Proposed Action Item:	Alignment with Plan Goals
Move City Hall, which contains the Police, Fire, and Administrative offices, out of the tsunami inundation zone.	Decrease disruption to critical services. Protect life. Minimize damage to public and private buildings and infrastructure.

Rationale for Proposed Action Item:

City Hall (containing the Administrative Offices, Planning and Building Departments, Police Department, and Fire Department) and the Public Works Building across the street are in the tsunami inundation zone. These governmental services are essential to operate during and after a disaster. Moving these facilities will ensure continuous service for Warrenton's residents. Several areas outside of downtown are outside the tsunami inundation zone, and these include area East of 101, near Ft. Stevens, and west of the community soccer fields.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Moving City Hall and emergency facilities that are located in the building will increase the city's resiliency to tsunami hazards.

Ideas for Implementation:

Search for suitable locations outside the tsunami inundation zone. These include areas east of highway 101, area near Ft. Stevens, and west of the community soccer fields.

Identify sources to pay for the relocation.

Coordinating Organization:	City Administration

Internal Partners:	External Partners:
All City Departments	FEMA, OEM

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	4 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing action item.

Tsunami # 2

Proposed Action Item:	Alignment with Plan Goals
Develop more tsunami evacuation routes.	Protect life. Increase education and awareness of the risks and hazards in Clatsop County.

Rationale for Proposed Action Item:

Warrenton has developed a tsunami evacuation route map with two assembly areas, as shown in figure 5 in the Warrenton Addendum. However, these routes are dependent on roads and bridges remaining operational. In the event of a local earthquake event that renders roads and bridges inoperable, travel on foot would be the alternative. Developing additional tsunami evacuation routes that take into account the possibility that roads and bridges are inoperable will make them more effective for citizens and visitors to Warrenton.

Ideas for Implementation:

Consult with the Oregon Department of Geology and Mineral Industries to develop addition tsunami evacuation routes.

Incorporate Warrenton's existing trail system in the tsunami evacuation route map to allow for evacuation on foot.

DOGAMI has issued updated tsunami evacuation route maps based on recent modeling of tsuanami events resulting from subduction zone earthquakes.

Coordinating Organization:	City of Warrenton Administration

Internal Partners:	External Partners:
All city departments	Oregon Dept. of Geology and Mineral Industries, Warrenton Trail Association, FEMA

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 years		

Form Submitted by:	City of Warrenton
Action Item Status	Completed.

Tsunami # 3

Proposed Action Item:	Alignment with Plan Goals
Relocate the high school to higher ground out of the tsunami inundation zone.	Protect life. Minimize damage to public and private buildings and infrastructure.

Rationale for Proposed Action Item:

Warrenton's high school is partially in a tsunami zone. Relocating the high school to higher ground will protect the school from tsunami inundation events. Relocating the school will protect students from tsunami hazards and allow the school to be used as a possible shelter for residents or visitors that may be displaced from a tsunami event.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Relocating the high school to higher ground will protect this important facility from tsunami events.

Ideas for Implementation:

- Search for new locations outside the tsunami area.
- Identify funding sources to pay for the relocation.

Coordinating Organization:	City of Warrenton Administrative Office

Internal Partners:	External Partners:
City Administration, Planning Department	Warrenton School Administration DOGAMI, FEMA

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	4 + years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Wildfire # 1

Proposed Action Item:	Alignment with Plan Goals
Adopt policies and programs of the Community Wildfire Protection Plan, once it is completed, into the Warrenton Comprehensive Plan.	Protect natural and cultural resources. Increase cooperation and collaboration among County partners.

Rationale for Proposed Action Item:

Clatsop County and cities within the county are currently developing a Community Wildfire Protection Plan (CWPP) to address the wildfire hazard in the county. A CWPP assesses the risk of wildfires in a community and develops actions to address these risks and reduce the impact of wildfires. Many of these actions propose policies and programs communities can adopt to reduce wildfire risk. Incorporating policies and programs found in Clatsop County's CWPP into the Warrenton Comprehensive Plan will provide Warrenton with a policy framework for mitigating wildfires.

Ideas for Implementation:

Obtain a copy of the CWPP once it is completed and determine policies and programs Warrenton can incorporate into the Comprehensive Plan.

Collaborate with the CWPP's implementation committee and with Clatsop County to incorporate relevant policies and programs.

Coordinating Organization:	Fire Department

Internal Partners:	External Partners:
Planning Department, Fire Chief	Clatsop County, CWPP Committee, Oregon Department of Forestry

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 years		

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Wildfire # 2

Proposed Action Item:	Alignment with Plan Goals
Apply for wildfire grants to implement action items in the Community Wildfire Protection Plan, now being developed, as they pertain to the city of Warrenton.	Protect natural and cultural resources.

Rationale for Proposed Action Item:

When completed, the Community Wildfire Protection (CWPP) Plan will include a list of action items that Warrenton can implement to reduce the city's risk from wildfire events. Currently the city of Warrenton fire chief is part of the CWPP committee and is working toward Warrenton being considered an "interface" community because there are areas at risk to wildfires. These include forested areas along Ridge Road, DeLaura Beach Road, the Skipanon River between Alternate 104 and Harbor Drive, and Alternate 101 along the Forest Rim Subdivision where 650 units are to be built in three phases. Applying for grants to implement the CWPP will reduce the risk of wildfires to these areas.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Funding and implementing wildfire mitigation actions that address new and existing developments in Warrenton will help reduce the community's overall wildfire risk.

Ideas for Implementation:

Coordinate efforts with the implementation committee for the Clatsop County Community Wildfire Protection Plan to write grants.

Identify grant resources for wildfire action items.

Coordinating Organization:	Warrenton Fire Department

Internal Partners:	External Partners:
Public Works, Planning, Fire Department	Clatsop County, CWPP Committee

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 years		

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Wildfire # 3

Proposed Action Item:	Alignment with Plan Goals
Upgrade the size of and loop water lines to improve firefighting capabilities.	Minimize damage to public and private buildings and infrastructure. Decrease disruption to critical services.

Rationale for Proposed Action Item:

Some of the water lines in Warrenton may be too small to support wildfire suppression efforts, especially in areas identified in the Wildland Urban Interface. Upgrading the size of water lines in the community will enable the fire department to adequately suppress wildfires that threaten the city.

The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that address new and existing buildings and infrastructure [201.6(c)(3)(ii)].Upgrading the size of water lines will improve existing water lines and help in protecting new and existing buildings in the community.

Ideas for Implementation:

Identify water lines in the city that need upgrading.

Develop a plan and funding resources for water line improvements.

Coordinating Organization:	Warrenton Public Works

Internal Partners:	External Partners:
Fire Department, City Administration, Public Works	Oregon Department of Forestry

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	4+ years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Winter Storm/Wind Storm # 1

Proposed Action Item:	Alignment with Plan Goals
Develop a plan for removal of trees.	Protect life. Reduce economic loss. Minimize damage to public and private buildings & infrastructure.

Rationale for Proposed Action Item:

In a windstorm event, fallen trees can damage utility lines, block entrances to homes, preclude travel on roads and create perilous situations to people and property. Developing a plan for tree removal after a windstorm event will minimize damage to infrastructure within the community.

Ideas for Implementation:

Establish partnerships with Nygaard Logging, Weyerhaeuser, Trails and Material Recovery and Recycling and other similar companies to use their equipment and labor to remove trees.

Work with the Oregon Department of Forestry to develop an area for placement of removed trees.

Coordinating Organization:	**Pacific Power & Light**

Internal Partners:	External Partners:
Fire and Police Departments, City Administration	Nygaard Logging, Weyerhaeuser, Trails Recovery, Oregon Department of Forestry

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing action item

Winter Storm/Wind Storm # 2

Proposed Action Item:	Alignment with Plan Goals
Place existing utilities underground to avoid damage in wind/winter storm events.	Protect life. Minimize damage to public & private buildings & infrastructure. Reduce economic loss.

Rationale for Proposed Action Item:

Tree falls during wind or winter storm events can be a risk to overhead power lines. During a wind or winter storm, tree falls have the potential to down overhead power lines, causing electric power failures. Warrenton has a number of aboveground utilities found throughout the city. Undergrounding these utilities can reduce the effect of ice loading and tree falls to reduce Warrenton's risk to wind or winter storms, and limit disruptions in service.

Warrenton has experienced severe winter/wind storm events in the past and is vulnerable to windstorm events. The wind storm risk assessment notes that Warrenton's probability of a wind/winter storm recurring is high and the city's vulnerability to wind/winter storm events is also high. Undergrounding utilities to reduce the effect of ice loading and tree falls can help mitigate a community's risk to wind or winter storms, and limit disruptions in service.

The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continuing to support/encourage electrical utilities to use underground construction methods where possible can reduce future power outages from windstorms.

Ideas for Implementation:

Support/encourage electrical utilities to use underground construction methods outside of new subdivisions and in older subdivisions, or where possible to reduce power outages from windstorms.

Consider providing incentives to utilities or property owners to underground utilities.

Contact Pacific Power and Light and Qwest/Charter Communications to participate in future mitigation plan update processes. Document concerns, where applicable, and seek funding to underground utilities.

Develop a hazardous tree inventory for all community properties.

Coordinating Organization:	Public Works

Internal Partners:	External Partners:
Planning Department, Warrenton Urban Renewal District Advisory Committee, City Administration	Pacific Power & Light, Century Link, Charter Communications

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Multi-Hazard # 1

Proposed Action Item:	Alignment with Plan Goals
Develop educational outreach materials for all of Warrenton's natural hazards.	Protect life. Increase education and awareness of the risk and hazards in Warrenton

Rationale for Proposed Action Item:

The risk assessment portion of Warrenton's Addendum outlines the risk the city faces to natural hazard events. According to the risk assessment, Warrenton has a high probability and high vulnerability to coastal erosion, earthquake, wildfire, and windstorm/winter storm hazards. Warrenton has a moderate probability that a tsunami will occur, but a high vulnerability to the tsunami hazard. Warrenton also has a moderate probability and vulnerability to the flood hazard. Given Warrenton's risk to these natural hazards, educational outreach is important to inform citizens on where to go, what to do, and how to minimize the risk from natural hazards. Possible educational outreach materials are listed below.

Ideas for Implementation:

- Distribute list of emergency shelters.
- Create a brochure on what to do in an earthquake.
- Use *The Columbia Press* and the city's web site to inform citizens.
- Create signs for tsunami route.
- Post Stormwater Master Plan on the city's web site.
- Use water bills to disseminate information such as where to pick up bottled water, when to boil water or how to conserve water.
- Establish an informational board at City Hall, the library and other locations.
- Continue to coordinate with state and federal management on emergency preparedness and public education.
- Create and distribute awareness survey.
- Combine outreach efforts with those of Clatsop County, Astoria, Seaside, and Cannon Beach.

Coordinating Organization:	Planning Department

Internal Partners:	External Partners:
City Administration	Local businesses, clinics, Astoria Warrenton Chamber of Commerce, Clatsop County, City of Astoria, Seaside, Cannon Beach

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing action item

Multi-Hazard # 2

Proposed Action Item:	Alignment with Plan Goals
Establish and furnish the Community Center as an emergency shelter and develop a list of additional community shelters such as churches and schools.	Protect life.

Rationale for Proposed Action Item:
In the event of a natural disaster, residents and visitors need to have a place to stay, to have a meal, and to obtain necessities. While Warrenton's population is relatively small, the area gets a significant amount of visitors due to Fort Stevens Park located northwest of the city. Establishing the Community Center as an emergency shelter, and developing a list of additional community shelters in churches and schools will prepare Warrenton for a natural disaster event. These emergency shelters can also be areas where community members can obtain supplies, such as blankets, food, medication, water, and other necessities.

Ideas for Implementation:
Contact churches, schools, the Community Center, Wastewater Treatment Plant, and other buildings for possible shelters. Coordinate efforts with the local Red Cross who may have developed a list of emergency shelters for Warrenton. Incorporate shelter information when developing an Emergency Response Plan as outlined in Multi-Hazard Action # 3. Contact restaurants, seafood companies, churches, and retailers to identify areas to provide and distribute emergency supplies.

Coordinating Organization:	City of Warrenton Administration

Internal Partners:	External Partners:
City Administration, Public Works, Planning, Emergency Services, Fire	Local churches, Red Cross, School District, local churches, Local food retailers/restaurants [Buoy 9, Fred Meyer, Costco, Main Street Market, Clatsop County Food Distributor, Rite Aid, & Walgreens, Serendipity, Rods Bar & Grill]

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 years		

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Multi-Hazard # 4

Proposed Action Item:	Alignment with Plan Goals
Establish a list of vulnerable persons that need to be monitored during and after a disaster to ensure their safety.	Protect life.

Rationale for Proposed Action Item:
The city of Warrenton has a number of vulnerable populations that include school-age children and the elderly. Identifying vulnerable populations and where they live can help to develop mitigation strategies to protect them from future disasters. In addition, identifying vulnerable populations can help a city in its response and recovery efforts to make sure that these populations are safe.

Ideas for Implementation:
Develop a contact list of vulnerable populations to monitor in a response and recovery effort. Consider mapping vulnerable populations to help develop mitigation strategies to reduce their vulnerability and identify their locations in a response and recovery. Combine efforts with Clatsop County.

Coordinating Organization:	Warrenton Police and Fire Departments

Internal Partners:	External Partners:
Fire Department, Public Works	Clatsop County, Medics, Hospitals

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Multi-Hazard # 5

Proposed Action Item:	Alignment with Plan Goals
Identify areas/facilities to establish a temporary medical facility after a disaster occurs.	Protect life

Rationale for Proposed Action Item:
Warrenton does not have a hospital and there is only one medical office in the city. After a disaster occurs, Warrenton may need to establish a temporary medical facility to assist ill or injured people for transfer to a local hospital. Identifying areas or facilities that would serve as a temporary medical facility before a disaster occurs will help prepare Warrenton for an eventual catastrophic event and reduce the potential for loss of life. The temporary facility would not only serve residents of Warrenton, but could also assist visitors from nearby Fort Stevens Park.

Ideas for Implementation:
Partner with medical and emergency services to develop appropriate locations for a temporary medical facility. Incorporate locations for a temporary medical facility in the Warrenton Emergency Operations Plan (see Multi-Hazard Action # 3).

Coordinating Organization:	Warrenton Fire and Police Departments

Internal Partners:	External Partners:
Warrenton Fire & Police Departments, Planning Department, City Administration	Columbia Memorial and Providence Hospitals, Medix Ambulance

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item.

Multi-Hazard # 6

Proposed Action Item:	Alignment with Plan Goals
Establish a partnership with Sunset Empire Transportation to help people seek shelter, to obtain supplies, or travel for other needs after a natural disaster.	Protect life.

Rationale for Proposed Action Item:
In the event of a natural disaster, people may be unable to obtain food or stay in housing that is damaged to the extent it is not habitable. In addition, roads and bridges may be closed or difficult to travel because of the hazard situation. Establishing a partnership with Sunset Empire Transportation will help in transporting people, obtaining supplies, checking on relatives and family, or traveling for other needs.

Ideas for Implementation:
Coordinate development of the partnership with the planning efforts surrounding emergency response in Warrenton.

Coordinating Organization:	Emergency Operations

Internal Partners:	External Partners:
Fire and Police Departments, Public Works	Sunset Empire Transportation District

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
2 years		

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item

Multi-Hazard # 7

Proposed Action Item:	Alignment with Plan Goals
Develop a public notification system.	Protect life.

Rationale for Proposed Action Item:

A public notification system can warn people of a disaster to give them time to take the necessary precautions. This public notification system can be web-based, make use of a reversed 9/11 telephone system, use a siren, and/or use radio/media broadcasting efforts. This public notification system should be developed in conjunction with emergency response planning efforts indicated in multi-hazard action item #3.

Ideas for Implementation:

Partner with New Northwest Broadcasters.

Conduct a feasibility study on the most cost-effective and appropriate emergency notification system for the city of Warrenton.

Combine development of the emergency notification system with public outreach efforts to ensure the public understands notification warnings.

Coordinating Organization:	State and local emergency services.

Internal Partners:	External Partners:
City Administration, Public Works, Planning, Police, Fire.	Oregon Emergency Management, New Northwest Broadcasters

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing Action Item.

Multi-Hazard # 8

Proposed Action Item:	Alignment with Plan Goals
Conduct an inventory of generators and fuel supplies for use in an emergency.	Protect life. Decrease disruption to critical services.

Rationale for Proposed Action Item:
Electricity is oftentimes not available during a disaster. The location of available generators would facilitate providing electricity where it is needed. Delivery of fuel could be curtailed during an emergency creating a shortage of fuel. Preparing an inventory of fuel distribution areas provides the location of fuel for emergency vehicles, people working on the disaster, and citizens.

Ideas for Implementation:
Contact major retailers or organizations that may have generators and/or fuel supplies to develop an inventory. Develop partnerships with these organizations to help in distributing these supplies in the event of an emergency. Coordinate efforts with the emergency response planning efforts as indicated in multi-hazard action item #3.

Coordinating Organization:	Warrenton Fire Department

Internal Partners:	External Partners:
Public Works & Police and Administration	Retail, private sector and citizens

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	3 years	

Form Submitted by:	City of Warrenton
Action Item Status	Ongoing action item.

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Volume IV:
Mitigation Resources

The purpose of this volume is to provide documentation of the following plan development resources:

- Appendix A – Action Item Forms
- Appendix B – Planning & Public Process
- Appendix C – Economic Analysis of Mitigation Actions
- Appendix D – Oregon Coast Regional Profile
- Appendix E – Household Survey
- Appendix F – Community Organizations

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Appendix A: Action Items Forms

The purpose of this appendix is to document the actions identified in the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan. City-specific actions can be found in the city addendums in Volume III.

Each action item listed below was included in the previously adopted plan and has a corresponding action item worksheet describing the activity, identifying the rationale for the project, identifying potential ideas for implementation, and assigning coordinating and partner organizations. The action item worksheets, which contain more detailed information, can assist the community in pre-packaging potential projects for grant funding.

Action Items

The following items include those which were identified in the 2008 Natural Hazards Mitigation Plan but at the time of this update have yet to be completed. Italicized items indicate items which are ongoing or in progress but not completed. Although a number of items were deferred due to cost and feasibility issues, none of the items from the previous plan were deleted. These action items are still considered relevant items and therefore remain part of the updated plan.

Multi-Hazard

- Centralize County 911 system.
- Develop a pre-plan of how to accommodate visitors to the coast following a major disaster.
- Evaluate the feasibility of undergrounding utilities where appropriate.
- Develop secondary back-up power, communications, and lighting for the Port of Astoria airport.
- Develop Post-Disaster Recover Plans for communities in Clatsop County.
- Develop an inventory of available generators and fuel distribution.
- Emergency Preparedness CDs.
- Relocate Lewis & Clark RFPD – Station #1.
- Upgrade Wickiup Grange to become shelter for both short- and long-term disasters.
- Public Emergency Information Boards.
- Outreach and education to volunteer organizations that may be designated relief sites in a disaster regarding safe food, water, and sanitation practices.
- *Identify and develop emergency shelter facilities throughout the County.*
- *Partner with Clatsop County Community College on mitigation efforts.*
- *Post-disaster pet/animal shelter.*
- *CERT Program Support.*
- *Food and Emergency Supply stations.*
- *Encourage residents to maintain and update 72-hour kits.*
- *Mitigate the risk of communicable disease in vulnerable, congregate settings.*
- *Increase public education and outreach in natural hazards which affect the north coast.*

Tsunami

- Build vertical evacuation towers in coastal cities.
- Elevate Brownsmead Rural fire District Station
- Seismic vulnerability assessment/vertical evacuation routes.
- Establish high ground commercial districts (above tsunami lines).
- Rebuild four Seaside School District schools outside of the tsunami inundation zone.
- *Improve public notification and warning system (2011).*
- *Establish long-term supply and assembly areas outside of the inundation zones.*
- *Upgrade and improve evacuation routes as well as assembly areas outside of the tsunami inundation zones.*
- *Conduct preliminary research on the development of a County Land Use Ordinance relating to tsunami hazards.*

Wind & Winter Storm

- Promote tree planting projects on private and public properties.
- Find/identify one to three (1-3) ISA-certified arborists in each community that know how to properly prune storm damaged trees.
- Heightened awareness by first responders and appropriate city/county staff of the factors contributing to tree stability.
- Educate homeowners about methods to tie down metal roofs and metal sheds.
- *Develop and implement hazard tree program.*

Earthquake

- Retrofit county bridges that are identified by a seismic vulnerability assessment.
- Conduct seismic vulnerability assessment of county-owned bridges.
- Seismic upgrades for the Ecola Creek Bridge in Cannon Beach (Hwy 101).
- Complete a seismic vulnerability assessment for Port of Astoria facilities.
- Develop incentive programs to encourage homeowners to do seismic retrofits.
- Seismic retrofitting of old Hamlet Fire Station.

Flood

- Elevate runway at Port of Astoria airport and improve diking around the airport.
- Complete a risk assessment related to levees in the county and adjacent development.
- Westport rail bridge replacement.
- *Provide support and assistance to diking districts with respect to accreditation of the county levees.*
- *Continue compliance with the National Flood Insurance Program (NFIP).*

Landslide

- Build new access road on east side of Astoria from Hwy 30.
- Develop alternative transportation routes around slide-prone areas in County.
- *Continue upgrading and enhancing County GIS.*

Drought

- *Investigate the viability of countywide public awareness activities regarding water conservation.*

Completed Action Items

The following action items include those which were identified in the 2008 Natural Hazards Mitigation Plan and are since completed:

Multi-Hazard

- *Build new centralized Emergency Operations Center. (2013)*
- *Evaluate the vulnerability of wastewater treatment facilities in the County. (2013)*
- *Harden the Wickiup repeater site. (2010)*
- *Develop a Disaster Debris Management Plan. (2012)*

Tsunami

- *Complete tsunami risk assessment for Clatsop County. (2013)*
- *Relocate Arch Cape Fire Station out of the tsunami inundation and flood zones. (2013)*

Wind/Winter storm

- *Identify major transportation routes that are at risk during a major storm event.*

Flood

- *Make improvements to the Hwy 101 roadway near Seaside to avoid annual winter flooding. (2012)*

Wildfire

- *Develop and implement the Community Wildfire Protection Plan. (2010)*

Rationale or Key Issues Addressed

Action items should be fact-based and tied directly to issues or needs identified throughout the planning process. Action items can be developed at any time during the planning process and can come from a number of sources, including participants in the planning process, noted deficiencies in local capability, or issues identified through the risk assessment. The rationale for proposed action items is based on the information documented in Section 2 and the Hazard Annexes.

Ideas for Implementation

The ideas for implementation offer a transition from theory to practice and serve as a starting point for this plan. This component of the action item is dynamic, since some ideas may prove to not be feasible, and new ideas may be added during the plan maintenance process. Ideas for implementation include such things as collaboration with relevant organizations, grant programs, tax incentives, human resources, education and outreach, research, and physical manipulation of buildings and infrastructure.

Implementation through Existing Programs

The Clatsop County multi-jurisdictional Natural Hazard Mitigation Plan includes a range of action items that, when implemented, will reduce loss from hazard events in the County. Within the plan, FEMA requires the identification of existing programs that might be used to implement these action items. Clatsop County currently addresses statewide planning goals and legislative requirements through its comprehensive land use plan, capital improvements plan, mandated standards and building codes. To the extent possible, Clatsop County will work to incorporate the recommended mitigation action items into existing programs and procedures.

Many of the Clatsop County multi-jurisdictional Natural Hazards Mitigation Plan's recommendations are consistent with the goals and objectives of the County's existing plans and policies. Where possible, Clatsop County will implement the multi-jurisdictional Natural Hazard Mitigation Plan's recommended actions through existing plans and policies. 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. Implementing the Natural Hazard Mitigation Plan's action items through such plans and policies increases their likelihood of being supported and implemented.

Coordinating Organization

The coordinating organization is the public agency with the regulatory responsibility to address natural hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring and evaluation.

Internal and External Partners

The internal and external partner organizations listed in the Action Item Worksheets are potential partners recommended by the project Steering Committee but not necessarily contacted during the development of the plan. The coordinating organization should contact the identified partner organizations to see if they are capable of and interested in participation. This initial contact is also to gain a commitment of time and/or resources toward completion of the action items.

Internal partner organizations are departments within the County or other participating jurisdictions that may be able to assist in the implementation of action items by providing relevant resources to the coordinating organization.

External partner organizations can assist the coordinating organization in implementing the action items in various functions and may include local, regional, state, or federal agencies, as well as local and regional public and private sector organizations.

Plan Goals Addressed

The plan goals addressed by each action item are identified as a means for monitoring and evaluating how well the mitigation plan is achieving its goals, following implementation.

Timeline

Action items include both short- and long-term activities. Each action item includes an estimate of the timeline for implementation. Short-term action items (ST) are activities that may be implemented with existing resources and authorities in one to two years. Long-term action items (LT) may require new or additional resources and/or authorities, and may take from one to five years to implement.

Multi-Hazard #1

Proposed Action Item:	Alignment with Plan Goals:
Build new centralized Emergency Operations Center	***Decrease disruption to critical services*** ***Increase cooperation and collaboration among County partners***

Rationale for Proposed Action Item:

- **The current Emergency Operations Center located at the Sheriff's Building in Astoria is not large enough to accommodate the amount of people needed during a large disaster recovery effort. This was evidenced during the December 2007 storm.**
- **"It is important that critical facilities functions during and after disasters. Strengthening all essential facilities will improve recovery capacity and reduce risk and loss of life..." Examples of upgrading community services include developing "an Emergency Operations Center (EOC) that would house the County's emergency departments and serve as a shelter for critical County staff;" combining police, fire and 911 dispatch in a center that would also serve as a shelter for first responders during an emergency.**
- **This action was one of the Steering Committee's top three priorities for 2008-2009.**

Ideas for Implementation:

- **Camp Rilea in the Clatsop plains area has been identified as a potential candidate site.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:		External Partners:
		Oregon Emergency Management
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #2

Proposed Action Item:	**Alignment with Plan Goals:**
Centralize Countywide 911 system	*Decrease disruption to critical services* *Increase cooperation and collaboration among County partners*

Rationale for Proposed Action Item:

- **"It is important that critical facilities functions during and after disasters. Strengthening all essential facilities will improve recovery capacity and reduce risk and loss of life..." Examples of upgrading community services include developing "an Emergency Operations Center (EOC) that would house the County's emergency departments and serve as a shelter for critical County staff;" combining police, fire and 911 dispatch in a center that would also serve as a shelter for first responders during an emergency.**
- **This was one of the Steering Committee's top three priorities for 2008-2009.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #3

Proposed Action Item:	**Alignment with Plan Goals:**
Develop a pre-plan of how to accommodate visitors to the coast following a major disaster.	***Protect life***

Rationale for Proposed Action Item:

- **Each year, hundreds of thousands visit communities in Clatsop County. If a major disaster were to strike during peak visitation times (summer), communities would be overwhelmed by the numbers of people to take care of.**

Ideas for Implementation:

- **Work with the County's Emergency Services Coordinator to develop pre-plan.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #4

Proposed Action Item:	Alignment with Plan Goals:
Evaluate the vulnerability of waste water treatment facilities in the County.	***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- **Many communities in Clatsop County have waste water treatment facilities that are at risk to earthquakes, tsunamis and/or floods.**
- **Retrofitting of vital infrastructure, such as schools and community buildings, provides important improvements that reduce hazard exposure and the cost and time associated with recovery.**
- **Protecting utilities from damage can minimize the economic and social disruption caused by natural disasters.**

Ideas for Implementation:

- **Complete vulnerability assessment**
- **Prioritize mitigation projects**
- **Seek funding for mitigation projects**
- **Complete mitigation projects**
- **Document successes**

Coordinating Organization:	**Clatsop County Public Works**

Internal Partners:		External Partners:
		City of Cannon Beach, City of Gearhart, City of Seaside, City of Warrenton, City of Astoria
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #5

Proposed Action Item:	**Alignment with Plan Goals:**
Evaluate the feasibility of undergrounding utilities where appropriate	*Minimize damage to public and private buildings and infrastructure* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **During the December 2007 windstorm, overhead utilities were vulnerable to disruption due to downed trees. This action is to identify those areas most susceptible to damage by falling trees and explore the feasibility of relocating critical utilities underground.**
- **Tree falls during winter storm events can be a risk to overhead power lines. During a winter storm, tree falls have the potential to down overhead power lines, causing electric power failures. Undergrounding utility extensions to reduce the effect of ice loading and tree falls can help mitigate a community's risk to winter storms, and limit disruptions in service in the event of a winter storm.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Public Works**

Internal Partners:	**External Partners:**
	City of Cannon Beach, City of Gearhart, City of Seaside, City of Warrenton, City of Astoria

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #6

Proposed Action Item:	**Alignment with Plan Goals:**
Identify and develop emergency shelter facilities throughout the County.	*Protect life* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **The December 2007 storm exposed the lack of a coordinated emergency shelter system for the County. No one knew where shelters were to be located and the ones that emerged were not adequately stocked.**

Ideas for Implementation:

- **Establish County shelter plans that identify where shelters are located. Ensure that shelters will be accessible, especially following seismic events.**
- **Equip shelters with appropriate equipment – cooking, lighting, emergency power.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
	American Red Cross

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #7

Proposed Action Item:	**Alignment with Plan Goals:**
Develop secondary back-up power, communication, and lighting for the Port of Astoria airport	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Currently, the airport lacks back-up power, communication and lighting. This was an issue during the December 2007 windstorm.**
- **The Port of Astoria airport is considered a critical facility and therefore, having back-up power, communication and lighting are important for maintaining services.**

Ideas for Implementation:

Coordinating Organization:	**Port of Astoria**

Internal Partners:	**External Partners:**
	Clatsop County, City of Warrenton, FAA

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #8

Proposed Action Item:	**Alignment with Plan Goals:**
Develop Post-Disaster Recovery Plans for communities in Clatsop County	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Clatsop County and the cities therein are vulnerable to the Cascadia Subduction Zone earthquake and resultant tsunami.**
- **Communities can start to address the redevelopment issues they will face following the event now by engaging in post-disaster recovery planning to identify goals and strategies for redevelopment.**
- **The City of Cannon Beach began this process in 2006 and has a post-disaster recovery work plan.**

Ideas for Implementation:

- **Utilize the Partnership for Disaster Resilience Post-Disaster Recovery Planning How To Guide to facilitate community forums.**
- **Develop recovery work plans and begin the planning process before the event.**
- **Develop guiding principles for rebuilding the community.**
- **Partner with public and private utilities to identify strategies for rebuilding infrastructure and utilities.**

Coordinating Organization:	**Clatsop County Planning**

Internal Partners:	**External Partners:**
	City of Cannon Beach, City of Gearhart, City of Seaside, City of Warrenton, City of Astoria

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #9

Proposed Action Item:	**Alignment with Plan Goals:**
Encourage residents to maintain and update 72 hour kits	***Protect life*** ***Increase education and awareness of the risks and hazards in Clatsop County***

Rationale for Proposed Action Item:

- **Every citizen should have a 72 hr survival kit because when a large scale hazard event affect the north coast, we become very isolated from outside support. This means that citizens will need to have stocked enough survival gear and food to last through an extended recovery period.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
	Chambers of Commerce, Title companies

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #10

Proposed Action Item:	Alignment with Plan Goals:
Harden the Wikiup repeater site	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **The Wikiup repeater site was down during the December 2007 windstorm creating lack of communication issues throughout the County.**
- **The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on both new and existing buildings, critical facilities, and infrastructure. [201.6(c)(3)(ii)]. Relocating critical facilities out of hazard zones will reduce the vulnerability of a community and avoid disruption of critical facilities.**
- **A strategy to avoid future disruption of critical facilities is to "relocate critical facilities and equipment out of known hazard zones or retrofit the facilities to minimize disruption of services."**

Ideas for Implementation:

- **Utilize Hazard Mitigation Grant Program (HMGP) 5% dollars to harden repeater site.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:		External Partners:
		Oregon Emergency Management
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #11

Proposed Action Item:	**Alignment with Plan Goals:**
Develop an inventory of available generators and fuel distribution	***Decrease disruption to critical services*** ***Increase cooperation and collaboration among County partners***

Rationale for Proposed Action Item:

- **A better inventory is needed to increase the efficiency of generator and fuel distribution following a disaster.**
- **"It is important that critical facilities function during and after disasters. Local units of government want to insure continuous service by strengthening essential facilities such as fire stations, city halls, shelters, and police stations. In addition, emergency backup generators should be provided to each critical facility." Ensuring continuous service will assist residents in recovering from a natural disaster as well as make the process easier.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
Clatsop Co. Public Works	

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #12

Proposed Action Item:	**Alignment with Plan Goals:**
Partner with Clatsop County Community College on mitigation efforts	*Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services* *Increase cooperation and collaboration among County partners*

Rationale for Proposed Action Item:

- **The College can provide workforce training.**
- **Students and faculty are available for projects.**
- **Facilities can be utilized for training – CERT, Fire training, etc..**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
	Clatsop Community College, City of Astoria

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #13

Proposed Action Item:	**Alignment with Plan Goals:**
Post-disaster pet/animal shelter	*Protect life*

Rationale for Proposed Action Item:

- **People will have more time to coordinate with disaster plans better and have better peace of mind if they knew where their pets and/or livestock are located**
- **Hurricane Katrina highlighted the importance of planning for pets before disasters.**

Ideas for Implementation:

- **Create 3 pet/animal shelters across the county**
- **At least one for livestock (County fairgrounds is one suggestion)**
- **Involve local vets, feed stores, pet stores and interested citizens**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
	Pet stores, livestock stores, local veterinarians, etc.

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Caren Black (CERT volunteer)**

Multi-Hazard #14

Proposed Action Item:	**Alignment with Plan Goals:**
Emergency Preparedness CDs	***Increase education and awareness of the risks and hazards in Clatsop County***

Rationale for Proposed Action Item:

- **Two local KMUN radio programs have already been produced giving vital information on emergency preparedness and emergency behaviors (from interviews with Mike Jackson (Astoria Fire Marshall), Vanessa Clarkson (Red Cross),Don Hillgartner (RACES, ARES), Tom Manning (Tillamook County), Patrick Corcoran (OSU Extension Service), Deb Truesdell (Seaside Tsunami Prep Coordinator), and Ana Marie Jones (Firstvictims.org)**
- **There is a wealth of local emergency prep information in these interviews and it would be a great service to County residents to create and distribute CDs of the interviews to the general public.**

Ideas for Implementation:

- **CDs are not expensive and thus this project could produce a lot of free CDs and make them available at key locations throughout the County.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:		**External Partners:**
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Caren Black (CERT volunteer)**

Multi-Hazard #15

Proposed Action Item:	**Alignment with Plan Goals:**
Food and Emergency Supply Stations	***Protect life***

Rationale for Proposed Action Item:

- **Food, water and other emergency supplies are critical items when a disaster strikes. Creating stations outside of the areas that are most likely to be damaged during disasters can provide safe and reliable locations for people to congregate and receive these items.**
- **This idea is already being developed in Seaside. They are storing emergency supplies in plastic barrels above the tsunami inundation line to ensure adequate supplies in the event that a tsunami strikes. The goal is to expand this idea to other areas in the County.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Caren Black (CERT volunteer)**

Multi-Hazard #16

Proposed Action Item:	**Alignment with Plan Goals:**
Relocate Lewis and Clark RFPD – Station #1	*Minimize damage to public and private buildings and infrastructure* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **The #1 Station is located in Jeffers Gardens which is below sea level and vulnerable to levee failure due to flooding and tsunamis.**
- **The all-volunteer RFPD staff will not be able to perform its duties in the event that the station floods.**

Ideas for Implementation:

- **Relocate the station above the tsunami inundation and 100 year flood lines (one possible location is near the Lewis and Clark Middle School.**

Coordinating Organization:	**Lewis and Clark RFPD**

Internal Partners:	**External Partners:**
	Clatsop County Emergency Management

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Christopher Paddon, CERT volunteer**

Multi-Hazard #17

Proposed Action Item:	**Alignment with Plan Goals:**
CERT Program support	*Protect life* *Increase education and awareness of the risks and hazards in Clatsop County* *Increase cooperation and collaboration among County partners*

Rationale for Proposed Action Item:

- **The CERT programs in Clatsop County are not large enough to provide CERT assistance in the entire County. The goal is to provide CERT programs with enough assistance to be able to grow to accommodate more of the County.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management, CERT**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Multi-Hazard #18

Proposed Action Item:	Alignment with Plan Goals:
Upgrade Wickiup Grange to become shelter for both short and long term disasters	*Protect life*

Rationale for Proposed Action Item:

- **The Wickiup Grange already serves as a well-known and central location for the surrounding community. It is near a senior citizens center, a market, Highway 30, and a half-mile from a rural Clatsop County Sheriff substation**

Ideas for Implementation:

- **The facility needs to build wheelchair access, add showers, upgrade kitchen and other infrastructure as well as retrofit building to withstand earthquakes.**
- **Upgraded facility can serve as a designated county shelter**

Coordinating Organization:	Clatsop County Emergency Management, Wickiup Grange

Internal Partners:	External Partners:

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	Clatsop County Steering Committee

Multi-Hazard #19

Proposed Action Item:	**Alignment with Plan Goals:**
Public Emergency Information Boards	***Increase education and awareness of the risks and hazards in Clatsop County***

Rationale for Proposed Action Item:

- **The County can post public information boards at known locations to provide critical information to the public during emergencies.**
- **In the event that there is no power, these could be boards that residents know to go to in order to get the latest emergency information. During the last major winter storm event in Dec 2007, the public did not know where to go to receive critical information. This created confusion and thus much time was spent running around trying to get the latest information because there were no central locations identified to disseminate this information to the public.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**City of Warrenton Water Treatment Services**

Multi-Hazard #20

Proposed Action Item:	Alignment with Plan Goals:
Outreach and education to volunteer organizations that may be designated relief sites in a disaster regarding safe food, water, and sanitation practices.	*Increase education and awareness of the risks and hazards in Clatsop County*

Rationale for Proposed Action Item:

- **In times of disasters many community organizations voluntarily step forward to help the community by providing basic emergency services such as food distribution, meal preparation, and shelter.**
- **Organizations/community groups not pre designated "official relief sites" are often not prepared with the technical knowledge, expertise, nor supplies to assure safe practices for mass feeding, emergency water disinfection or onsite sanitation issues.**
- **Identified as an issue in the North Coast 2008 Winter Storm After Action Report - Informal community feeding sites opened up and accepted privately donated perishable foods that did not meet the acceptable cold chain requirements. Serving foods not in compliance with cold chain requirements, in addition, to foods from unapproved sources creates a high risk for food borne illness.**
- **Assuring that volunteer mass feeding/ shelter operations conform to appropriate practices for safe food, water, sanitization is essential in the aftermath of a disaster to prevent food borne illnesses or the spread of communicable diseases.**

Ideas for Implementation:

1. **Provide targeted outreach and preparedness trainings in the areas of emergency food salvaging, food preparedness, water disinfection, and sanitation practices to volunteer groups/organizations that could provide group-setting services after a disaster.**

2. **Provide a resource guide and ready to use safe food handling kit to feeding sites and shelters.**

3. **Conduct a tabletop exercise with external partners to identify strategic locations for food receiving, storage and distribution, and an improved public communication strategy regarding food safety during disasters.**

Coordinating Organization:	Clatsop County Health and Human Services, Environmental Health

Internal Partners:	External Partners:
	Clatsop County food banks **Clatsop County Community Action** **North Coast Meals on Wheels** **Department of Agriculture** **Potential community meal sites**

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
X		

Form Submitted by:	Maureen Taylor, Environmental Health Clatsop County Health and Human Services 503-325-8500 x1927

. Multi-Hazard #21

Proposed Action Item:	**Alignment with Plan Goals:**
Mitigating the risk of communicable disease in vulnerable, congregate settings.	*Protect life*

Rationale for Proposed Action Item:

- **The control of communicable diseases depend on a healthy environment-clean water, adequate sanitation, vector control, shelter, population immunization and health care workers trained in early diagnosis and treatment. Disasters compromise the infrastructures that support healthy environments.**
- **Congregate facilities in a disaster impact zone could have varying degrees of damage to their water, sewer, and power infrastructures.**
- **People affected by disasters are particularly vulnerable to communicable diseases due to stress, fatigue, malnutrition, and unsanitary living conditions.**
- **Communicable disease outbreak risk factors are associated with water and vector borne diseases, and contagious diseases spread by the close personal contact in crowded temporary accommodations, such as shelters.**
- **Community organizations identified as potential congregate settings should be prepared in: general infection control and prevention, monitoring for and management of persons with infectious diseases and response plans to manage potential gastrointestinal and respiratory diseases outbreaks.**

Ideas for Implementation:

1. **Provide consultation/trainings to community organizations, municipalities, and other groups who will provide post disaster relief services in a congregate setting, on recommended guidelines for prevention and control of communicable diseases.**

2. **Provide information packets with ready to use fact sheets, check lists, and infectious disease control & prevention protocols.**

Coordinating Organization:	**Clatsop County Health and Human Services**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	**Unknown at this time**
X		

Form Submitted by:	**Maureen Taylor, Environmental Health Clatsop County Health and Human Services 503-325-8500 x1927**

Multi-Hazard #22

Proposed Action Item:	Alignment with Plan Goals:
Develop a disaster debris management plan	***Minimize damage to public and private buildings and infrastructure*** ***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- **It is important for the county to develop a plan to better coordinate debris management following a disaster. In our county, it is particularly important because of the distance to landfills.**
- **Establishing beneficial uses for recovered materials will help to reduce the amount that goes to landfills.**
- **One option is using ground woody debris (which made up the majority of the Dec 2007 storm's debris) for energy by sending it to local mills to be used as hog fuel.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	External Partners:
Clatsop Co. Planning Dept.	**Western Oregon Waste Co.**

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Laura Leebrick, W.O.W.**

Multi-Hazard #23

Proposed Action Item:	**Alignment with Plan Goals:**
Increase public education and outreach in natural hazards which affect the north coast	*Increase education and awareness of the risks and hazards in Clatsop County*

Rationale for Proposed Action Item:

- **Following the December 2007 storm, it became clear that better education and outreach efforts are needed to inform the county's citizens about the hazards which affect us and how to prepare and mitigate for them.**
- **Education programs play a pivotal role in reducing risk from coastal hazards. Techniques used for hazard preparedness by an individual are primarily a function of their level of awareness. Realistic perceptions can minimize potential risk by influencing siting and design decisions. An educated community has a greater likelihood of making decisions that will reduce risk in coastal hazard situations.**
- **The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the County's actions to mitigate hazards.**

Ideas for Implementation:

- **Tie county efforts to state efforts**
- **Coordinate efforts with other local groups involved in education and outreach.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
	Lower Columbia Preservation Society, Long-term Disaster Recovery Committee, Astoria Visual Arts, Oregon Emergency Management

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #1

Proposed Action Item:	**Alignment with Plan Goals:**
Rebuild four Seaside School District schools outside of the tsunami inundation zone.	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Four out of five schools in the Seaside School District are located in the tsunami inundation zone and are located at elevations of 7 feet or less.**
- **DOGAMI estimates that the average wave height for the Cascadia Subduction Zone will be 40 – 50 feet.**

Ideas for Implementation:

- **Partner with DOGAMI to determine adequate elevations for the relocation**
- **Secure bonds to fund the relocation efforts**
- **Partner with the Cities to identify potential new properties outside of the inundation zone.**

Coordinating Organization:	**Seaside School District**

Internal Partners:		**External Partners:**
		City of Cannon Beach, City of Seaside, City of Gearhart, Weyerhauser Co.
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #2

Proposed Action Item:	**Alignment with Plan Goals:**
Build "tsunami towers" in coastal cities	***Protect life***

Rationale for Proposed Action Item:

- **Tsunami towers are tall, reinforced buildings (think giant lighthouse-like structure) which can provide for quick evacuations in tsunami zones that do not have nearby high ground to get to. These structures would be visible icons that can provide tsunami awareness simply due to their prominence in the area. They can also be built in an aesthetically pleasing fashion which could provide an added tourist attraction for the area.**
- **Tsunami towers have already been employed in Japan and can provide guidance for building them.**
- **The area where a tsunami tower can be most effective is perhaps Seaside due to the large number of tourists that congregate there, combined with the fact that there is no nearby high ground.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County, Coastal cities**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #3

Proposed Action Item:	Alignment with Plan Goals:
Complete tsunami risk assessment for Clatsop County	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services* *Protect natural and cultural resources*

Rationale for Proposed Action Item:

- **The tsunami inundation maps completed in 1995 are no longer adequate. The Indian Ocean tsunami in 2004 has resulted in better modeling capabilities.**
- **Cannon Beach received new tsunami maps in 2008 from DOGAMI which showed a substantial increase in the inundation zones. DOGAMI needs to expand its new modeling to include the entire county.**

Ideas for Implementation:

- **Continue mapping efforts for other tsunami prone areas in Clatsop County**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:		External Partners:
		City of Cannon Beach, City of Gearhart, City of Seaside, City of Warrenton, City of Astoria, DOGAMI
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #4

Proposed Action Item:	**Alignment with Plan Goals:**
Improve public notification and warning system	*Protect life* *Increase education and awareness of the risks and hazards in Clatsop County*

Rationale for Proposed Action Item:

- **The current public notification system along the coastline is patchy and not integrated. The County can collaborate with each of the coastal cities to ensure that sirens that are voice capable are able to be heard in all critical inundation zones.**
- **The coordination of a warning alert to the local level is as important is the alert itself**

Ideas for Implementation:

- **Purchase sirens that are voice capable.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
Clatsop County	**Coastal Cities**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	X	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #5

Proposed Action Item:	**Alignment with Plan Goals:**
Relocate Arch Cape Fire Stations out of the tsunami inundation and flood zones.	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **The Cannon Beach Fire Station was relocated out of the old tsunami inundation zone level. However, new tsunami modeling has indicated that the tsunami hazard area is much greater than originally identified and the relocated Cannon Beach Fire Station is still located in the inundation zone.**
- **The Arch Cape Fire Station is located in a flood hazard area.**

Ideas for Implementation:

- **Cannon Beach has purchased new property outside the inundation zone, but needs to seek funding for the construction costs.**

Coordinating Organization:	**Cannon Beach Fire**

Internal Partners:	**External Partners:**
	Clatsop County

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #6

Proposed Action Item:	Alignment with Plan Goals:
Elevate Brownsmead Rural Fire District Station	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Station is located in tsunami inundation zone, but needs to stay where it is located in order to be centrally located within the community.**
- **Most of Brownsmead is in the Tsunami inundation zone making it hard to relocate the station to higher ground, therefore elevating the station in its current location is the preferred option.**

Ideas for Implementation:

- **FEMA Pre-disaster mitigation grant program combined with local funding avenues**

Coordinating Organization:	**Knappa Fire**

Internal Partners:	External Partners:
Clatsop County	**Fire Defense Board, Watershed Council**

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	X	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #7

Proposed Action Item:	Alignment with Plan Goals:
Establish long term supply and assembly areas outside of inundation zones.	*Decrease disruption to critical services* *Increase cooperation and collaboration among County partners*

Rationale for Proposed Action Item:

- **To prepare for a tsunami, emergency supply locations will need to be identified and established in areas near tsunami-prone population centers, but outside the inundation zones.**
- **The City of Seaside has already begun this process.**

Ideas for Implementation:

- **Coordinate with Seaside to expand the program to include the rest of the inundation zones within the County.**

Coordinating Organization:	Clatsop County Emergency Management

Internal Partners:	External Partners:
	All cities and population centers in inundation zones

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	X	

Form Submitted by:	Clatsop County Steering Committee

Tsunami #8

Proposed Action Item:	**Alignment with Plan Goals:**
Upgrade and improve evacuation routes as well as assembly areas outside of tsunami inundation zones	*Protect life* *Increase education and awareness of the risks and hazards in Clatsop County*

Rationale for Proposed Action Item:

- **Currently the evacuation routes and assembly areas that exist are not well defined or are inadequate for the total population of locals and visitors. The County should coordinate with each of the coastal cities to develop a more comprehensive county-wide evacuation map which can be disseminated to the public.**
- **Additionally, these evacuation routes should be better marked and maintained.**
- **These would be easily accessible sites on high ground with pre-staged food, water, tents, medical supplies, helicopter pad, generators and other necessities**
- **A network of government-funded evacuation trails. These would be designed and maintained to remain passable after a major quake, leading from low-lying areas to high ground above tsunami inundation zones.**

Ideas for Implementation:

- **Identify where current evacuation routes and assembly areas are located**
- **Identify where additional pedestrian evacuation routes could be developed.**

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
Clatsop Co Planning Dept	**Population centers at risk of tsunami inundation.**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #9

Proposed Action Item:	**Alignment with Plan Goals:**
Seismic vulnerability assessment/vertical evacuation routes	***Protect life***

Rationale for Proposed Action Item:

- **Survey all tall buildings in the County to determine which buildings will be standing after an earthquake in order to design vertical evacuation routes during tsunami events.**
- **The Disaster Mitigation Act of 2000 requires communities to assess their vulnerability to natural hazards, particularly by identifying the types and number of buildings, infrastructure, and critical facilities that could be affected.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #10

Proposed Action Item:	**Alignment with Plan Goals:**
Conduct preliminary research on the development of a County Land Use Ordinance relating to Tsunami Hazards	*Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **A Tsunami Hazards Overlay district may be a useful tool for planners to address the issues involved in land ownership in a tsunami inundation zone. Things such as landowner education for new homeowners may help to increase tsunami awareness on the coast.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Planning Department**

Internal Partners:	**External Partners:**
Clatsop Co. Emergency Management	

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Tsunami #11

Proposed Action Item:	**Alignment with Plan Goals:**
Establish high ground commercial districts (above tsunami lines)	*Minimize damage to public and private buildings and infrastructure* *Reduce economic loss*

Rationale for Proposed Action Item:

- **High ground commercial zones can be established to encourage new or relocating businesses to establish themselves above tsunami zones. This will ensure that in the event of a disaster, there will be some businesses that are still operational and can help to serve the public following a disaster.**
- **They could also possibly serve as shelters.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County, Cities**

Internal Partners:	**External Partners:**
Clatsop County Emergency Management	

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Jessica Long, Residential Property Appraiser**

Wind/Winter Storm #1

Proposed Action Item:	**Alignment with Plan Goals:**
Develop and implement hazard tree program	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Protect natural and cultural resources*

Rationale for Proposed Action Item:

- **Lack of hazard tree inventories or management plans**
- **Wind and winter storms have the potential to down trees, causing injuries and damage to property and infrastructure. In counties with a high level of risk to wind and winter storms, developing and implementing programs to reduce the potential for wind and winter storms to cause damage by downing trees can assist a community in mitigating its overall risk to wind and winter storms.**
- **The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause damage by downing trees can assist a community in mitigating its overall risk to wind and winter storms.**

Ideas for Implementation:

- **Each city in Clatsop county is working from hazard tree management plans that are tailored to the needs of, and resources available to that city**
- **Partner with Oregon Department of Forestry to develop and implement program.**
- **Utilize low-cost access to tree inventory software specific to coastal communities acceptable to FEMA for resource damage reimbursements hoping to be made available by Oregon Department of Forestry**
- **Utilize existing Master Gardener participants in hazard tree programs**

Coordinating Organization:	**Clatsop County Public Works Dept.**

Internal Partners:	**External Partners:**
Clatsop County Public Works Dept. **Clatsop County Planning Dept.**	**Oregon Dept. of Forestry, Cities, OSE Extension**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
x		

Form Submitted by:	**Clatsop County Steering Committee**

Wind/Winter Storm #2

Proposed Action Item:	**Alignment with Plan Goals:**
Promote tree planting projects on private and public properties	*Minimize damage to public and private buildings and infrastructure* *Protect natural and cultural resources*

Rationale for Proposed Action Item:

- **Significant and additional community tree damage due to inadequate tree care after storm event, which may contribute to decrease in environmental services derived from community trees (wind buffering, wildlife habitat, erosion control, stormwater mitigation, etc.**
- **Landscaping and vegetation make a difference in mitigating the impacts of natural hazards. Trees break the force of the wind and stabilize the soil. Wetlands absorb much of the overflow from stream channels. Fire-resistant vegetation can retard the spread of wildfires toward vulnerable buildings. Planners can use landscaping requirements to preserve or enhance he protection such natural features afford. These requirements may be part of site plan reviews or a separate set of zoning regulations and environmental performance standards.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Public Works Dept.**

Internal Partners:	**External Partners:**
Clatsop County Public Works Dept. **Clatsop County Planning Dept.**	**Oregon Dept. of Forestry, cities, utility companies, nurseries, homeowners**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	x	

Form Submitted by:	**Clatsop County Steering Committee**

Wind/Winter Storm #3

Proposed Action Item:	**Alignment with Plan Goals:**
Have one to three ISA-certified arborists in each community that know how to properly prune storm damaged trees	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Current lack of ISA certified arborists in rural NW Oregon to meet local community needs**
- **Debris clearance is often traffic clearance as well, to the extent that roadways are blocked by felled trees or flood muck and thus impede other recovery functions.**
- **Ensuring the smooth function of this service also speeds the clearance of debris-ridden sites so that properties may be repaired and rebuilt, and enhances the prospects for economic recovery by eliminating potential eyesores.**
- **Debris management needs to be determined prior to a hazard to ensure a coordinated response.**
- **Often times, debris management is one of the largest local expenditures following a disaster. Having a plan ahead of time may assist the community in curbing excess spending post disaster.**

Ideas for Implementation:

- **Facilitate ISA arborist training and recruitment during Spring 2008**
- **Encourage interested participants to take ISA exam**
- **Work with ISA to hold certification exam on North Coast in 2009**

Coordinating Organization:	**Clatsop County Public Works Dept., Cities**

Internal Partners:	**External Partners:**
Clatsop County Public Works Dept. **Clatsop County Planning Dept.**	**Cities, local businesses, OSU Extension, ODF**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
x		

Form Submitted by:	**Clatsop County Steering Committee**

Wind/Winter Storm #4

Proposed Action Item:	**Alignment with Plan Goals:**
Heightened awareness by First Responders and appropriate city staff of the factors contributing to tree stability	*Increase education and awareness of the risks and hazards in Clatsop County*

Rationale for Proposed Action Item:

- **Potential for increased tree hazard in and around people and homes over time**
- **The Disaster Mitigation Act of 2000 requires communities to identify mitigation actions that are being considered by the community to reduce the effect that natural hazards will have on the community [201.6(c)(3)(ii)]. Developing and implementing programs to reduce the potential for wind and winter storms to cause damage by downing trees can assist a community in mitigating its overall risk to wind and winter storms.**
- **Wind and winter storms have the potential to down trees, causing injuries and damage to property and infrastructure. In counties with a high level of risk to wind and winter storms, developing and implementing programs to reduce the potential for wind and winter storms to cause damage by downing trees can assist a community in mitigating its overall risk to wind and winter storms.**

Ideas for Implementation:

- **Broadly disseminate *How to Recognize Hazard Trees* brochure (with PNW-ISA, OEM); conduct training if there is enough interest**
- **Seek FEMA mitigation funds for local cost share grants**

Coordinating Organization:	**Clatsop County Planning Dept., Clatsop County Public Works Dept.**

Internal Partners:	**External Partners:**
Clatsop County Public Works Dept. Clatsop County Planning Dept.	**ODF, OSU Extension, citizens, local businesses, OEM/HMGP**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
x		

Form Submitted by:	**Clatsop County Steering Committee**

Wind/Winter Storm #5

Proposed Action Item:	**Alignment with Plan Goals:**
Educate homeowners about methods to tie down metal roofs and metal sheds.	*Minimize damage to public and private buildings and infrastructure* *Increase education and awareness of the risks and hazards in Clatsop County*

Rationale for Proposed Action Item:

- **During the December 2007 windstorm, metal roof and metal sheds caused secondary damage when they became windborne. This is because many of those roofs and sheds are not secured very well to a solid foundation. This action is to develop an education program to get information out to the public on securing these types of structures.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Planning/Building**

Internal Partners:	**External Partners:**
Clatsop Co Emergency Mgmt	**Manufacturers, distributors of these types of structures**
Timeline:	**If available, estimated cost:**

Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Wind/Winter Storm #6

Proposed Action Item:	**Alignment with Plan Goals:**
Identify major transportation routes that are at risk during a major storm event	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Use this data when considering capital improvement projects and maintenance activities within County maintained transportation system.**
- **Develop and publicize alternative transportation routes in the event that a major winter storm event restricts access to essential County and State transportation routes.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Transportation and Development Dept.**

Internal Partners:	**External Partners:**
Other County departments	

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Earthquake #1

Proposed Action Item:	**Alignment with Plan Goals:**
Retrofit County bridges that are identified by a seismic vulnerability assessment	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Conduct a seismic vulnerability assessment and then use it to retrofit bridges identified as in need of retrofitting.**
- **Planning post-disaster transportation strategies ahead of time will assist communities in disaster recovery efforts. "The condition of bridges and streets is a very important component of post-disaster data assessment." In addition, "damaged transportation systems may delay the arrival of goods, services, and resources vital to response and recovery efforts."**
- **This was one of the Steering Committee's top three priorities for 2008-2009.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Earthquake #2

Proposed Action Item:	**Alignment with Plan Goals:**
Complete seismic vulnerability assessment of County owned bridges	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **There are isolated "nodes" of development in the County that may become more isolated by damaged bridges.**
- **Planning post-disaster transportation strategies ahead of time will assist communities in disaster recovery efforts. "The condition of bridges and streets is a very important component of post-disaster data assessment." In addition, "damaged transportation systems may delay the arrival of goods, services, and resources vital to response and recovery efforts."**

Ideas for Implementation:

- **Look at ODOT's County owned bridge list and determine priority for retrofits**
- **Utilize the results of this assessment to aid in identifying potential shelter locations.**

Coordinating Organization:	**Clatsop County Planning**

Internal Partners:	**External Partners:**
	ODOT

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Earthquake #3

Proposed Action Item:	**Alignment with Plan Goals:**
Seismic upgrades for the Ecola Creek Bridge in Cannon Beach (Hwy 101)	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **This bridge was washed out during the 1964 tsunami event.**
- **The bridge is the only ingress/egress on the north side of the city.**

Ideas for Implementation:

- **Partner with ODOT to develop implementation strategy**

Coordinating Organization:	**City of Cannon Beach**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Earthquake #4

Proposed Action Item:	**Alignment with Plan Goals:**
Complete a seismic vulnerability assessment for Port of Astoria facilities.	*Protect life* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Much of the Port land has been created by fill, and as a result, the port facilities are particularly vulnerable to earthquakes. The Port needs a comprehensive seismic vulnerability assessment performed on all of the facilities at the port in order to identify those areas in need of seismic upgrades.**
- **A seismic event may negatively impact a local economy, especially if a community's businesses are located in unreinforced masonry buildings. Completing an inventory of commercial buildings that may be vulnerable to earthquake damage will assist a community in prioritizing buildings for seismic retrofit.**
- **The Disaster Mitigation Act of 2000 requires communities to identify actions and projects that reduce the effects of hazards on the community [201.6(c)(3)(ii)]. Implementing seismic hazard area ordinances will reduce a community's vulnerability to seismic hazard by helping communities identify what steps should be taken to minimize damage from earthquakes.**

Ideas for Implementation:

Coordinating Organization:	**Port of Astoria**

Internal Partners:	**External Partners:**
	DSL, City of Astoria

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Earthquake #5

Proposed Action Item:	**Alignment with Plan Goals:**
Develop incentive programs to encourage homeowners to do seismic retrofits.	*Protect life* *Minimize damage to public and private buildings and infrastructure*

Rationale for Proposed Action Item:

- **Incentive programs include a variety of benefits to building owners or developers that help to offset the cost of mitigation. Examples of possible incentive programs include: density bonuses, tax credits, property tax incentives or deferrals, real estate disclosures, property acquisition or purchase of development rights, increased funding of public infrastructure programs, and phasing retrofitting programs over a longer period of time.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Emergency Management**

Internal Partners:	**External Partners:**
	City of Cannon Beach, City of Gearhart, City of Seaside, City of Warrenton, City of Astoria

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Earthquake #6

Proposed Action Item:	Alignment with Plan Goals:
Seismic retrofitting of old Hamlet Fire Station	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **The Hamlet fire station needs to be upgraded and retrofitted to be able to withstand an earthquake**
- **"For governments, less damage to government structures will mean continued services and normal processes or at least minimal interruptions. If government structures come through an earthquake with little or no damage, agencies will not have to relocate services, and public officials can respond to the immediate and long-term demands placed on them by the event. In short, seismic rehabilitation as a pre-event mitigation strategy actually will improve post-event response by lessening life loss, injury, damage, and disruption."**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County, Hamlet RPFD**

Internal Partners:	External Partners:

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Bill Boone, Hamlet RFPD**

Flood #1

Proposed Action Item:	Alignment with Plan Goals:
Partner with ODOT to elevate Highway 101 roadbed to an elevation sufficient to avoid annual winter flooding on multiple sections between the City of Seaside and the Junction of Highways 101 and 26.	***Minimize damage to public and private buildings and infrastructure*** ***Decrease disruption to critical services***

Rationale for Proposed Action Item:

- **Routine winter flooding of this section of Highway 101 has several negative effects:**
  - **Disrupts coastal economy from Tillamook to Astoria and beyond**
  - **Prevents or delays timely ambulance response between Seaside and points south and west.**
  - **Prevents or delays police and fire mutual support to and from Seaside during emergencies.**
  - **Prevents or delays routine patrols by Oregon State Police and Clatsop County Sheriffs Office.**
  - **Damages vehicles attempting to drive through the flooded sections of roadway**
  - **Causes vehicles to be swept off the roadway while attempting to drive through sections of flooded roadway, posing a threat to life.**
  - **Consumes many hours of labor for ODOT and other public agencies attempting to control or warn motorists of the hazard**
  - **Consumes motorist funds for towing and repairs to vehicles disabled by floodwaters.**
  - **Flooding on the highway can impact public safety as well as the economic vitality of communities in Clatsop County.**

Ideas for Implementation:

- **Gain political consensus for project from ODOT and affected counties, cities, state & federal agencies, and citizens**
- **Conduct engineering studies for raising roadway elevations or utilize existing studies in ODOT files.**
- **Prepare or utilize existing job specifications**
- **Estimate job costs**
- **Obtain funding**
- **Solicit bids for the specified work**
- **Award a contract for the work**
- **Complete the project**

Coordinating Organization:	State of Oregon, Dept. of Transportation

Internal Partners:		External Partners:
Division of State Lands, Dept. of Fish and Wildlife		FEMA, Clatsop County, Clatsop Co. Cities, Oregon Emergency Management
Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	Clatsop County Steering Committee

Flood #2

Proposed Action Item:	**Alignment with Plan Goals:**
Elevate runway at Port of Astoria airport and improve diking around the airport	*Minimize damage to public and private buildings and infrastructure* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **The runway is vulnerable to flooding and tsunamis.**
- **The US Coast Guard relies on the runway.**

Ideas for Implementation:

Coordinating Organization:	**Port of Astoria**

Internal Partners:	**External Partners:**
	Clatsop County, City of Warrenton, FAA

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Flood #3

Proposed Action Item:	Alignment with Plan Goals:
Complete a risk assessment related to levees in the County and adjacent development	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Clatsop County has a policy that allows development behind diked lands. Because of this, a risk assessment needs to be performed county-wide to evaluate the potential for dike failures.**
- **The 2000 Disaster Mitigation Act states that technical and financial assistance for Pre-Disaster Mitigation may be used to improve assessments of a community's vulnerability to natural hazards. Collecting data for non-declared natural hazards events will assist communities in determining overall vulnerability and risk to natural hazards.**

Ideas for Implementation:

- **Explore opportunities for transfer of development rights.**

Coordinating Organization:	**Clatsop County Planning**

Internal Partners:	External Partners:
	Department of Land Conservation & Development

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Flood #4

Proposed Action Item:	**Alignment with Plan Goals:**
Westport Railroad Bridge (71.3) replacement	*Minimize damage to public and private buildings and infrastructure* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **The railroad bridge is made up of many rows of trestles which cause debris to pile up against during flooding events. This debris jam causes Plimpton Creek to overflow at the bridge and flood surrounding homes.**
- **The goal of the project would be to replace the trestle bridge with an open span bridge, thus allowing flood debris to flow underneath without causing flooding in Westport.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County**

Internal Partners:	**External Partners:**
	Railroad Company, State Agencies

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
	X	

Form Submitted by:	**Clatsop County Steering Committee**

Flood #5

Proposed Action Item:	**Alignment with Plan Goals:**
Provide support and assistance to diking districts in respect to accreditation of the County's levees.	*Minimize damage to public and private buildings and infrastructure* *Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **With the new flood map revisions FEMA is in the process of decertifying almost all of the dikes (levees) in the county. This results in a higher BFE of many places and the inclusion in a flood zone for others (when they previously were excluded because of levee protection).**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Planning Department**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Flood # 6

Proposed Action Item:	Alignment with Plan Goals:
Continue compliance with the National Flood Insurance Program (NFIP).	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services* *Increase education and awareness of the risks and hazards in Clatsop County*

Rationale for Proposed Action Item:

- **The National Flood Insurance Program (NFIP) provides communities with federally backed flood insurance, provided that communities develop and enforce adequate floodplain management measures. According to the NFIP, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance.**
- **The Disaster Mitigation Act of 2000 requires that communities identify actions and projects that reduce the impact of a natural hazard on the community, particularly to new and existing buildings and infrastructure [201.6(c)(3)(ii)]. Continued participation in the NFIP will diminish flood damage to new and existing buildings in communities while providing homeowners, renters, and business owners additional flood insurance protection.**

Ideas for Implementation:

- **Actively participate with DLCD and FEMA during Community Assistance Visits. The Community Assisted Visit (CAV) is a scheduled visit to a community participating in the NFIP for the purpose of: 1) conducting a comprehensive assessment of the community's floodplain management program; 2) assisting the community and its staff in understanding the NFIP and its requirements; and 3) assisting the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered.**
- **Conduct an assessment of Clatsop County floodplain ordinances to ensure they reflect current flood hazards.**

Lead Agency:	Community Development

Internal Partners:	External Partners:
County Commission, Public Works	**FEMA**

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	
	LT (ongoing)	

Form Submitted by:	Clatsop County Steering Committee

Action Item Status: Pending

Landslide #1

Proposed Action Item:	**Alignment with Plan Goals:**
Build new access road on east side of Astoria from Hwy 30	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **If Leif Erickson Drive is blocked, such as through a landslide which occurs regularly, then there is no other access to Highway 30 heading east from Astoria**
- **Planning post-disaster transportation strategies ahead of time will assist communities in disaster recovery efforts. "The condition of bridges and streets is a very important component of post-disaster data assessment." In addition, "damaged transportation systems may delay the arrival of goods, services, and resources vital to response and recovery efforts."**

Ideas for Implementation:

- **Route the new road through Land Reserve Area**

Coordinating Organization:	**Clatsop County, City of Astoria, ODOT**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Rosemary Johnson, City of Astoria Planner**

Landslide #2

Proposed Action Item:	**Alignment with Plan Goals:**
Continue upgrading and enhancing County GIS	*Decrease disruption to critical services* *Increase cooperation and collaboration among County partners*

Rationale for Proposed Action Item:

- **This should be done in order to more efficiently identify areas prone to landslide and mass movement.**
- **The current landslide hazard maps are a compilation of the existing maps. These maps are a "work in progress" and have been compiled at widely varying scales and sometimes only depict risk for certain types of landslides. These various scales and levels of detail may lead to people to believe that some areas have no slope hazard, when the case is that those areas just have not been evaluated yet. Systematic upgrading of these maps will lead to greater understanding of hazard locales. Focusing on areas that will be developed and will affect people and critical infrastructure will improve land use planning and provide for more efficient and cost effective development.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Planning Department**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Landslide #3

Proposed Action Item:	**Alignment with Plan Goals:**
Develop alternative transportation routes around slide-prone areas in County	*Decrease disruption to critical services*

Rationale for Proposed Action Item:

- **Identify historically slide-prone areas and then develop alternative routes in advance of a slide event.**
- **This will help to reduce the time it takes to re-open a road following a slide.**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County Planning Department**

Internal Partners:	**External Partners:**

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Drought #1

Proposed Action Item:	Alignment with Plan Goals:
Investigate the viability of County-wide public awareness activities regarding water conservation	***Increase education and awareness of the risks and hazards in Clatsop County***

Rationale for Proposed Action Item:

- **Even though drought does not affect this county very often, it would be a positive to address water conservation in the event those steps are needed.**
- **"The Disaster Mitigation Act of 2000 requires that communities continue to involve the public beyond the original planning process [201.6(c)(4)(ii)]. Developing public education programs for hazard risk mitigation would be a way to keep the public informed of, and involved in, the County's actions to mitigate hazards."**

Ideas for Implementation:

Coordinating Organization:	**Clatsop County**

Internal Partners:	External Partners:

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	**Clatsop County Steering Committee**

Wildfire #1

Proposed Action Item:	Alignment with Plan Goals:
Develop and implement the Community Wildfire Protection Plan	*Protect life* *Minimize damage to public and private buildings and infrastructure* *Reduce economic loss* *Decrease disruption to critical services* *Increase cooperation and collaboration among County partners*

Rationale for Proposed Action Item:

- **The plan is needed to better address the very real dangers of wildfires in this forest rich county.**
- **Natural disasters, including earthquakes, tsunamis, tornadoes, hurricanes, flooding, and wildfires, pose great danger to human life and to property throughout the United States; (2) greater emphasis needs to be placed on- (A) identifying and assessing the risks to States and local governments (including Indian tribes) from natural disasters.**

Ideas for Implementation:

- **The process began in 2008 and will eventually be incorporated into the Wildfire Annex of the Pre-disaster mitigation plan.**

Coordinating Organization:	Clatsop County Emergency Management

Internal Partners:	External Partners:
	Fire Defense Board, etc.

Timeline:		If available, estimated cost:
Short Term (0-2 years)	Long Term (2-4 or more years)	

Form Submitted by:	Clatsop County Steering Committee

Appendix B: Planning and Public Process

The purpose of this appendix is to provide documentation of the planning and public process utilized to develop the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan.

2014 Natural Hazards Mitigation Plan Update

The following events and documents (where applicable) are included in the 2014 Update:

Date	Description
03/26/09	Steering Committee Meeting Agenda & Minutes
August 2009	Clatsop County Fair
08/27/09	Steering Committee Meeting Agenda & Minutes
10/10/09	Home Depot Safety Fair
05/19/10	Steering Committee Meeting Agenda & Minutes
August 2010	Clatsop County Fair
09/15/10	Steering Committee Meeting Agenda & Minutes
10/09/10	Home Depot Safety Fair
05/26/11	Steering Committee Meeting Agenda & Minutes
August 2011	Clatsop County Fair
10/08/11	Home Depot Safety Fair
11/22/11	Steering Committee Meeting Agenda & Minutes
06/20/12	Steering Committee Meeting Agenda & Minutes
August 2012	Clatsop County Fair
09/08/12	NW Natural Gas Preparedness Fair
11/25/12	Steering Committee Meeting Agenda & Minutes
04/25/13	Steering Committee Meeting Agenda & Minutes
09/14/13	NW Natural Gas Preparedness Fair
10/12/13	Home Depot Safety Fair
2014	Natural Hazards Mitigation Plan Update Survey
02/11/14	Planning Commission Meeting Agenda & Minutes
02/13/14	Press Release
02/19/14	EPREP Committee Meeting Agenda & Minutes
05/27/14	Steering Committee Meeting Agenda & Minutes
09/18/14	Emergency Operations Center Open House
09/24/14	Emergency Operations Center Open House
09/25/14	September Event Calendar – Paid Advertising
09/27/14	NW Natural Gas Preparedness Fair
09/27/14	Community Resilience Symposium
09/28/14	Race the Wave Preparedness Fair
10/09/14	October Event Calendar – Paid Advertising
10/18/14	Emergency Operations Center Open House

2008 Natural Hazards Mitigation Plan

The following documents were included in the original plan and descriptions are provided here as reference:

Date	Description
	Steering Committee MOU
	City/Special District Planning Process Handout
	Public Involvement Strategy
	Stakeholder Interview Summary
	Public Outreach Fliers & Talking Points
11/15/07	Steering Committee Meeting Agenda & Minutes
2/14/08	Steering Committee Meeting Agenda & Minutes
4/16/08	Steering Committee Meeting Agenda & Minutes
8/7/08	Steering Committee Meeting Agenda & Minutes
1/11/08	Newspaper Article
1/16/08	Newspaper Article
1/17/08	Newspaper Article
1/18/08	Newspaper Article
1/8/08	Press Release
3/27/08	Steering Committee Meeting Agenda & Minutes
4/22/08	Press Release
8/19/08	Newspaper Article
8/28/08	Steering Committee Meeting Agenda & Minutes
2/12/08	Open for Business Training
4/30/08	Emergency Preparedness Fair
5/1/08	NHMP Public Forum

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

March 26, 2009

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING August 27, 2009

HMP Meeting Minutes
March 26, 2008

MEETING CALLED TO ORDER:
10:03 AM by Convener Gene Strong Director Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 3/27/08 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke CREST, Jennifer Bunch, Clatsop County Planning Department, Margo Lalich/Maurine Taylor, Clatsop County Public Health, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, Doug Dougherty, Seaside School District, Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

NEW COMMITTEE MEMBERS
Thomas E. Manning CEM, OCEMS Emergency Management Coordinator for Clatsop County Emergency Services, Sheriff's Department, Alexander Bancke CREST who replaces Jay Flint.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. The question was brought to the committee by Thomas Manning if the plan will incorporate technological or manmade hazards into the plan, including resource shortages? At this time OEM only wanted Natural Hazards. There may be another plan to address these hazards. Gene Strong
b. City of Seaside Plan status.
   The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.

NEW BUSINESS

a. Wickiup Repeater Site: Clatsop County Emergency Services is developing a scope of work to present to OEM for submitting the grant request to move forward on the Wickiup Site. Dennis Sigrist our OEM SHMO is working with us at Emergency Management.

MEMBER/COMMITTEE REPORTS

None

PUBLIC COMMENT

None

GOOD OF THE ORDER

None

NEXT MEETING: August 27, 2009

ADJOURNMENT:

11:20 AM by Gene Strong

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

August 27, 2009

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING May 19, 2010

HMP Meeting Minutes
August 27, 2009

MEETING CALLED TO ORDER:
10:03 AM by Convener Gene Strong Director Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 3/26/09 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke CREST, Jennifer Bunch, Clatsop County Planning Department, Margo Lalich/Maurine Taylor, Clatsop County Public Health, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, Doug Dougherty, Seaside School District, Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. City of Astoria, needs to update the plan to identify our underground water distribution lines. Landslides are affecting our system.
b. City of Seaside Plan status.
   The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.

NEW BUSINESS

a. Wickiup Repeater Site: Clatsop County Emergency Services is still developing a scope of work to present to OEM for submitting the grant request to move forward on the Wickiup Site. Dennis Sigrist our OEM SHMO is working with us at Emergency Management.

MEMBER/COMMITTEE REPORTS

None

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PUBLIC COMMENT

None

GOOD OF THE ORDER
None

NEXT MEETING: May 19, 2010

ADJOURNMENT:
11:20 AM by Gene Strong

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

May 19, 2010

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING September 15, 2010

HMP Meeting Minutes
May 19, 2010

MEETING CALLED TO ORDER:
10:03 AM by Convener Gene Strong Director Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 08/27/09 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke C.R.E.S.T., Jennifer Bunch, Clatsop County Planning Department, Margo Lalich/Maurine Taylor, Clatsop County Public Health, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, , Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. City of Astoria, needs to update the plan to identify our underground water distribution lines. Landslides are affecting our system.
b. City of Seaside Plan status.
   The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.

NEW BUSINESS

a. Wickiup Repeater Site: Clatsop County Emergency Services has completed the scope of work, and is going though NEPA review. Dennis Sigrist is our State contact..

MEMBER/COMMITTEE REPORTS

None

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PUBLIC COMMENT

None

GOOD OF THE ORDER
None

NEXT MEETING: September 15, 2010

ADJOURNMENT:
11:05 AM by Gene Strong

Pre-Hazard Mitigation Steering Committee Meeting
May 19, 2010

1000 Hrs ... .Meeting called to order by Gene Strong / Introductions

1010 Hrs.....Discussion on Plan Review / Committee Members

- Update Priorities that have been met
- Add New Priorities
- Update Committee Membership
- Review new Hazard Analysis
- Any New / or Old Concerns
- Plan Update Process / Time Line

1130 Hrs.....Adjourn Committee Meeting – Gene Strong

2013
April 25th

* Need to meet twice a year

Action Items:

Jun, 20 @ 10:00AM
2012
~~Oct~~ 25
NOV

MARCH 4 Thursday (27)
AUGUST 4 TH (28) 2008

2009
MARCH (26)
(27)

2010 MAY (19)
SEPT (15)

2011
MAY (26)
NOV 22

DRAFT

HAZARD ANALYSIS

CLATSOP COUNTY SHERIFF'S OFFICE
EMERGENCY SERVICES DIVISION

January 29, 2009

By: Director Gene Strong Emergency Services
Thomas E. Manning CEM, ORCEMS

General Overview

Demographics

Clatsop County Population

Area	1970	1980	1990	2000	2004*
Clatsop County	28,473	32,489	33,301	35,630	36,400
Astoria	10,244	9,998	10,069	9,813	9,880
Seaside	4,402	5,193	5,359	5,900	6,080
Warrenton	1,825	2,495	2,681	4,096	4,330
Gearhart	829	967	1,027	995	1,040
Cannon Beach	779	1,187	1,221	1,588	1,650
Hammond	500	516	589	(see note)	
Unincorporated	9,894	12,136	12,355	13,238	13,420

Sources: US Census Bureau, Census 2000 (May 2001); 1990 US Census (for 1970, 1980 and 1990 figures); * Certified Estimates, July 1, 2004, Population Research Center, Portland State University.
Note: Hammond merged with Warrenton in 1991.

Income Levels - Clatsop County's economy relies on government-related activity, service businesses, retail sales, forestry, forest products processing, fishing and seafood processing, and tourism.

As the region's economy experiences growth in service industries, the region's income has fallen significantly below that of both the state and the nation, despite general growth in the economy.

2002 Per Capita Income

Clatsop County:	$25,196 (13th of Oregon's 36 counties)
Portland Metropolitan Service Area:	$32,167 (third highest in state)
Oregon 2003:	29,340
United States 2003:	$ $31,632

Source: Oregon Employment Department

Community - Residents and visitors alike enjoy art galleries, museums, live theater, concerts and other special cultural events. The Columbia River Maritime Museum has recently completed a $6 million expansion. The Astoria River walk and historic trolley, Fort Clatsop National Memorial, Fort Stevens State Park, the Seaside Community Center and swimming pool, and the Astoria Aquatics Center provide numerous opportunities for adults and scheduled activities for children.

Hospitals - Two hospitals serve Clatsop County: Columbia Memorial Hospital, located in Astoria, has 49 beds and 231 employees. It is designated as a Level II Trauma Center. Providence Seaside Hospital, located in Seaside, has 34 acute care beds, 22 extended care beds, and 188 employees. Both hospitals have 24-hour emergency rooms; helicopter landing pads, and a wide variety of services.

Schools -Talented teachers from around the country are attracted to the region. Clatsop Community College and five school districts are located in Clatsop County. Clatsop Community College has an enrollment of 6,000 students (full-time and part-time) and a faculty of 172.

Industry - Like other Northwest coastal resource-based communities, Clatsop County is working to diversify its economy to offset the loss of family-wage jobs in the timber and fishing industries. Our Timber and Fishing industry still plays a valuable piece of our local economy. Today major employers include Georgia Pacific, Columbia Memorial Hospital, Providence Seaside Hospital, Management Training Corporation, State of Oregon, U.S. Coast Guard, Fred Meyer, Safeway, Steve Martin Management (visitor accommodations), Clatsop County government, and the Astoria School District.

Availability - The labor market consists primarily of Clatsop (Oregon) and Pacific (Washington) counties. Using 2004 data from the Oregon Employment Department, Clatsop County's civilian labor force was 18,823. Pacific County's 2003 population estimate, based on 2000 US Census, is 20,900. The combined labor pool is 27,933 (Clatsop County, 18,823; Pacific County, 9,110).
The 2004 annual average unemployment rate in Clatsop County was 6.9%, below Oregon's 7.4% and the Portland Metropolitan Service area's 7.2% and above the nation's 5.5%. The current county unemployment rate is 7.0% (raw February 2005), and the state's is 7.5% (raw February 2005). Pacific County's November 2003 unemployment rate was 8.5%.

Sunset Empire Transportation District - Clatsop County is served by the Sunset Empire Transportation District, which provides intra- and intercity transit service. Transit routes and schedules are established to best serve the needs of residents and employers. The Astoria-Warrenton area currently is served with nearly hourly transit service from 7:00 a.m. to 6:00 p.m. Monday through Saturday. The Sunset Empire Transportation District Executive Director has assured that the District would work with private employers to make sure transit needs are met and to determine whether employer tax credits, shared costs, etc. are appropriate. The District's new Inter-model Transit Facility is located at the corner of 9th and Marine in Astoria.

Transportation - Three major highways converge in Clatsop County: Highway 101 (Pacific Coast Scenic Byway), Highway 26, and Highway 30. The Interstate I-5 four-lane, north-south freeway is at Longview, Washington, about 50 minutes east of Astoria. Clatsop County adopted its 20-year Transportation System Plan (TSP) in 2003. The TSP provides a comprehensive assessment of existing conditions and needed improvements and includes multi-modal plan elements to include highways, air, rail, transit and bicycle/pedestrian facilities.

Port of Astoria - Clatsop County is bordered by the Columbia River on the north and the Pacific Ocean on the west. Located at Columbia River Mile 13 from the open sea and less than 10 minutes from either the North Coast Business Park or the Airport Industrial Park, the Port's facilities are the first on the Columbia River and include three piers with five deepwater ship berths and a barge ramp.

The Port of Astoria's 2005 schedule includes stopovers by 14 cruise ships.

Rail service is available in Clatsop County. Portland & Western Railroad, Inc., owns the track that runs along the Columbia River between Portland and Tongue Point in east Astoria. The City of Astoria owns the line west of Tongue Point to the Port of Astoria.

Recreation - Clatsop County is a major recreation center for the Pacific Northwest and the nation, well known for its history and the many recreational opportunities afforded by the ocean beaches, dense forests, mountains, rivers, and streams. Miles of broad beaches offer beachcombing, digging for razor clams, and quiet walks. The communities of Gearhart, Seaside, and Cannon Beach are major beach resorts, each with a special character. Charter fishing boats leave Warrenton and Hammond filled with sports anglers. Anglers also try their luck casting into the surf, from jetties or from the banks of rivers, lakes and streams. Hunters find both variety and challenge in the Coast Range forests and in the area's marshes and estuaries. Other outdoor enthusiasts enjoy state parks and waysides that provide ocean views, picnic sites, miles of hiking and bicycle trails, and overnight campgrounds. Boaters find suitable waters in Clatsop County for waterskiing, rowing, or sailing. And for

Rail service is available in Clatsop County. Portland & Western Railroad, Inc., owns the track that runs along the Columbia River between Portland and Tongue Point in east Astoria. The City of Astoria owns the line west of Tongue Point to the Port of Astoria.

Clatsop County is a major recreation center for the Pacific Northwest and the nation, well known for its history and the many recreational opportunities afforded by the ocean beaches, dense forests, mountains, rivers, and streams. Miles of broad beaches offer beachcombing, digging for razor clams, and quiet walks. The communities of Gearhart, Seaside, and Cannon Beach are major beach resorts, each with a special character. Charter fishing boats leave Warrenton and Hammond filled with sports anglers. Anglers also try their luck casting into the surf, from jetties or from the banks of rivers, lakes and streams. Hunters find both variety and challenge in the Coast Range forests and in the area's marshes and estuaries. Other outdoor enthusiasts enjoy state parks and waysides that provide ocean views, picnic sites, miles of hiking and bicycle trails, and overnight campgrounds. Boaters find suitable waters in Clatsop County for waterskiing, rowing, or sailing. For golfers, there are four challenging courses. For the less active, Clatsop County is rich in historic lore and offers numerous activities and sites.

Climate - Clatsop County's climate is mild year-round. The mean temperature at Astoria ranges between 41 degrees F (5 degrees C) in January and 61 degrees F (16 degrees C) in August. There has been an average of one day each year with a temperature of over 90 degrees F (32 degrees C), and no days with temperatures below 0 degrees F (-17 C). There are usually one or two strong storms per year. The average wind speed is 8.5 miles per hour (13.7 km/hr). Normal precipitation at Astoria is about 70 inches (178 cm) per year, and generally more in the southern and inland parts of the county.

Hospitals - Two hospitals serve Clatsop County: Columbia Memorial Hospital, located in Astoria, has 49 beds and 231 employees. It is designated as a Level II Trauma Center. Providence Seaside Hospital, located in Seaside, has 34 acute care beds, 22 extended care beds, and 188 employees. Both hospitals have 24-hour emergency rooms, helicopter landing pads, and a wide variety of services.

Schools -Talented teachers from around the country are attracted to the region. Clatsop Community College and five school districts are located in Clatsop County. Clatsop Community College has an enrollment of 6,000 students (full-time and part-time) and a faculty of 172.

Astoria Regional Airport - Located on 870 acres in Warrenton, the airport is four miles south of downtown Astoria. The facility has a 5,796-foot runway serviced by ILS and VOR and an additional 4,990-foot VFR runway. This enables the facility to handle air traffic under all weather conditions. Fixed-base operators with fuel and tie-downs spaces are available. Coast Guard Group Astoria Headquarters, Coast Guard Air Station is located at the airport. The airport is supported by a NWS - ASOS automated weather Station. There is no scheduled passenger service at this time. United Parcel Service has twice-daily service to and from the airport and Federal Express uses the airport as demand warrants.

Telecommunications - Construction of a telecommunications fiber ring and the electronics necessary to establish route diversity via fiber to and from the Portland metropolitan area was completed in September 2002. DSL (Digital Subscriber Line) equipment was installed at the same time. A mini-ring to serve the North Coast Business Park and other Warrenton businesses and residences with full route diversity within the city was completed shortly thereafter, as well.

Oregon Emergency Management (OEM)
HAZARD ANALYSIS METHODOLOGY

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Completing the Narrative ..... page 4

Other Methodologies ..... page 4

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Additional Hazard Analysis Matrix ..... page 6

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BACKGROUND AND OVERVIEW

This hazard analysis methodology was first developed by FEMA circa 1983, and gradually refined by OEM over the years. During 1984, the predecessor agency to OEM (Emergency Management Division) conducted workshops around the State of Oregon that resulted in all of Oregon's 36 counties producing an analysis using this methodology. Since then, several cities have also conducted an analysis using this method.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible), one order of magnitude from lowest to highest. Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

For local governments, conducting the hazard analysis described in this document is a useful early step in planning for hazard mitigation, response, and recovery. This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest.

Among other things, this hazard analysis can:

- help establish priorities for planning, capability development, and hazard mitigation;
- serve as a tool in the identification of hazard mitigation measures;
- be one tool in conducting a hazard-based needs analysis;
- serve to educate the public and public officials about hazards and vulnerabilities; and
- help communities make objective judgments about acceptable risk.

HAZARD ANALYSIS MATRIX
WORKSHEET

JURISDICTION:

Hazards		History WF = 2	Vulnerability WF = 5	Maximum Threat WF = 10	Probability WF = 7	Total Score
Flood	WF X SR	2 X 10 =	5 X 9 =	10 X 8 =	7 X 10 =	215
	Sub score	20	45	80	70	
Wind Storm	WF X SR	2 X 10 =	5 X 7 =	10 X 8=	7 X 10 =	205
	Sub score	20	35	80	70	
Wildland Fire	WF X SR	2 X 10 =	5 X 9 =	10 X 9 =	7 X 10 =	225
	Sub score	20	45	90	70	
Earthquake/Tsunami	WF X SR	2 X 10 =	5 X 10 =	10 X 10 =	7 X 10 =	240
	Sub score	20	50	100	70	
HazMat	WF X SR	2 X 10 =	5 X 8 =	10 X 8 =	7 X 10 =	210
	Sub score	20	40	80	70	
Land Slide	WF X SR	2 X 10 =	5 X 9 =	10 X 8 =	7 X 10 =	215
	Sub score	20	45	80	70	
Snow & Freezing Rain	WF X SR	2 X 8 =	5 X 9 =	10 X 8 =	7 X 9 =	208
	Sub score	80	45	80	63	
Maritime Disasters	WF X SR	2 X 8 =	5 X 10 =	10 X 7 =	7 X 9 =	199
	Sub score	16	50	70	63	
Aircraft Incident	WF X SR	2 X 6 =	5 X 8 =	10 X 7 =	7 X 8 =	183
	Sub score	12	45	70	56	
Terrorism	WF X SR	2 X 5 =	5 X 8 =	10 X 5 =	7 X 5 =	140
	Sub score	10	45	50	35	
Coastal Erosion	WF X SR	2 X 10 =	5 X 8 =	10 X 7 =	7 X 8 =	191
	Sub score	20	45	70	56	
Drought	WF X SR	2 X 2 =	5 X 5 =	10 X 5 =	7 X 6 =	121
	Sub score	4	25	50	42	

Date: January 29, 2009 AGENCY: Clatsop County Emergency Services

HAZARD ANALYSIS MATRIX

Hazards		History WF = 2	Vulnerability WF = 5	Maximum Threat WF = 10	Probability WF = 7	Total Score
Dam Failure	WF X SR	2 X 2 =	5 X 5 =	10 X 6 =	7 X 8 =	180
	Sub score	4	25	60	56	
Resource Shortage	WF X SR	2 X 10 =	5 X 10	10 X 8 =	7 X 7 =	199
	Sub score	20	= 50	80	49	
Contagious Disease	WF X SR	2 X 10	5 X 10 =	10 X 8 =	7 X 5 =	185
	Sub score	20	50	80	35	
Civil Disturbance	WF X SR	2 X 8 =	5 X 6 =	10 X 6 =	7 X 8 =	162
	Sub score	16	30	60	56	
War	WF X SR	2 X 7 =	5 X 4 =	10 X 6 =	7 X 7 =	143
	Sub score	14	20	60	49	
Pest Infestation	WF X SR	2 X 10 =	5 X 4 =	10 X 3 =	7 X 9 =	133
	Sub score	20	20	30	63	
Volcano	WF X SR	2 X 4 =	5 X 7 =	10 X 6 =	7 X 6 =	145
	Sub score	8	35	60	42	

SEVERITY RATINGS (to be applied to the four categories)

LOW = 1 - 3 points
MEDIUM = 4 - 7 points
HIGH = 8 - 10 points

WF = weight factor
SR = severity rating

The following categories are used in developing the scores for this analysis:

HISTORY (record of previous occurrences)

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

VULNERABILITY (percentage of population and property likely to be affected)

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

MAX. THREAT (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 one incident likely within a 75 to 100 year period
MEDIUM one incident likely within a 35 to 75 year period
HIGH one incident likely within a 10 to 35 year period

NARRATIVE

Flood (215 Points)
Clatsop County has a long history of flooding along our coastal rivers and streams. Oregon has a detailed history of flooding with flood records dating back to the 1860s. The principal types of flood that occur in Clatsop County include: (1) riverine and (2) ocean flooding from high tides and wind-driven waves or tsunami event. There are two distinct periods of riverine flooding in this region, winter and late spring. The most serious flooding occurs during December, January, and February. The situation is especially severe when riverine flooding, caused by prolonged rain and melting snow, coincides with high tides and coastal storm surges.

Wind Storm (205 Points)
Destructive wind and winter storms that produce ice, rain and freezing rain, and high winds have a long history in Clatsop County. Severe storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March. Destructive windstorms are less frequent, and their pattern is fairly well known. They form over the North Pacific during the cool months (October through March), move along the coast and swing inland in a northeasterly direction. Wind speeds vary with the storms. Gusts exceeding 100 miles per hour have been recorded at several coastal locations.

Wildland Fire / Conflagration (225 Points)
Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property particularly in the state's growing rural communities. Wildfires are fires occurring in areas having large areas of flammable vegetation that require a suppression response. Areas of wildfire risk exist throughout the state with areas in central, southwest and northeast Oregon having the highest risk. Since some of our communities like Astoria are built on steep terrain with high-density structures, there remains a high likelihood for the potential of a catastrophic fire such as a conflagration that would require mutual aid from surrounding fire agencies.

Earthquake/Tsunami (240 points) An earthquake is the result of tectonic movement within the earth's crust. These changes are manifested as localized ground shaking and/or soil liquefaction. After the initial seismic event, tremors and aftershocks can occur for an extended period of time resulting in additional structural damage to buildings and public facilities. The largest earthquake in Oregon occurred in 1872 in the North Cascades. This earthquake had an estimated magnitude of 7.4 and was followed by many aftershocks. More recently, in 1993, a magnitude 5.7 earthquake caused significant damage to a bridge and numerous unreinforced masonry structures in Clackamas, Marion, and Yamhill counties, recent seismic events in Scott's Mills (March 1993) and Klamath County (September 1993) seem to indicate an increase in seismic activity in the state. Subduction zone earthquakes must also be considered a threat to Clatsop County residents. In the Pacific Northwest, oceanic crust is being pushed beneath the North American continent along a major boundary parallel to the coast of Washington and Oregon. This boundary, called the "Cascadia Subduction Zone," lies about 100 miles offshore and extends from the middle of Vancouver Island in British Columbia past Washington and Oregon to Northern California. Geologic evidence shows that the Cascadia Subduction Zone has generated great earthquakes (magnitude 9 or greater), and could generate several Tsunami waves which would washout infrastructure, and destroy homes and lifeline utilities, The most recent Cascadia Subduction was about 300 years ago. If a major earthquake were to occur, there would be no warning and the region-wide impact is likely to be quite severe. Extensive damage to private and public facilities could be expected along with mass casualties and disruption of transportation routes, communications, and public utilities. In addition, an earthquake may cause other hazards such as fires, floods associated with dam failures, and hazardous materials spills.

Hazardous Materials Incident (210 points) This hazard involves an accidental release or spillage of materials that have a detrimental impact on life, the environment, and/or property. This occurrence may be associated with long-term contamination or toxicity to the affected area. A hazardous material incident is most commonly associated with a transportation accident (highway, rail, or waterway), but an incident may also be associated with a fixed facility. Clatsop County has, in addition to some locations where hazardous materials are manufactured or used, areas where those materials are stored, such as distributor petroleum product tank farms. The seafood processing industry uses large quantities of anhydrous ammonia that could become a hazard in the event of a fire or a seismic event. Cargo ship traffic represents a potential incident of horrific proportions.

Landslide (215 Points)
Landslides are a major geologic threat in almost every state in the United States. In Oregon, a significant number of locations are at risk from dangerous landslides and debris flows.
While not all landslides result in property damage, many landslides do pose serious risk to people and property. Rain-induced landslides and debris flows can potentially occur during any winter in Clatsop County.

Winter Storm (Snow/Ice/Extreme Cold - 205 points) The history with the Coastal Mountain range, have produced strong pacific storms where inclement weather is always a possibility, especially during the winter months. While annual snowstorms rarely pose more than an inconvenience, there are occasionally severe storms, which can cause area-wide power disruptions. In addition, heavy snowfall can curtail transportation not only within the county, take down thousand of trees blocking routes leading into and out of the county. Vulnerability: Because of the diverse terrain within the county, it is difficult to estimate the impact on the population. However, if a major storm, with snow levels down to 500 feet materialized, it is possible that up to 60% of the county's population could be affected. That same type storm could affect up to 50% of the county itself. Maximum threat: Based on a worst-case scenario, up to 90% of the county's population could experience some difficulty in the form of power outages, inability to drive, etc. Up to 70% of the county itself could be affected. Probability: There have been a number of major winter storms over the past ten years, and there is no reason to believe that the possibility will decrease in the future.

Maritime Disasters

Clatsop County is Oregon's Shipping hub, where thousands of ships load and unload cargo for North America and for World Trade. The shipping lanes can be very dangerous coming in off of the Pacific Ocean into the Columbia River during storm and high surf events. Accidents can and do occure on a regular basis. The potential of a HazMat incident is very high. If the Shipping lanes we blocked, this could lead to major resource shortages.

Aircraft Mishap or Incident

These incidents are few and far between, however, the potential for a serious disaster can occur due to fog and limited visibility during storms or even from a mechanical failure. Since we have high density populations located in our county an aircraft crashing to one of these areas would be catastrophic.

Terrorism (140 Points)

Clatsop County has experienced ecco-terrorism against our Timber Industry. Law enforcement works closely with the Portland F.B.I. and other Terrorism Task Forces. Terrorism has the potential to disrupt our community and put our citizen at risk.

Coastal Erosion (191 Points)
Coastal erosion is a natural process that continually affects the entire coast. Erosion becomes a hazard when human development, life and safety are threatened. Coastal erosion processes create special challenges for people living near the ocean, requiring sound planning in order to minimize the potential dangers to life and property. Attempts to stabilize the shoreline or beach are often futile because the forces that shape the coast are persistent and powerful. Inadequate understanding of the complex interaction of coastal land forms and waters and the various types of coastal erosion can result in serious threats to people, communities and infrastructure.

Drought (121 Points)
Droughts are not uncommon in the State of Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state, in both summer and winter. There are no records of a severe drought in Clatsop County. Drought is averted as a result of the County's high rainfall from moist air masses moving onto land from the Pacific Ocean, especially during winter months.

Dam Failure (180 Points)
Fish Hawk Lake Dam has the potential of breeching if proper maintenance is not kept up, such as cleaning the Glory Hole over Dam Spillway. This Dam is an Earthen Dam and does not meet the National Dam Safety Standards. In the event of a Cascadia Subduction Earthquake there would be a real likelihood that the Dam would fail. This Dam is owned and operated by a private organization. If the Dam were to fail the Nehalem River would flood and create a large path of destruction.

Resourse Shortage (199 Points)
Most transportation routes in Clatsop County are susceptible to blockage due to landslides, floods or downed trees. This creates a special problem for re-supplying our stores, gas stations and even medical supplies. In a mass casualty incident we will need supplies to augment our one mass casualty trailer located in North and South County.

Contagious Disease/Bio Hazards (185 Points)
We are also susceptible to bio-hazards which can lead to an epidemic, or overwhelm the limited resources of the County. Influenza can affect our at-risk population and limited Updated health care and EMS system. The Clatsop County Heath Department monitors our vulnerability on a daily basis and works closely with State Health.

Civil Disturbance (162 Points)
No one is immune to Civil uprising, this can be triggered by strong political views, resource shortages, job loss, a local, State or National depression , or a long-term recovery operations following a disaster where many people have been dislocated and have lost homes and loved ones.

War (143 Points)
The United States has entered into several wars historically, and since Clatsop County is a coastal community there is always a potential that enemy combatants can enter our Country by way of the Pacific Ocean. Civil Defense or Emergency Services will notify the public if we are under attack, or may need to shelter in place as needed.

Pest Infestation (133 Points)
Pest infestation can destroy our timber industry and can have a devastating effect on our community. Pest infestation such as West Nile Virus can have limited impacts on our community and would have a higher risk factor on our senior citizens, children and individuals with chronic illnesses. These and other diseases can have serious health concerns including death for our at-risk population. Other diseases and heath concerns can lead to a localized epidemic if not properly managed.

Volcano (145 Points)

The Cascade Range of the Pacific Northwest has more than a dozen active volcanoes. These snow-clad peaks are part of a 1,000 mile-long chain of mountains, which extend from southern British Columbia to northern California. Although there are no active volcanoes in Clatsop County it is important for counties to know the potential impacts of nearby volcanoes. While immediate danger area around a volcano is approximately 20 miles, ash fall problems may occur as much as 100 miles or more from a volcano's location; therefore, ash fall my affect Clatsop County.

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

September 15, 2010

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING May 26, 2011

HMP Meeting Minutes
September 15, 2010

MEETING CALLED TO ORDER:
10:03 AM by Convener Gene Strong Director Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 08/27/09 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke C.R.E.S.T., Jennifer Bunch, Clatsop County Planning Department, Margo Lalich/Maurine Taylor, Clatsop County Public Health, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, , Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. City of Astoria, is requesting disaster assistance to cost share the replacement and moving of their waterline for a mitigation activity, it may work under 406 mitigation. Dennis Sigrist is looking into this request.
b. City of Seaside Plan status.
   The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.

NEW BUSINESS

a. Wickiup Repeater Site: Clatsop County Emergency Services has completed the scope of work, and is going though NEPA review. Project was approved by OEM and FEMA. Dennis Sigrist is our State contact..

MEMBER/COMMITTEE REPORTS
None

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PUBLIC COMMENT
Deb Trusdale – Can our NHMP fund vertical evacuations in the Seaside Area along the Beach? If the City of Seaside includes this in the NHMP at least it might be considered.

GOOD OF THE ORDER
None

NEXT MEETING: May 26, 2011

ADJOURNMENT:
11:05 AM by Gene Strong

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

May 26, 2011

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING November 22, 2011

HMP Meeting Minutes
May 26, 2011

MEETING CALLED TO ORDER:
10:03 AM by Convener Gene Strong Director Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 09/15/09 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke C.R.E.S.T., Jennifer Bunch, Clatsop County Planning Department, Margo Lalich/Maurine Taylor, Clatsop County Public Health, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, , Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. City of Astoria, is requesting disaster assistance to cost share the replacement and moving of their waterline for a mitigation activity, it may work under 406 mitigation. Dennis Sigrist is looking into this request.
b. Clatsop County Emergency Management is under-going a re-organization and the Plan will need to reflect these changes.
c. City of Seaside Plan status. The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.
d. Alexander Bancke with CREST was given the proposed Plan Updates.

NEW BUSINESS

a. Wickiup Repeater Site: Clatsop County Emergency Services has completed the scope of work, and is going though NEPA review. Project was approved by OEM and FEMA. Dennis Sigrist is our State contact. We are developing an RFP for building our Wickiup site.
b. We have held 2 Town Hall meetings for community outreach and feedback, the firest meeting was at the Warrenton Community Center and the 2nd meeting in the City of Astoria was at the Liberty Theater. We had approximately 400 people participate.

c. **MEMBER/COMMITTEE REPORTS**
None

PUBLIC COMMENT
None.

GOOD OF THE ORDER
None

NEXT MEETING: November 22, 2011

ADJOURNMENT:
11:05 AM by Gene Strong

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

November 22, 2011

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING June 20, 2012

HMP Meeting Minutes
November 22, 2011

MEETING CALLED TO ORDER:
10:03 AM by Convener Gene Strong Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 05/26/11 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke C.R.E.S.T., Jennifer Bunch, Clatsop County Planning Department, Margo Lalich/Maurine Taylor, Clatsop County Public Health, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, , Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. City of Astoria, is requesting disaster assistance to cost share the replacement and moving of their waterline for a mitigation activity, it may work under 406 mitigation. Project is under review..
b. Clatsop County Emergency Management is under the County Managers Office and the new organizational chart was given to Alexander Bancke to update.
c. City of Seaside Plan status. The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.
d. Alexander Bancke with CREST was given the proposed Plan Updates.

NEW BUSINESS

a. Wickiup is completed and operational. This is a completed item on our NHMP activity.
b. 3rd request to Alexander Bancke was tasked by the Committee to bring in a digital copy of the plan and to show our updates so we can review and comment.
c. Gene Strong has asked Tom Manning to be the Convener to take Gene Strong's place.

MEMBER/COMMITTEE REPORTS
Each City also expressed that CREST should provide a Word Copy of the NHMP.

PUBLIC COMMENT
None.

GOOD OF THE ORDER
None

NEXT MEETING: June 20, 2012

ADJOURNMENT:
11:05 AM by Gene Strong

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

June 20, 2012

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING November 25, 2012

HMP Meeting Minutes
June 20, 2011

MEETING CALLED TO ORDER:
10:03 AM by Convener Tom Manning Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 11/22/11 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke C.R.E.S.T., Jennifer Bunch, Clatsop County Planning Department, Margo Lalich/Maurine Taylor, Clatsop County Public Health, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, , Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. City of Astoria, is requesting disaster assistance to cost share the replacement and moving of their waterline for a mitigation activity, it may work under 406 mitigation. Project is under review..
b. Clatsop County Emergency Management is under the County Managers Office and the new organizational chart was given to Alexander Bancke to update.
c. City of Seaside Plan status. The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.
d. Alexander Bancke with CREST was given the proposed Plan Updates.

NEW BUSINESS

a. 4th request to Alexander Bancke was tasked by the Committee to bring in a digital copy of the plan and to show our updates so we can review and comment.
b. Gene Strong has retired and we wish him well..

MEMBER/COMMITTEE REPORTS
Each City also expressed that CREST should provide a Word Copy of the NHMP.

PUBLIC COMMENT
None.

GOOD OF THE ORDER
None

NEXT MEETING: November 25, 2012

ADJOURNMENT:
11:05 AM by Tom Manning

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

November 25, 2012

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING April 25, 2013

HMP Meeting Minutes
November 25, 2012

MEETING CALLED TO ORDER:
10:03 AM by Convener Tom Manning Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 06/2012 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke C.R.E.S.T., Jennifer Bunch, Clatsop County Planning Department, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, , Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services.

PENDING BUSINESS

a. Any Planning updates or newly identified hazards. City of Astoria, is requesting disaster assistance to cost share the replacement and moving of their waterline for a mitigation activity, it may work under 406 mitigation. Project is under review..
b. Clatsop County Emergency Management is under the County Managers Office and the new organizational chart was given to Alexander Bancke to update.
c. City of Seaside Plan status. The City has limited staff time at present, and will be working on their plan as time permits. Plan is under development. Kevin Cupples indicated.
d. Alexander Bancke with CREST was given the proposed Plan Updates.

NEW BUSINESS

a. Alexander Bancke was tasked by the Committee to bring in a digital copy of the plan and to show our updates so we can review and comment. No updates provided at this time. He lost the updates so Tom Manning gave him his copy.
b. The County Hazard Analysis is now being updated which may lend additional mitigation opportunities.
c. The NHMP Official Update will be due next year around September. We need to retrieve a working digital copy of the plan from CREST.

MEMBER/COMMITTEE REPORTS

Each City also expressed that CREST should provide a Word Copy of the NHMP. Members all expressed concern that OEM has not provided any guidance or a new FEMA Plan Review Check-off? Tom Manning indicated that he would email any information received from OEM concerning the NHMP Update.

PUBLIC COMMENT

None.

GOOD OF THE ORDER

None

NEXT MEETING: April 25, 2013

ADJOURNMENT:

11:05 AM by Tom Manning

PRE-HAZARD MITIGATON PLAN STEERING COMMITTEE

April 25, 2013

Meeting Agenda

10:00 AM.....Meeting called to order by: Gene Strong

10:15 AM.....Planning Updates by CREST: Mr. Bancke

10:30 AM.....Any New Plan Updates: Committee

10:45 AM.....City of Seaside Plan Status: Seaside

11:00 AM .....Public Comments

11:30 AM..... Adjourn – Gene Strong

NEXT MEETING November TBA

HMP Meeting Minutes
April 25, 2013

MEETING CALLED TO ORDER:
10:03 AM by Convener Tom Manning Clatsop County Emergency Services.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
* made and * seconded a motion to approve the 11/25/2012 meeting minutes.

WELCOME COMMITTEE MEMBERS
Alexander Bancke C.R.E.S.T., Jennifer Bunch, Clatsop County Planning Department, Brett Estes, City of Astoria, Kevin Cupples, City of Seaside, Richard Mays, City of Cannon Beach, Patrick Corcoran, OSU Sea Grant Extension, Clatsop County, , Gene Strong Clatsop County Emergency Management, Thomas E. Manning Clatsop County Emergency Services, Margo Lalich/Maurine Taylor, Clatsop County Public Health,

PENDING BUSINESS
a. Any Planning updates or newly identified hazards. City of Astoria is requesting disaster assistance to cost share the replacement and moving of their waterline for a mitigation activity, it may work under 406 mitigation. Project is underway and close to completion.
b. Clatsop County Emergency Management is under the County Managers Office and the new organizational chart was given to Alexander Bancke to update.
c. Alexander Bancke with CREST was given the proposed Plan Updates.

NEW BUSINESS
a. Alexander Bancke was tasked by the Committee to bring in a digital copy of the plan and to show our updates so we can review and comment. No updates provided at this time. He lost the updates so Tom Manning gave him his copy.
b. The County Hazard Analysis is now being updated which may lend additional mitigation opportunities.
c. The NHMP Official Update will be due next year around September. We need to retrieve a working digital copy of the plan from CREST.
d. Please continue working on updating your plans.
e. City of Seaside has completed their Plan, congratulations on all your hard work.

MEMBER/COMMITTEE REPORTS

a. No guidance provided by OEM as of this meeting.
b. Each City also expressed that CREST should provide a Word Copy of the NHMP. Members all expressed concern that OEM has not provided any guidance or a new FEMA Plan Review Check-off? Tom Manning indicated that he would email any information received from OEM concerning the NHMP Update.
c. Alexander Bancke has left CREST and no updates were provided to the committee, and only a PDF file on their website is available. I contacted CREST to see if they could provide us with word documents and they could not locate Alexander Bancke' s Files and could not locate a working file on our plan.
d. Tom Manning stated that in the future anyone or contractor from OEM, must provide a copy of the plan in a working file such as Microsoft word. The committee all agreed.

PUBLIC COMMENT

Who had oversight over CREST? OEM hired CREST to develop and write our plan with public and government input.

GOOD OF THE ORDER

None

NEXT MEETING: November, 2013 Date TBA

ADJOURNMENT:

11:30 AM by Tom Manning

CLATSOP COUNTY PLANNING COMMISSION

REGULAR MEETING AGENDA
Tuesday, February 11, 2014
10:00 a.m.

Judge Guy Boyington Building
857 Commercial Street
Astoria. OR 97103

1. CALL MEETING TO ORDER (Bruce Francis, Chairperson)
2. FLAG SALUTE
3. ROLL CALL
4. ADOPT AGENDA
5. PRESENTATION:
   - Clatsop County Natural Hazards Mitigation Plan – Tiffany Brown, Clatsop County Emergency Manager
6. BUSINESS FROM THE PUBLIC:
   - This is an opportunity for anyone to give a brief presentation about any land use planning issue or county concern that is not on the agenda.
7. MINUTES:
   - Regular Meeting Minutes November 12, 2013 **(Page 3)**
8. PUBLIC HEARINGS
   - Francis Capital Group – Variance/Major Design Review **(Page 5)**
     Staff: Julia Decker
9. OTHER BUSINESS:
   - Open discussion – This is an opportunity for the commission to discuss topics of interest.
10. ADJOURN

Agendas and staff reports are available for review at www.co.clatsop.or.us. Select 'Land Use Planning' under 'Services'.

NOTE TO PLANNING COMMISSION MEMBERS:
Please contact the Community Development Department (503-325-8611) if you are unable to attend this meeting.

ACCESSIBILITY: This meeting location is accessible to persons with disabilities. A request for an interpreter for the hearing impaired or for other accommodations for persons with disabilities should be made at least 48 hours prior to the meeting by contacting the Community Development Land Use Planning Division, 503-325-8611.

Minutes of February 11, 2014
Clatsop County Planning Commission
Regular Session

Judge Guy Boyington Building
857 Commercial Street
Astoria, Oregon 97103

The meeting was called to order at 10:03 a.m. by Chair Francis.

Commissioners Present	Commissioners Absent	Staff Present
Bruce Francis (BF)		Clancie Adams (CA)
Lianne Thompson (LT)		Julia Decker (JD)
Kay Foetisch-Robb (KFR)		Jennifer Bunch (JB)
Robert Stricklin (RS)		Ed Wegner (EW)
Susana Gladwin (SG)		Chris Crean (CC)
Michael Tiedeman (MT)		
Jan Mitchell (JM)		

Agenda Adoption:

Commissioner Stricklin moved and Commissioner Mitchell seconded to adopt the agenda as presented. Motion passed unanimously.

Presentation:

TB: My name is Tiffany Brown and I am the Emergency Manager for Clatsop County. I'm here today because we are in the process of updating our Natural Hazard Mitigation Plan and we have elected to involve the Planning Commission in the public portion of the process.

I'm going to make a brief presentation today regarding the plan in general, talk a little bit about the updates and then what you can do to help us with this process. We'll start with the basics and that's a definition of natural hazard mitigation. Natural hazard 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. This is what this plan addresses. The purposes of the plan are to aid in that endeavor by doing the following:

- The plan identifies mitigation strategies.
- It promotes cooperation and communication within the community through the planning process
- And increases potential for state and federal funding for recovery and reconstruction projects.

This plan was originally drafted in 2008 with a grant provided by FEMA. The lead partner was University of Oregon and CREST assisted us locally in putting that together. The plan update has come due and we are in the process of updating. At this point most of the cities have completed their drafts. The county has completed their draft plan and we are commencing with the public process portion of this, the planning effort.

A little bit about the plan history. As I said it was conducted by OPDR, University of Oregon, and CREST locally. All of the cities, save one, and the Port of Astoria participated. And there was a public process. It's a very important part of this process that occurred last time. The 2014 update, that's where we're at right now. As I said, the draft plans have been completed. Our public process portion is currently under way. We anticipate FEMA approval of this plan in March, after which we will take it to our Board of Commissioners for final approval.

I brought a hard copy of this plan. It's in a binder over here. And I'm happy to leave that when I'm done if anybody wants to look through it. We're also, I don't know if it's happened yet, my PIO has been out of the office, we are posting a copy of the 2008 plan on the county website.

I want to just talk a little bit about the plan layout for any of you who are inclined to go through it. The basic plan includes an executive summary, an introduction, a community overview. It just kind of lays the foundation for the plan. We didn't make a lot of substantive changes during this update. And what I'll tell you from the outside is that what we noticed when we got into the plan were a lot of redundancies. Now redundancy is one of the tenets of emergency management. We talk about it all the time but it was unnecessary in this plan. Just as an example, there's a hazard risk analysis diagram within the first few pages of the plan and OPRD developed that image as part of their plan. They're noted at the bottom. It simply illustrates how the hazard, how the risk and hazard analysis is developed. It appears eight times in the plan. So I am the primary person working on this plan. I sat down to read through the plan initially and started having déjà vu experiences where I thought, I think I've read this before. And I went through with my word document and found that entire paragraphs were replicated throughout the plan. So, probably the primary difference that you'll see when we get the plan update posted to the website is that it will be shorter. And that those redundancies have been done away with.

The second part of the plan are the hazard annexes. These are the nine hazards which have been identified as pertaining to our area.

The third portion of the plan are the city addendums. These are many natural hazard mitigation plans that each of the cities developed themselves.

And then the back of the plan, or the appendices that have a combination of action item forms, mitigation strategies that were initially identified when the plan was developed. It outlines the public process that occurred the first time around, an economic analysis as it relates to those hazards, our regional profile, and a household preparedness survey conducted by OPRD initially.

So, how can you help? We have developed a survey monkey with respect to this plan. If it's not already up on our website it will be under hot topics by the end of the week. And it will say NHMP survey. You could really help us by logging on and participating in this survey. No need to have reviewed the plan prior to doing so. It's something we'll be advertising in the media and hopefully getting members of the community to participate in as well. Once our draft plan has been reviewed by the Planning Committee, we will post it on our website at that point. We encourage you to get on and look at that draft plan and submit any comments. The survey monkey offers some opportunity for feedback but because you are the planning commission, we would certainly welcome anything that you were, any of your observations having reviewed the final draft plan. And I bring up the 2008 plan as a precursor to that. Just to try and get a feel for what changes were made and it remained the same.

And then last thing that you can do is to spread the word with regard to the survey monkey. As I said, we plan to advertise in the media. We'll be presenting it at our local E-Prep meeting and to the board of Commissioners. But if in your circles you think anyone else would be interested in taking the survey, that would be terrific. And that's it for my presentation. I put this picture up because the Seaside 101 flooding was one of the mitigation strategies identified in the 2008 plan. We will happily report that we addressed that issue. And at this time I'll take any questions.

BF: Any questions of Miss Brown?

RS: I haven't looked at it of course. Does it get into who's in charge kind of thing? Networking, command control, military pattern, whatever. What happens next? Does it go that way?

TB: It does not. Those types of things are found in our emergency operations plan, which is our county plan. This plan really carries no regulatory power. It's a guiding document. The Clatsop County Emergency Management and Clatsop County Planning Department are named the co-conveners. And that's about as far as it gets into the weeds in terms of responsibility. The responsibility piece comes when FEMA reviews the plan because they have a review tool which requires certain elements that are command and control and not necessarily the things that you spoke to but that they consider to be the key elements that make a good plan.

RS: My point is that I know we have local people who are off far away learning about how social networking works. Well like what happened in Alabama or in Georgia in the big storms that magnificently social networking really was how information got passed and it wasn't someone off in a command center that was handling it all. So it's kind of a fascinating era.

TB: Absolutely. I don't recall social networking being addressed in the 2008 plan but I absolutely anticipate that it will come up this time around. Thank you.

SG: I'm always known for my questions. So, just a little quickie on the survey monkey. I'm, I heard the word survey monkey the other day for the very first time.

TB: Okay.

SG: I think that might be off-putting to people that would like, what in the world is that term? Because I don't know what it means really.

TB: I set up a survey monkey yesterday for the very first time. It's a, you click a link. It takes you to an online survey. I didn't bring it with me. I'll try to recall. There are about 13 questions. It starts off by asking you to identify which part of the county

SG: But, but, no. Because I have a couple of other questions. Just say that I think the terminology is confusing and off putting but I, for old folks. I come from the Jewell area and I think that anybody out in Jewell would like, what?

TB: Survey Monkey is simply the company. So it's listed on the website and it says survey. So hopefully that won't be off putting.

SG: All right.

JM: I'm older than you and I'm not offended.

SG: So. This is only a very small part of the plan. Is that right? What we have here or is this what's

TB: I don't know what you have. I didn't provide any materials.

JB: That is not part of the plan. That's a recent document prepared by the Department of Land Conservation and Development regarding planning, land use planning for tsunami hazards. And that's just provided to you for information today. And it's not part of the plan that Tiffany is speaking about.

MT: I didn't know that.

SG: And then, I'm just curious of your role in emergency services. Has the Oregon LNG Company approached you for ways to prepare if they do put in pipelines in the vicinity?

TB: Not this time around. Oregon, County Emergency Management was contacted by LNG during the proposed Bradwood project and again, not again,

JB: No they weren't, Oregon Pipeline, Oregon LNG to this point has not involved Clatsop County Emergency Management.

TB: They asked for feedback from Gene Strong, the former emergency manager with regard to safety issues and what not, but not in the last three years. They've not contacted us.

SG: No, I mean specifically the Oregon LNG Company. I just want that on the record that they have not talked to you. I talked to somebody but not the official one at Camp Rilea and they said they didn't even know it was being revisited as an export facility and the Jewell Fire Department also, where the pipeline goes a quarter mile, a half a mile from the fire department. They were never aware that it was being revisited either. Thank you.

TB: You bet. Any other questions?

LT: Just one. We had a little fire down in our part of the world recently and it brought up fresh for me the essential nature, the connection of county, especially emergency management, in situations like that. So I appreciate that you are going forward with this and I hope that we continue to go forward to involve local media and local groups, certs and ham radios and Red Cross volunteers and all of those to share information in timely basis so that we don't find out information about the fire from social media coming from outside sources as much. So however we can support, I want to say building the linkages, building the networks that facilitate the sharing of information and the preparation and response of citizens. I think we're eager to do that. So, keep us in the loop and we'll carry on.

TB: Thank you.

RS: Do rural slash burns count as natural disasters?

BF: Yeah they do.

TB: No.

LT: Three hundred acres in an EOC established, says to me that there's a level of significance there that would indicate a broader concerted response, but you know what, it's new. We're inventing this as we go.

RS: But do we need to broaden the term of natural disaster to include man made.....

BF: Natural disasters.

TB: Wildfires identified in our natural hazard mitigation plan and you'll also see, I'll just bring this up of interest, drought is also identified. And that's something we may be looking at more closely this year.

RS: I guess words like, acts of god, kind of take the responsibility off of those who created the problems. Maybe that would be more palatable.

LT: Fire is fire.

JM: What city did not participate?

TB: Seaside did not submit an independent plan in 2008 but they've already submitted for the update.

JM: Oh good. Okay. I was just wondering, I was thinking about ways, because it is interesting, I've done surveys online and it's, and I used to be, used to, was a planner and it's really, opens up a whole range of things if you can get people to engage. It's a lot better than having a two hour meeting with 80 people. Is there a way that you can contact the cities directly to try to make sure that the elected officials participate? That would be really interesting because it would be a way of pulling them in.

TB: The cities really are on their own in terms of developing their plans. Each city

JM: I'm talking about the survey tool.

TB: Sure. Sure. Yes. And I'll be sending it to all of our, you know, the agencies and the community partners and the planning team. Our planning process consists of a planning team, which are the five people working on the individual plans. Myself, city planners. In Gearhart it's the city manager for example. To think of it in terms of concentric circles, outside of that are the stakeholder group and so we have an additional group of stakeholders in the county that will come together to review the plan. We're in the process of updating those names and contact information. And then outside of, and then to continue the public process.

RS: Do you feel connected to the outside world outside of your group? You know, this was created but it wasn't kind of an organic creation. It kind of was brought into being.

TB: We're certainly left to our own devices in terms of how to create that connection. So we created the survey. We'll create the media opportunities and then moving forward we'll provide information when we participate in outreach activities. So if you, we'll have a booth at the county fair and there will be information there on the natural hazard mitigation plan. It's a slow process, you know. You can advertise in the media and you can shoot it out to everyone and you still may only get a small amount of people. And I can tell you, in my department it seems like we often get the same people over and over instead of sort of new faces and new voices to chime in.

BF: So you're saying you're going to pursue the media in different ways to get this into the public and create awareness, increase participation? Have you looked at the social media aspects of it?

TB: As I said, I think that that will become a more prominent piece. One of the roles of the natural hazard mitigation plan committee is to meet twice a year and to talk about these things. To talk about how to keep it alive and how to generate that public feedback. And how to make people, to create awareness around this plan.

BF: One of the things I'd like to see is you take advantage of everybody walking around with one of these devices. And I think that maybe if there's an interaction between the main carriers and a countywide implementation of awareness for disasters and fires. You know, the out of control. We can put it out there. You know, I know it exists through other media and I'd like to see the county get involved in spearheading that through this into the social media aspects where everybody, bang, there's a fire at Arch Cape. Everybody in the county gets a notification. What you do with that information is up to you. But the thing is, at least everybody would know. The same with the tsunami, same with flooding of 101. Hopefully that doesn't

happen because I know Ed's worked really hard to try and mitigate that process. But I'm just saying we need to really look at modern technology and embrace it and take advantage of it. So I'm hoping that becomes part of the process.

TB: Thank you.

RS: Is there anybody under 30 involved in your entire process?

TB: No. Not that I can think of but that's where the public process comes in. So these are terrific suggestions and this is just the kind of feedback that we're looking for. Social media is admittedly underdeveloped in our department. I think it's one of the things that we have identified in our upcoming budget year in terms of expanding. It will certainly serve this project.

BF: Okay. One last question.

SG: Actually I have two but. Let me just go back to, well to what Bruce just said, yes for example highway closures because of all the snow stuff. I remember calling KMUN saying, you know, in Jewell we're having a ton of snow. It hadn't started snowing here. Anybody planning to go to Portland through 26 and maybe 30 would, so they could get a text. And the earthquake people have a way that you can, I know there are programs where you can sign up for a very specific text if you want.

TB: What you're referring to is the mass notification. I think we've switched gears from social media to mass notification now. When you're talking about us pushing out messages. We have a mass notification system for the County. It's supported by the Everbridge Corp. and it's called Clatsop Alerts. I believe it's still under the hot topics on the home page of the county website. There's some very specific protocol and policies around that system and so, I think Lianne was referring to, maybe us not using it during the fire and I think you're talking about us using it for highway closure. But the system, it's twofold. There's the emergency notification aspect of it and for that we have imported all of the land line, a database import of all the land lines in our county. And we have the ability to push out emergency messages to all of those land lines and to anyone who has opted into the system. In other words, gotten online and registered their cell phone number.

The other part of it is a community aspect. That aspect is something that people have to opt in and sign up for. So for example, you can go on and sign up, if you have a land line phone your number is already in the system, you can go on the county website and enter any additional information that you are interested in cell phones, emails, additional cell phones where you are interested in getting alerts, emergency alerts. Additionally you can sign up to receive community alerts. And community alerts would be things such as road closure. Anything that would be helpful to know but that is not necessarily a direct threat to life or property. And the policy around this system states that we will not use the emergency side of this, the land line phones, unless there is a threat to life or property. And for that reason it doesn't get used very often. It's a best practices concept that we don't want to desensitize people to getting those calls over their phone.

RS: Your best efforts are squelched by the junk roto calls that are used to using the word alert to sell one thing or another at no charge to Medicare aged people and whatever. So there's a, alert doesn't mean squat except typically it's a marketing call. And you're kind of in a hard thing where

TB: That's where we rely on public education. So we

RS: It has to go beyond that because even the no call list is totally ignored and besieged with alerts from marketing companies.

TB: None of them should say Clatsop Alerts on your caller ID. Ours list a local phone number. It says Clatsop Alerts. Anyone who is interested in understanding that, should understand that when that call comes through it's either a test that has been well advertised or it's an emergency alert.

LT: Mr. Chair, I have one. So when you say the magic phrase, threat to life or property, when I smell smoke and start hearing about fires I feel threatened in my life and property. So it's really useful to me to get information. I understand the protocols. I think, though, our point is the evolution of the technology may call for reexamination of those policies and protocols. Because we're used to something different now both from marketing scams but also the explosion in the use of technology. It would comfort me to know that I could depend on you, that I could rely on you to tell me, yes worry, relax. But data. Giving me some sense of predictability and control. That would be useful.

TB: Sure. And by registering for community alerts you certainly put yourself in a position to receive those. I'll also note that it's not my decision or the decision of my department to send those emergency alerts. In the example of the fire, we're back to incident command system. There was an incident commander on the scene and it would be his decision whether or not to send an emergency message to, for example, evacuate the area.

LT: Well or that we didn't have to. So who was in fact that emergency commander?

TB: I'm sure that it changed throughout the event. I don't know for certain.

LT: I'm speaking of the agency. Was that, what agency person. Because if we have

TB: The Department of Forestry

LT: So it was the Department of Forestry.

TB: as overseeing that.

LT: Thank you.

BF: Okay. Thank you. I've got to close this up.

TB: Thank you so much.

BF: Thank you very much.

Business from the Public:

BF: Okay. Business from the Public. This is an opportunity for anyone to give a brief presentation about any land use/planning issue or county concern that's not on the agenda. Not seeing any we'll go to the minutes. Oh I'm sorry. Debra?

DB: My name is Debra Birkby (DB). I live at 79829 Gelinsky in Arch Cape, Oregon. Most of you probably know that I have resigned my position. And the reason I'm here today is to speak to that. And I just wanted to say that Clatsop County Board of Commissioners appointed each of you in 2011 to this planning commission. I'm here today to personally thank you for stepping up to serve as a volunteer on this commission to evaluate and discern the appropriateness

NEWS from Clatsop County

Clatsop County Manager's Office
800 Exchange St., Suite 410, Astoria, OR 97103
(503) 325-1000 Fax (503) 325-8325

MEDIA CONTACT:
Tiffany Brown, Emergency Manager, (503) 325-8645

FOR IMMEDIATE RELEASE:
Thursday, Feb. 13, 2014

ONLIVE SURVEY INVITES PUBLIC INPUT ON NATURAL HAZARDS PLAN

Clatsop County is seeking citizens' input as it updates its plan for handling natural disasters.

The Natural Hazards Mitigation Plan identifies the types of hazards that threaten the county and local communities, evaluates our vulnerability to those hazards and outlines a strategy to reduce or eliminate the risk to life and property.

The multi-jurisdictional plan was developed in coordination between Clatsop County and the cities of Astoria, Cannon Beach, Gearhart, Seaside and Warrenton. The state and federal governments require local jurisdictions to adopt hazard mitigation plans to be eligible for certain disaster assistance and recovery funding.

Clatsop County is updating the existing 2008 plan, and welcomes citizen input. A brief survey available online asks respondents their opinions on the natural hazards of biggest concern to them, and actions they would like to see taken to minimize the risks associated with those hazards.

To take the survey, and to view the current NHMP document, go to www.co.clatsop.or.us and click on "Survey – Natural Hazards Mitigation Plan" under "Hot Topics."

-30-

Released by:
Tom Bennett
Community Relations Coordinator
(503) 338-3622

Clatsop County

Emergency Management
800 Exchange St., Suite 400
Astoria, Oregon 97103
www.co.clatsop.or.us

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NOTICE

Emergency Preparedness Committee Meeting

Wednesday, February 19, 2014 at 10:00 am

Camp Rilea
Post Headquarters, Building 7021, Auditorium
33168 Patriot Way, Warrenton, OR

AGENDA

1. Call Meeting to Order

2. Additions or Changes to the Agenda

3. Approval of Minutes dated December 18, 2013

4. Old Business:
   a. Natural Hazard Mitigation Plan Update – Tiffany Brown
   b. Training Updates – Tiffany Brown

5. New Business:
   a. Laurie VanLeuven, Deputy Director, Office of Oregon Emergency Management – briefing about OEM strategic planning process and an overview of the Cascadia Playbook project.

6. Member/Committee Reports:
   a. State Fire Marshal – Tad Pedersen
   b. Oregon State Police – Sgt. Merila
   c. Oregon Department of Transportation – David Neys/Kevin Werst
   d. Fort Stevens State Park – Mike Stein
   e. US Coast Guard – CDR Brenda White/LT Chantel Schneider
   f. Camp Rilea Military Reservation – Col (Ret.) Jim Miller/LTC Shaun Martin
   g. 116th Air Control Squadron – LtCOL Jim Mitchell/LtCOL Ted Lawson
   h. Oregon Department of Forestry – Neal Bond
   i. American Red Cross – Cara Sloman
   j. Fire Defense Board – Chiefs Ron Tyson/Paul Olheiser
   k. MEDIX – Duane Mullins
   l. Local Law Enforcement – Chief Matthew Workman/Sr. Police Officer Alfonzo Fontana
   m. Port of Astoria – Mike Weston

n. Columbia Memorial Hospital – Tara Dyrset
o. Providence Seaside Hospital – Ray Cain/Erik Meyer
p. Sunset Empire Transportation District – Jay Flint/Scott Earls
q. 911 Communications – Lynn Smith/Jeff Rusiecki/Chris Dugan
r. Clatsop County Public Works – Ed Wegner
s. Clatsop County Public Health – Brian Mahoney
t. Cannon Beach Public Works – Daniel Grassick
u. Local Emergency Planning Committee (LEPC) and County CERT – Tiffany Brown
v. ARES/RACES - Jeff and Roxanne Holwege
w. Western Oregon Waste (WOW) – Rich Kuehn/Debbie Hamel
x. KMUN Coast Community Radio – Ray Merritt/Joanne Rideout
y. North Coast Youth Correctional Facility – Michael Barter
z. OSU Extension Hazards Outreach Specialist, Oregon Sea Grant – Patrick Corcoran

7. Public Comment

8. Good of the Order

9. Adjournment: **Next E-Prep meeting is scheduled for Wednesday, April 16, 2014, 10:00 a.m. Camp Rilea, Warrenton, OR.**

Attachments:
1. E-Prep Meeting Minutes – December 18, 2013
2. Training Schedule
3. Deputy Director VanLeuven Biography

NOTES:

Emergency Preparedness Meeting Minutes
February 19, 2014

Dean Perez called the meeting to order at 10:00 a.m. at Camp Rilea, 116 ACS, Oregon Air National Guard, Bldg. 7116, McCarter Road, Warrenton, OR. Also in attendance were Tiffany Brown, Caren Black, Ray Merritt, Laurie VanLeuven, Al Fontana, Michael Mueller, Shaun Kutschel, Jim Mitchell, Tonya Case, Greg Bosin, Stan Brawley, Brian Mahoney, Andrew Merila, Tad Pedersen, Dave Rankin, Paul Olheiser, Scott Miethe, Catherine Baumiller, Jim Miller, Shaun Martin, Patrick Corcoran, and Lynn Smith.

AGENDA APPROVAL
No changes or amendments.

APPROVAL OF MINUTES
Pederson made and Merritt seconded a motion to approve the 12/18/13 meeting minutes.

OLD BUSINESS
a. Natural Hazard Mitigation Plan Update. Brown advised that the NHMP public process was currently underway and that the steering committee would be convened in the next month or so to finalize the draft of the 2014 update. She advised that an online survey had been created as part of the public process and asked all in attendance to participate. Perez said he would send the survey link to the group following the meeting.

b. Training Updates. There were no training updates, but Brown directed those in attendance to the county website where the county training calendar is posted and updated.

MEMBER/COMMITTEE REPORTS
a. State Fire Marshal. Pedersen advised that the state mobilization plan was complete, and was to be approved/printed in March. He referenced the fire which had occurred in Arch Cape, characterizing it as unusual for the area, and said that forestry had taken the lead but resources from all of Clatsop County, and some from Tillamook, had been used. He said that preliminary reports indicate that 2014 will be an active (expensive) fire season, and that a joint conference had been set for April in preparation.
b. Oregon State Police. Merila reminded that effective Feb. 1 he had been named Lieutenant for the Astoria office, which had created a vacant Sergeant position.
c. Oregon Department of Transportation. No report.
d. Fort Stevens State Park. No report.
e. US Coast Guard. Mueller had nothing significant to report, but shared that he didn't anticipate seeing an influx of Japanese Tsunami Debris.
f. Camp Rilea Military Reservation. Training site manager Miller introduced the new post emergency manager, Baumiller. Martin described the structural collapse 'rubble' building anticipated to be completed early this summer adding that it was designed specifically for first responders. He explained that features such as collapsed buildings and flames were added for realism. He described it as a 'big deal' explaining that nothing in the area currently compares to it in terms of size, location and main elements. He said it would be a regional training resource

to which civilian responders will have access. Pedersen said he anticipated an influx of training to the county as a result.
g. 116th Air Control Squadron. Mitchell said he had nothing to report.
h. Oregon Department of Forestry. No report.
i. American Red Cross. Black had no report.
j. Fire Defense Board. Olheiser reported that the county fire board had just completed the Mass Casualty Incident plan, and anyone interested in seeing it should contact Chief Bill Eddy, Gearhart.
k. MEDIX. No report.
l. Local Law Enforcement. Fontana said Warrenton was currently down one officer, but hoped to be back to normal by June as they had hired Robert Wirt who was beginning at the academy the following week.
m. Port of Astoria. No report.
n. Columbia Memorial Hospital. No report.
o. Providence Seaside Hospital. Tonya Case introduced herself as the new emergency preparation coordinator, and explained she'll be taking over for Erik Meyer.
p. Sunset Empire Transportation District. No report.
q. 911 Communications. Smith reported both agencies had initial meetings with Century Link and the equipment provider for new 911 systems. She added that Astoria will be the first to install the new equipment, she said some glitches were already identified, and she is hoping to wrap up before summer.
r. Clatsop County Public Works. No report.
s. Clatsop County Public Health. Mahoney gave an update of influenza in Oregon, remarking that it seems to be waning. He said he had been performing continuity of operations planning so far this year and was working with Emergency Management on a Mass Fatality incident tabletop exercise scheduled for May 5. Smith said she thought 911 should be involved in the exercise.
t. Cannon Beach Public Works. No report.
u. Local Emergency Planning Committee (LEPC). Brown provided dates for the upcoming LEPC exercise: March 26 Planning Conference, April 23 Final Planning Conference, and May 7 Functional Exercise.
v. Citizen Corp (CERT). Brown advised that CCEMD was facilitated bimonthly meetings for CERT leaders. She reminded that a Wilderness Survival Training hosted by Search & Rescue was set for the first weekend in March, and that Polk County CERT was delivering CERT Train-the-Trainer the first weekend in April at the Holiday Inn Express.
w. Western Oregon Waste (WOW). Miethe, coastal operations supervisor, reported that they were in the final stages of drafting their Emergency Operations Plan. He admitted that he had yet to see it, but said they would conduct a plan review on March 18, and advised they were reaching out to local officials to review plan, and they would plan an exercise once completed.
x. KMUN Coast Community Radio. Merritt said trees had been removed to the east of the tower at the Megler site.
y. North Coast Youth Correctional Facility. No report.
z. OSU Extension/Oregon Sea Grant. Corcoran characterized his position as helping citizens. He talked about the economic project he is working on which centers around the interconnectivity of businesses inside and outside the inundation zone.

NEW BUSINESS

VanLeuven touched briefly on the Oregon Emergency Management (OEM) strategic planning process, the Cascadia Subduction Playbook project then proceeded with a Powerpoint presentation. She explained that OEM is in a rebuilding phase, and stated that for the first time in five (5) years, all five (5) of the management positions are simultaneously filled. With respect to the recent audit performed of OEM by the Secretary of State, VanLeuven said they have a good team which is addressing the issues, and they have continued to be transparent with the media about their efforts.

Next she talked about drought and winter storms currently impacting their agency. She said that, during the recent winter storm, Lane and Multnomah counties had experienced a number of hospital transportation issues both with staff and customers, i.e. people unable to get to or from the facility. Multnomah had trouble with high occupancy levels and trouble getting discharged patients home, many were shuttled by taxis to local motels because no one wanted to drive, and ultimately some ended up doing some coordination with ambulance American Medical Response (AMR). She said that it was merely a 3-day snowfall but that it created some stress. She said both counties used Emergency Management to coordinate transportation issues, and that they'd discovered in the process that Voluntary Organizations Active in Disaster (VOAD) had resources available as well though they weren't utilized—she characterized their system as well-vetted, an option worth exploring for all, and said she wanted to share the experience.

She talked about the beginning stages of a transition to NextGen 911 which will enable citizens to text 911 or send photographs. She characterized it as a large-scale, $75-$80 million project which will take 5 years to fully implement, and that OEM is working currently to appropriately staff the resource. Pedersen asked why they want people to be able to text 911, and VanLeuven explained the expectation drives the need because so many people communicate differently in this day and age. She said one challenge is that many systems are analog and will need to be converted to digital and summarized that technology evolves so rapidly that it is hard to keep up.

She announced the Emergency Management Conference April 1-3 in Sunriver which would provide a lot of information about grants, public/private partnerships, exercise/training/planning discussions, and she said it was a great opportunity for people around the state to gather. She also announced the statewide functional exercise hosted by Washington County on April 16, which offers two scenarios from which to choose for participants: Earthquake at 72 hours and flooding in real time.

She gave an overview of the RAPTOR program, a real-time assessment and GIS mapping tool, and said they were working with the private sector to monitor status, but that the program is available to public and county offices. She said OEM would come to Clatsop County for a presentation if desired.

She elaborated on the current strategic planning process at OEM, an internal project for her staff. The OEM core values are customer service, professionalism, teamwork, innovation, respect, and opportunity. She showed a slide outlining strategic planning process as well as a complementary document called the 'Action Agenda' which resembles a work plan and shows how they intend to accomplish their goal(s). VanLeuven said fully anticipates gaps, things they should be doing

but haven't, and maybe things they don't have a resource for. She advised that the Oregon Military Department is going through a strategic planning process as well.

VanLeuven passed around a draft copy of the Cascadia Playbook, which isn't yet complete. She described the document as a complimentary document to the existing plan which is action-oriented and talks about who needs to do what and when rather than how things need to be done. She said the approach was to take anticipated action items from the first 14 days of the event (no long-term recovery), then put them in an easy-to-ready format. She explained that playbooks are a hot commodity in the EM world right now. She continued that some of them are narrative, and some are data-filled but theirs is action-oriented. She said they went with the 18- versus 15-ESF structure because of the military and volunteer components. She said the playbook was a 5-year project still in the early stages, and that Adjutant General Hokanson planned to brief the governor on the playbook this spring. She said that the playbook could put Oregon ahead of the curve in terms of response planning and that it had been well-received by FEMA. Perez emphasized the importance of OEM engaging with the local jurisdictions. They agreed that the biggest challenge will be finding out what is occurring against the backdrop of communications problems. Miethe asked if VanLeuven would share the format, and she said yes. Corcoran said he thought the playbook was great, because the coastal strip is subject to all the events associated with the Cascadia, and said he'd like the language of the strategic plan to address the coastal strip region. He asked if OEM has a mandate on the plan, and she said it would. She added they continue to partner with the Oregon Department of Geological and Mineral Industries (DOGAMI) with outreach efforts, and offered that everyone can do more with shrinking budgets when they partner together.

Perez agreed to send out slides of VanLeuven's presentation, and said he would reach out to VOAD for EPREP attendance. He recapped the rubble pile discussion and said he would invite Martin back to a later meeting to deliver a presentation. He asked if participants were interested in a RAPTOR presentation, and many said yes.

PUBLIC COMMENT
None.

GOOD OF THE ORDER
None.

NEXT MEETING
April 16, 2014

ADJOURNMENT
11:30 a.m.

Clatsop County
Natural Hazards Mitigation Plan
2014 Biannual Review Agenda

Tuesday, May 27, 2014 @ 1:30 p.m.
Public Services Building
800 Exchange Street, Suite 430
Astoria, OR 97103

Welcome

Introductions

Review Process

State Review & Changes

County Plan Updates

Plan Continuity

- Page numbering system
- Table of contents
- Action item resolution

Committee Role

- Frequency
- Future goals/projects
- Action item review
- Annual evaluation reports

Public Comments

Adjournment

Clatsop County
Pre-Hazard Mitigation Plan Steering Committee
Meeting Minutes

Tuesday, May 27, 2014 @ 1:30 p.m.

Call to Order

The meeting was called to order at 1:30 p.m. by Emergency Manager Tiffany Brown at the Public Services Building, 800 Exchange Street, Suite 430, Astoria, OR.

Introductions

Tiffany Brown, Clatsop County Emergency Management
Jennifer Bunch, Clatsop County Planning
Chad Sweet, City of Gearhart
Skip Urling, City of Warrenton
Doug Dougherty, Seaside School District
Patrick Wingard, DLCD
Alejandro Bancke, Clatsop County Planning
Rosemary Johnson, City of Astoria
Patrick Corcoran, OSU Extension/Clatsop County

Review Process

Corcoran asked what the benefit of the plan was and how it interrelated with other plans. Brown acknowledged that a resiliency planning project around climate change which focused on the communities of Gearhart, Seaside and Cannon Beach was currently underway, and that results and recommendations stemming from that and other similar efforts would likely find their way into the NHMP. She summarized that the NHMP remains the 'mothership' of guiding documents for the hazard mitigation in the County.

State Review & Changes

Brown reported that the draft plans submitted by the County and Cities in Fall 2013 had been reviewed by the Hazard Mitigation Officer at Oregon Emergency Management and returned with suggestions for revision. She further advised that the entire plan would be resubmitted for final FEMA review once suggested edits were made.

County Plan Updates

The steering committee agreed to standardize several formatting aspects of the plan:

Page Numbering System. Individual numbering systems already contained within the plan would remain, but the County would paginate the entire plan once all sub-plans were received from cities.
Table of Contents. Brown said she would create a Table of Contents for each sub-plan upon receipt to conform with that used for the main plan. She agreed to forward to each of the cities upon completion so they could include in their drafts.
Action Item Resolution. The group discussed a method for reporting the progress of Action Items, specifically those which had been 'removed' and/or 'completed'. It was agreed that keeping a record of completed action items was important to illustrate progress and decided to include headings for 'Completed Action Items' in Appendix A and the Action Item sections of the city plans.

Committee Role
Frequency. Brown reminded that the plan states the group will meet twice annually. Urling asked what the reason would be for meeting once a year, and Brown answered that the responsibilities of the committee warrant two meetings a year. She advised they would meet again in Fall 2014 once the plan had been submitted to discuss next steps and review recommendations made by FEMA/OEM.
Future Goals/Projects. Brown encouraged a discussion about direction of the committee efforts once the plan update submission was completed. Bunch said that she thought having a presence at the County Fair booth could be valuable for soliciting public input and that committee members could share responsibility of manning the booth. She added that the DOGAMI maps had not yet been identified by the County/Cities, but once adopted the County would create a map overlay. She reminded that the TIM maps do not provide a regulatory function but simply let people know where there property sits within the inundation zone.

Dougherty advised that he came to the table to talk about moving schools, and reminded that the Seaside voters had rejected a bond measure which would move schools out of the inundation zone. Surveys conducted after the election revealed some reasons that voters weren't moved to support the bond, so they are in the process of rethinking a proposal in hope that they eventually get to a place where they find a price point.

Johnson said she thought the committee should review legislative updates.

Bunch said work could be done to integrate the NHMP into the county's Comprehensive Plan.

Sweet said that the Gearhart school was interested in participating and he and Dougherty discussed ways in which the two communities could share planning efforts since they are part of the same district.

Action Item Review. Dougherty and Sweet said that schools districts on the Washington peninsula with schools in the inundation zone were looking at vertical evacuation spots, and suggested adding the item to the Clatsop County plan. Brown said in addition to the Gearhart community, Fort Stevens State Park was another area of concern where vertical evacuation structures might be appropriate.

Public Comments

None.

Adjournment

2:30 p.m.

Clatsop County Emergency Management presents

September Preparedness Events

County Emergency Operations Center Open House

Check out the newly-constructed EOC.

Camp Rilea, Warrenton, OR

September 24

10 - 2 p.m.

County Emergency Operations Center Open House

Learn more about how the County responds to disaster.

Camp Rilea, Warrenton, OR

September 25

4 - 7 p.m.

NW Natural Gas Preparedness Fair

First 100 families receive a free Red Cross preparedness kit.

Seaside Fire Station

September 27

11 - 1 p.m.

Community Resilience Symposium

Join local & regional partners for a community discussion.

Cannon Beach City Hall

September 27

1:30 - 4 p.m.

Race the Wave 5K Walk/Run & Preparedness Fair

Know the Plan, Take the Route, Race the Wave

Register at Active.com

Cannon Beach, OR

September 28

9 – Noon

For Information & Registration:

Clatsop County Emergency Management

clatsopemd@co.clatsop.or.us

503/325-8645

Clatsop County Emergency Management presents

October Preparedness Events

Home Depot Annual Safety Fair
Education & fun for the whole family!
Warrenton Home Depot
October 11
10 – 2 p.m.

Great Oregon Shakeout – Get Ready!
Participate as a group or on your own.
Register at http://shakeout.org/oregon/
October 16
10:16 a.m.

PER304 Social Media in Disaster
Registration Required
Guy Boyington Building, Astoria
October 17 or October 18
9-5 p.m.

Jamboree on the Air (JOTA) Youth Amateur Radio Event
Registration Recommended – Drop-Ins Welcome
Clatsop County Emergency Operations Center
Camp Rilea, Warrenton, OR
October 18
10-2 p.m.

County Emergency Operations Center Open House
Tour the EOC and learn what you can do to prepare.
Camp Rilea, Warrenton, OR
October 18
10-2 p.m.

Community Emergency Response Team (CERT) Basic Training
Registration Required
Astoria Holiday Inn Express
October 24-26

For Information & Registration:
Clatsop County Emergency Management
clatsopemd@co.clatsop.or.us
503/325-8645

facebook

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Appendix C: Economic Analysis of Natural Hazard Mitigation Projects

This appendix was developed by the Community Service Center's Oregon Natural Hazards Workgroup at the University of Oregon. It has been reviewed and accepted by the Federal Emergency Management Agency as a means of documenting how the prioritization of actions shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

The appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan,* (Oregon State Police – Office of Emergency Management, 2000), and Federal Emergency Management Agency Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigation.* This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to evaluate local projects. It is intended to (1) raise benefit/cost analysis as an important issue, and (2) provide some background on how economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred. Evaluating possible natural hazard mitigation activities provides 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.

Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables. First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison. Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

What are some Economic Analysis Approaches for Evaluating Mitigation Strategies?

The approaches used to identify the costs and benefits associated with natural hazard mitigation strategies, measures, or projects fall into three general categories: benefit/cost analysis, cost-effectiveness analysis and the STAPLE/E approach. The distinction between the three methods is outlined below:

Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by the state Office of Emergency Management (OEM), the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Benefit/cost analysis is used in natural hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. 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. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoiding future damages, and risk. In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented. A project must have a benefit/cost ratio greater than 1 (i.e., the net benefits will exceed the net costs) to be eligible for FEMA funding.

Cost-Effectiveness Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating natural hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

Investing in Public Sector Mitigation Activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways. Economists have developed methods to evaluate the economic feasibility of public

decisions which involve a diverse set of beneficiaries and non-market benefits.

Investing in Private Sector Mitigation Activities

Private sector mitigation projects may occur on the basis of one or two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, who is required to conform to a mandated standard may consider the following options:

1. Request cost sharing from public agencies;
2. Dispose of the building or land either by sale or demolition;
3. Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
4. Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative.

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchases. Correcting deficiencies can be expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

STAPLE/E Approach

Considering detailed benefit/cost or cost-effectiveness analysis for every possible mitigation activity could be very time consuming and may not be practical. There are some alternate approaches for conducting a quick evaluation of the proposed mitigation activities which could be used to identify those mitigation activities that merit more detailed assessment. One of those methods is the STAPLE/E approach.

Using STAPLE/E criteria, mitigation activities can be evaluated quickly by steering committees in a synthetic fashion. This set of criteria requires the committee to assess the mitigation activities based on the Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation item in your community. The second chapter in FEMA's How-To Guide "Developing the Mitigation Plan- Identifying Mitigation Actions and Implementation Strategies" as well as the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process" outline some specific considerations in analyzing each aspect. The following are suggestions for how to examine each aspect of the STAPLE/E approach from the "State of Oregon's Local Natural Hazard Mitigation Plan: An Evaluation Process."

Social: Community development staff, local non-profit organizations, or a local planning board can help answer these questions.

- Is the proposed action socially acceptable to the community?
- Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- Will the action cause social disruption?

Technical: The city or county public works staff, and building department staff can help answer these questions.

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community goals?

Administrative: Elected officials or the city or county administrator, can help answer these questions.

- Can the community implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

Political: Consult the mayor, city council or county planning commission, city or county administrator, and local planning commissions to help answer these questions.

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

Legal: Include legal counsel, land use planners, risk managers, and city council or county planning commission members, among others, in this discussion.

- Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action?
- Will the community be liable for action or lack of action?
- Will the activity be challenged?

Economic: Community economic development staff, civil engineers, building department staff, and the assessor's office can help answer these questions.

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?

- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private?)
- How will this action affect the fiscal capability of the community?
- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

Environmental: Watershed councils, environmental groups, land use planners and natural resource managers can help answer these questions.

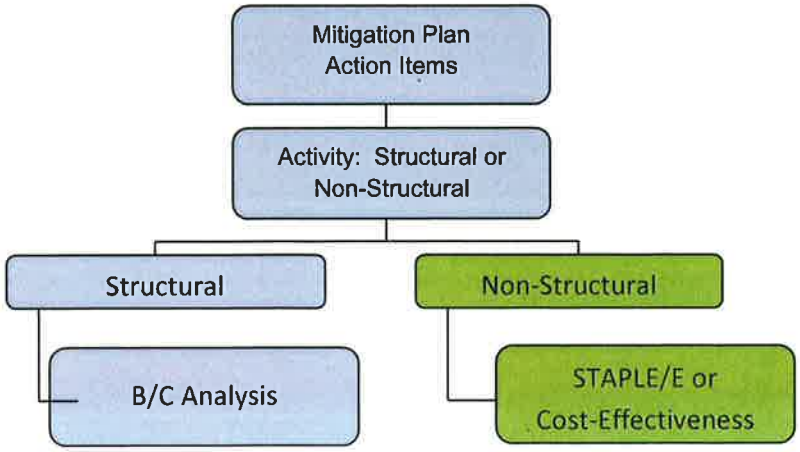
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

The STAPLE/E approach is helpful for doing a quick analysis of mitigation projects. Most projects that seek federal funding and others often require more detailed benefit/cost analyses.

When to use the Various Approaches

It is important to realize that various funding sources require different types of economic analyses. The following figure is to serve as a guideline for when to use the various approaches.

Figure A.1: Economic Analysis Flowchart



Source: Community Service Center's Oregon Natural Hazards Workgroup at the University of Oregon, 2005

Implementing the Approaches

Benefit/cost analysis, cost-effectiveness analysis, and the STAPLE/E are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating mitigation activities is outlined below. This framework should be used in further analyzing the feasibility of prioritized mitigation activities.

1. Identify the Activities

Activities for reducing risk from natural hazards can include structural projects to enhance disaster resistance, education and outreach, and acquisition or demolition of exposed properties, among others. Different mitigation projects can assist in minimizing risk to natural hazards, but do so at varying economic costs.

2. Calculate the Costs and Benefits

Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate activities. Potential economic criteria to evaluate alternatives include:

- ***Determine the project cost.*** This may include initial project development costs, and repair and operating costs of maintaining projects over time.
- ***Estimate the benefits.*** Projecting the benefits, or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.

- *Consider costs and benefits to society and the environment.* These are not easily measured, but can be assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impacts of structural projects to the physical environment or to society should be considered when implementing mitigation projects.
- *Determine the correct discount rate.* Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Activities

Once costs and benefits have been quantified, economic analysis tools can rank the possible mitigation activities. Two methods for determining the best activities given varying costs and benefits include net present value and internal rate of return.

- *Net present value.* Net present value is the value of the expected future returns of an investment minus the value of the expected future cost expressed in today's dollars. If the net present value is greater than the projected costs, the project may be determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.
- *Internal rate of return.* Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it can be compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project. Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk, project effectiveness, and economic, environmental, and social returns in choosing the appropriate project for implementation.

Economic Returns of Natural Hazard Mitigation

The estimation of economic returns, which accrue to building or land owners as a result of natural hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- Building damages avoided
- Content damages avoided
- Inventory damages avoided
- Rental income losses avoided
- Relocation and disruption expenses avoided
- Proprietor's income losses avoided

These parameters can be estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment can be important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

Additional Costs from Natural Hazards

Property owners should also assess changes in a broader set of factors that can change as a result of a large natural disaster. These are usually termed "indirect" effects, but they can have a very direct effect on the economic value of the owner's building or land. They can be positive or negative, and include changes in the following:

- Commodity and resource prices
- Availability of resource supplies
- Commodity and resource demand changes
- Building and land values
- Capital availability and interest rates
- Availability of labor
- Economic structure
- Infrastructure
- Regional exports and imports
- Local, state, and national regulations and policies
- Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from natural hazards. Economic analysis can also save time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that can assist in conducting an economic analysis for natural hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. With this in mind, opportunity rises to develop strategies that integrate natural hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating natural hazard mitigation with other community projects can increase the viability of project implementation.

Resources

CUREe Kajima Project, *Methodologies for Evaluating the Socio-Economic Consequences of Large Earthquakes,* Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, G&E Engineering Systems; Kenneth A. Goettel, Goettel and Associates, Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997

Federal Emergency Management Agency, *Benefit/Cost Analysis of Hazard Mitigation Projects,* Riverine Flood, Version 1.05, Hazard Mitigation Economics, Inc., 1996

Federal Emergency Management Agency, *Report on the Costs and Benefits of Natural Hazard Mitigation.* Publication 331, 1996.

Goettel & Horner Inc., *Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in the City of Portland,* Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel & Horner Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects* Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, Ocbober 25, 1995.

Horner, Gerald, *Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures,* Robert Olsen Associates, Prepared for Oregon State Police, Office of Emergency Management, July 1999.

Interagency Hazards Mitigation Team, *State Hazard Mitigation Plan,* (Oregon State Police- Office of Emergency Management, 2000.)

Risk Management Solutions, Inc., *Development of a Standardized Earthquake Loss Estimation Methodology,* National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., *A Benefit/Cost Model for the Seismic Rehabilitation of Buildings,* Volumes 1 & 2, Federal Emergency management Agency, FEMA Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., *Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects,* 1993.

VSP Associates, Inc., *Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model,* Volume 1, Federal Emergency Management Agency, FEMA Publication Number 255, 1994.

APPENDIX D:
Regional Profile, Risk Assessment & County Hazard Analysis

Report for Counties of:
Clatsop
Tillamook
Lincoln
Lane
Douglas
Coos
Curry

Prepared by:
State of Oregon

February 2012

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REGION 1

Oregon Coast*

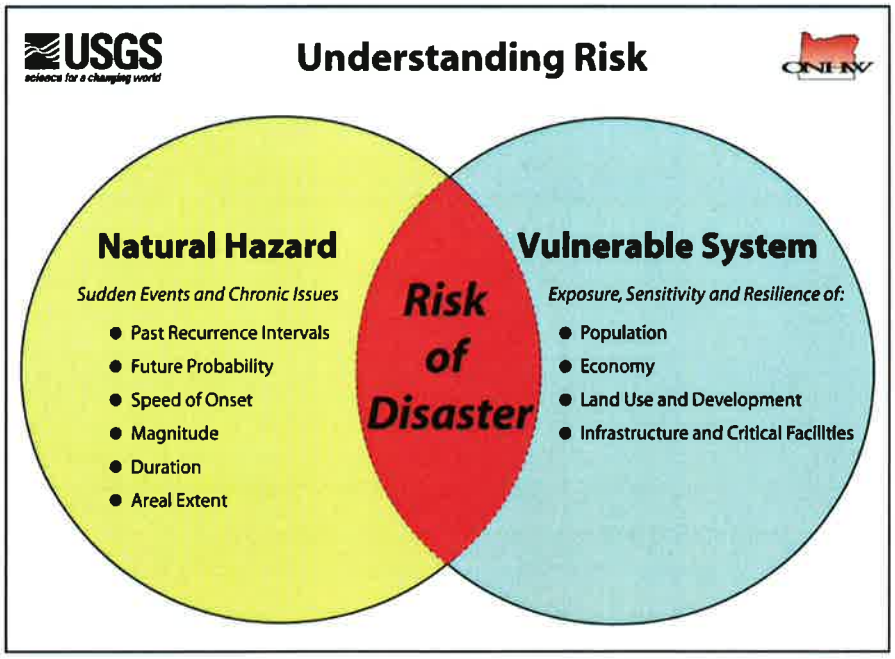
Regional Profile

* Region 1 includes all of Oregon's coastal counties: Clatsop, Coos, Curry, Douglas (coastal section), Lane (coastal section), Lincoln, Tillamook. The lower estuarine Columbia River is also included in Region 1 (Clatsop County).

Introduction and Purpose

Oregon faces a number of natural hazards with the potential to cause loss of life, injuries and substantial property damage. A natural disaster occurs when a natural hazard event interacts with a vulnerable human system. The following quote and graphic summaries the difference between natural hazards and natural disasters:

> Natural disasters occur as a predictable interaction among three broad systems: natural environment (e.g., climate, rivers systems, geology, forest ecosystems, etc.), the built environment (e.g., cities, buildings, roads, utilities, etc.), and societal systems (cultural institutions, community organization, business climate, service provision, etc.). A natural disaster occurs when a hazard impacts the built environment or societal systems and creates adverse conditions within a community.1



It is not always possible to predict exactly when a natural disaster will occur or the extent to which they may impact the community. However, communities can minimize losses from disaster events through deliberate planning and mitigation. A report submitted to Congress by the National Institute of Building Science's Multihazard Mitigation Council (MMC) highlights that for every dollar spent on mitigation society can expect an average savings of $4.[2]

How to use this Report

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center developed this report as part of the regional planning initiative funded by the Pre-Disaster Mitigation Grant.[†] OPDR updated these reports in 2011/ 2012 using Hazard Mitigation Grant Program funds (DR-1733-0010). In addition to serving as a regional resource for local planning initiatives, these profiles inform the risk assessment section of the State's enhanced natural hazard mitigation plan.

Regional Overview

The Oregon Coast region (Region 1 as identified in the state's natural hazard mitigation plan) includes Clatsop, Coos, Curry, Douglas, Lane, Lincoln, and Tillamook Counties. Only the coastal portions of Douglas and Lane Counties are included in the Oregon Coast Region. Not all datasets referenced in this profile were available for the coastal areas only, when this was the case, data for the entire County has been provided. This region is at relatively high risk from coastal erosion, earthquakes, floods, landslides, and wind and winter storms. It also faces low to moderate risk from wildfires and volcanic events.

Organization of Report

This report includes four main sections that work together to develop a comprehensive picture of the region and its sensitivity to natural hazards.

Regional Maps

Critical Infrastructure Map

Using 2003 data from ODOT, this map shows the approximant location of critical infrastructure, including schools, hospitals, bridges, dams, and power stations. Knowing the location of critical infrastructure is important when determining the sensitivities of the region.

[†] FEMA Pre-Disaster Mitigation Agreement Number - EMS-2006-PC-0003

County Hazard Risk Analysis Maps

These maps depict the county's perceived risk for each natural hazard. Data for these maps comes from the County Hazard Risk Analysis in which each county develops risk scores for Oregon's major natural hazards. Scores are current as of March 2003.

Regional Profile and Sensitivity Analysis

Using the best readily available data, the regional profile includes a *Geographic Profile* that discusses the physical geography of the area, a *Demographic Profile* that discusses the population in the Oregon Coast region, an *Infrastructure Profile* that addresses the region's critical facilities and systems of transportation and power transmission, and an *Economic Profile* that discusses the scale and scope of the regional economy with a focus on key industries. In addition to describing characteristics and trends, each profile section identifies the traits that indicate sensitivity to natural hazards.

The data sources used in this section are all publicly available. This report examines the Oregon Coast region as a whole and by individual counties when possible.

Regional Hazards Assessment

The regional natural hazard risk assessment section describes historical impacts, general location, extent, and severity of past natural hazard events as well as the probability for future events. This information is aggregated at the regional level and provides counties with a baseline understanding of past and potential natural hazards.

These assessments were based on best available data from various state agencies related to historical events, repetitive losses, county hazard analysis rankings, and general development trends. The risk assessment was written in 2003 as part of the State Natural Hazard Mitigation Plan and updated as part of the 2012 state plan updates.

Regional State Facilities Tables

The state of Oregon has prepared an analysis of state owned and managed facilities. This analysis is a first step at assessing which state owned structures are most vulnerable to the various hazards identified by region. From this overview, it is clear that a more detailed assessment in the future will yield a clearer picture of those structures specifically threatened by certain disasters and the potential damage that may occur.

Oregon Coast Region

Comprised of the state's costal line and the lower Columbia River, the Oregon Coast/Lower Columbia region has experienced an seven percent increase in population since 2000. This represents a lower rate of growth than other regions of the state. 63% of the region's population lives in incorporated areas. 28% percent of the region's houses were built before 1960, 36% between 1960 and 1980, and 36% were built after 1980. Transportation networks are an even greater consideration for the coastal region given the physical boundary of the ocean to the west and the Coast Range to the east. The average commute for workers in this region is 19 minutes each way. Seventy-three percent of the region's workers drive alone to work, 13% carpool, and five percent work from home. Most bridges in the area have not been seismically retrofitted, creating significant risk to the commuting population in areas at risk from earthquakes.

REGION FACTS*

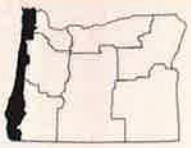
Population: 2010 Census

Total	653,112
Rural	240,503
Urban	412,609

* Population and Housing data includes data outside of Region 1 for Douglas and Lane Counties.

Housing:

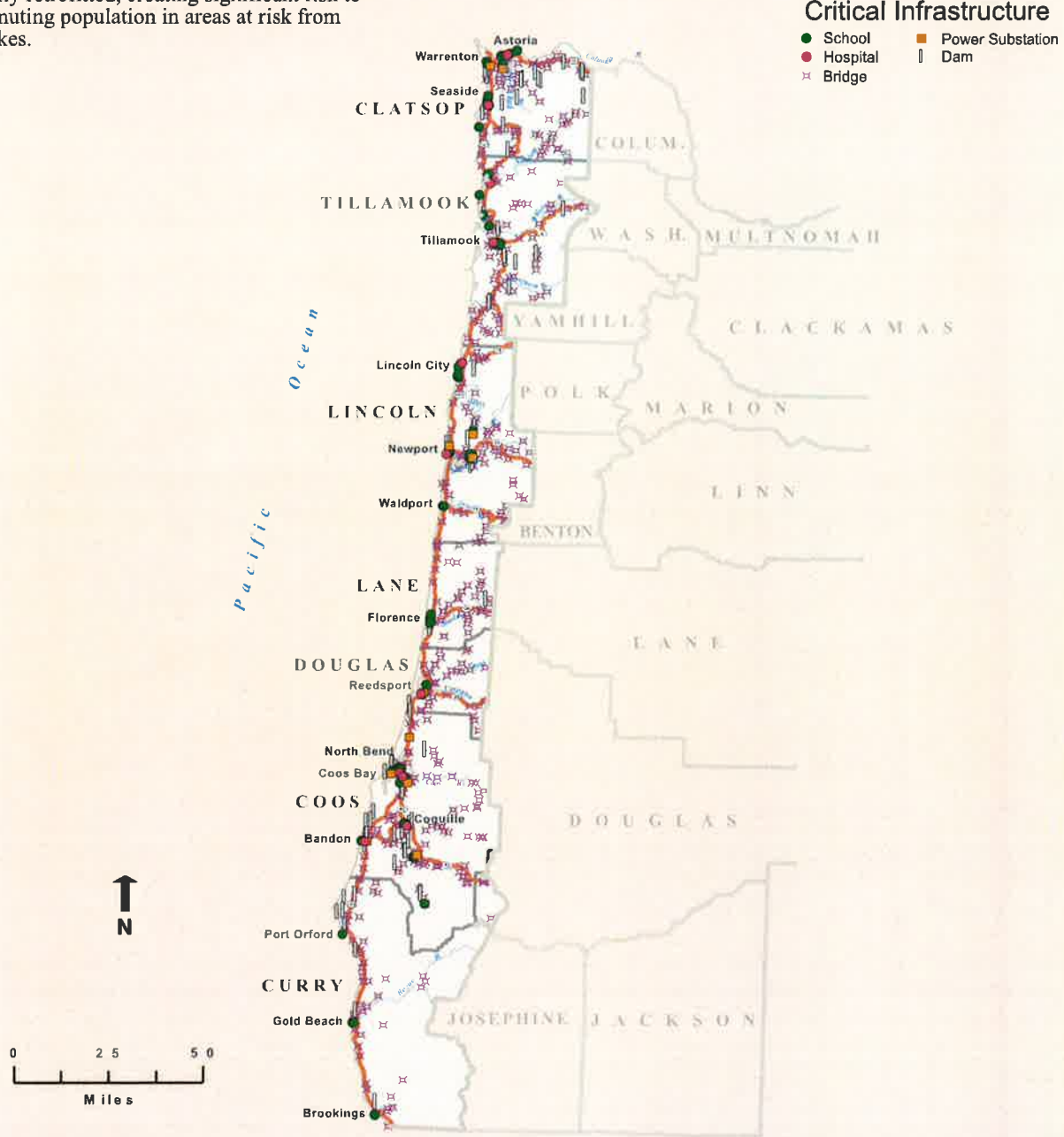
Single-Family	68%
Multi-Family	18%
Mobile Homes	13%
Boat, RV, Van, etc	1%



County	# of Hospitals	# of Hospital Beds	Police Stations	Fire & Rescue Stations	Power Plants	Dams*	Bridges
Clatsop	2	50	8	11	0	4	201
Coos	3	173	8	17	0	2	185
Curry	1	24	4	10	0	0	118
Douglas**	1	17	1	1	0	0	12
Lane**	1	21	1	1	0	0	19
Lincoln	2	50	5	8	0	5	159
Tillamook	1	29	8	7	0	0	171

* "High" Hazard Dams

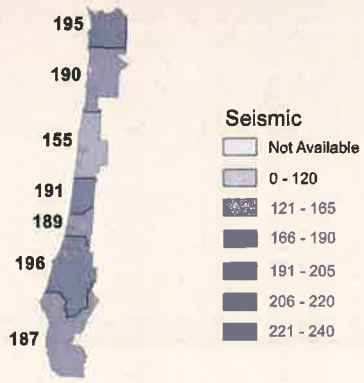
**Coastal portions of Douglas and Lane Counties only.



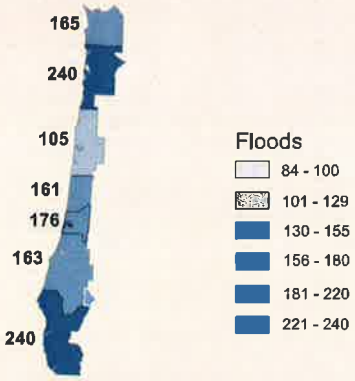
As part of the County Hazard Risk Analysis, each county develops risk scores for Oregon's major natural hazards. This score, ranging from 24 (low) to 240 (high), reflects the County's perceived risk for the particular hazard. Scores are current as of November 2008.

To obtain the most current scores, see http://www.oregonshowcase.org or contact Oregon Military Department – Office of Emergency Management http://www.oregon.gov/OMD/OEM.

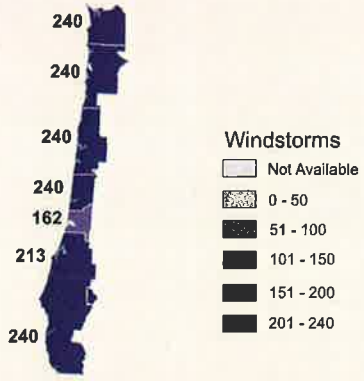
Seismic



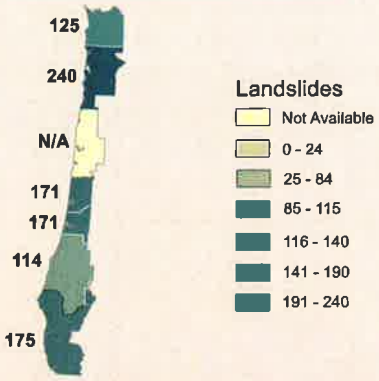
Floods



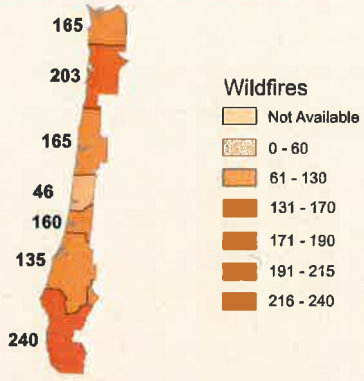
Windstorms



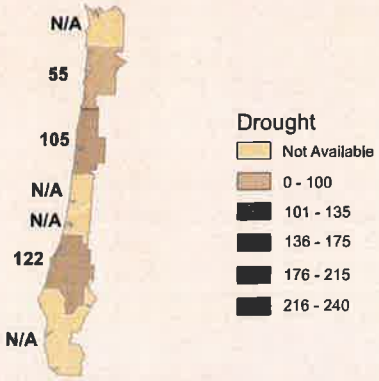
Landslides



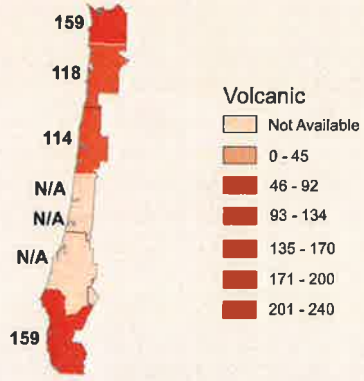
Wildfires



Drought



Volcanic



Regional Profile and Sensitivity Analysis

Section 1: Geography and Climate

The seven-county area of the Oregon Coast region is approximately 17,063 square miles. The Oregon Coast Range runs through the eastern part of the region and the Pacific Ocean borders the western part of the region. The Oregon Coast Range is volcanic in origin and is drained by hundreds of creeks, streams, rivers and lakes. Major rivers in the region include the Siuslaw, Umpqua, Nehalem, Rogue, Yaquina, Siletz, Nestucca, Trask, Wilson, Coos and Coquille. Average annual precipitation in the region ranges from 60 inches to 120 inches, with some locations receiving over 180 inches.[3]

Section 2: Demographic profile

This section describes the Oregon Coast region in terms of its population, demographics and development trends. Data is followed by a discussion of characteristics that indicate community vulnerability to natural hazards. Identifying populations that are particularly vulnerable enables communities to design targeted strategies to reduce their risk. Reviewing development trends provides further guidance on how communities can accommodate growth in a manner that increases resilience to natural hazards.

Population and Demographics

In 2010, the estimated population of the Oregon Coast Region was 653,112, representing an increase of 6.8% since 2000. This growth pattern in the Oregon Coast Region is projected to continue at a moderate rate over the next 20 years, according to the Oregon Office of Economic Analysis. Table 1 displays the population change in each Oregon Coast Region county.

Table 1. Population Growth, Oregon Coast Region, 2000-2010

County	2000 Population	2010 Population	2000-2010 Population Change	% Change 2000-2010
Clatsop	35,630	37,039	1,409	4.0%
Coos	62,779	63,043	264	0.4%
Curry	21,137	22,364	1,227	5.8%
Douglas*	100,399	107,667	7,268	7.2%
Lane*	322,959	351,715	28,756	8.9%
Lincoln	44,479	46,034	1,555	3.5%
Tillamook	24,262	25,250	988	4.1%
Regional Total	**611,645**	**653,112**	**41,467**	**6.8%**

*Data for only the coastal portions of the Counties were not available.

Sources: U.S. Census Bureau: 2000 Census Summary File 1. U.S. Census Bureau: 2010 Census Summary File 1.

The impact in terms of loss and the ability to recover varies among population groups following a disaster. Historically, 80% of the disaster burden falls on the public.[4] Of this number, a disproportionate burden is placed upon special needs groups, particularly minorities, and the poor. Minorities and the poor are more

likely to be isolated in communities, are less likely to have the savings to rebuild after a disaster, and less likely to have access to transportation and medical care. Additionally, minorities and the poor are more likely to rent than own homes, and in the event of a natural disaster, where homeowners would gain homeowner insurance, renters often do not have rental insurance. As of 2009, 15.6% of the region's population was living in poverty.[5]

Median household income can be used to compare economic areas as a whole, but does not reflect how the income is divided among area residents. Table 2 displays the median household income for the Oregon Coast Region, which was $39,079 in 2009. This is below the 2009 national average of $51,425 and the state's average of $49,033. The 13.8% median household income growth between 2000 and 2009 in the region is smaller than the 19.8% State and 22.5% national increase.

Table 2. Median Household Income, Oregon Coast Region, 2000 and 2009

County	2000	2009	% Change 2000-2009
Clatsop	$36,945	$40,426	9.4%
Coos	$32,063	$36,754	14.6%
Curry	$31,131	$36,175	16.2%
Douglas*	$34,196	$40,324	17.9%
Lane*	$37,893	$42,852	13.1%
Lincoln	$33,431	$38,170	14.2%
Tillamook	$34,663	$38,851	12.1%
Regional Average:	**$34,332**	**$39,079**	**13.8%**

*Data for only the coastal portions of the Counties were not available.

Source: U.S. Census Bureau. 2005-2009. American Community Survey – 5 year estimates.

In 2009, 13.5% of the nation's population was living in poverty, nearly the same as Oregon's state poverty average of 13.6%. Oregon Coast's regional poverty level was 15.6%, slightly more than the national and state average. While the median household incomes are lower in the region than the state as a whole, the similar poverty rate may be due to a higher cost of living in the Oregon Coast Region. Table 3 details the county and regional poverty rates in 2009.

Table 3. Poverty Rates, Oregon Coast Region, 2009

	Total Population in Poverty		Children Under 18 in Poverty	
County	Number	%	Number	%
Clatsop	4,505	12.6%	1,332	16.9%
Coos	10,294	16.5%	2,652	21.4%
Curry	2,933	13.7%	580	16.1%
Douglas*	14,030	13.7%	4,270	19.3%
Lane*	54,248	16.2%	11,053	15.7%
Lincoln	7,803	17.3%	1,898	22.0%
Tillamook	3,739	15.4%	1,150	22.9%
Regional Average		**15.6%**		**17.6%**

*Data for only the coastal portions of the Counties were not available.

Source: U.S. Census Bureau. 2005-2009. American Community Survey – 5 year estimates.

For hazard mitigation, low-income populations need special considerations, because they may not have the savings to withstand economic setbacks, and if work is interrupted, housing, food, and necessities become a greater burden. Additionally, low-income households are more reliant upon public transportation, public food assistance, public housing, and other public programs, all which can be impacted in the event of a natural disaster.

The age of the population is also an important consideration in hazard mitigation planning. In 2010, 35% of the regional population was under 14 or over 65 years of age.[6] Table 4 provides a breakdown of the percentages of youth and elderly in the Oregon Coast region counties.

Table 4. Oregon Coast Region Youth and Senior Populations, 2010

	0-14		65-74		75+	
County	**Number**	**%**	**Number**	**%**	**Number**	**%**
Clatsop	6,221	16.8%	3,470	9.4%	2,690	7.3%
Coos	9,729	15.4%	6,684	12.0%	6,302	9.4%
Curry	2,790	12.5%	2,874	15.9%	3,072	12.1%
Douglas*	17,823	16.6%	10,158	11.3%	9,951	9.6%
Lane*	57,289	16.3%	23,451	8.1%	23,791	6.9%
Lincoln	6,515	14.2%	4,428	12.6%	4,200	9.0%
Tillamook	4,079	16.2%	2,598	12.1%	2,323	8.8%
Regional Total and Average %:	**104,446**	**16.0%**	**63,995**	**9.8%**	**52,508**	**8.0%**

*Data for only the coastal portions of the Counties were not available.

Source: U.S. Census Bureau: 2010 Census

The high percentage of elderly individuals, particularly in Curry County, require special consideration due to their sensitivities to heat and cold, their reliance upon transportation for medications, and their comparative difficulty in making home modifications that reduce risk to hazards.

Young people also represent a vulnerable segment of the population. With the exception of Curry and Lincoln Counties, at least 15% of the population of all coast counties is within the 0-14 year age range. Special considerations should be given to young populations and schools, where children spend much of their time, during the natural hazard mitigation process. Children are more vulnerable to heat and cold, have fewer transportation options, and require assistance to access medical facilities.

Special consideration should also be given to populations who do not speak English as their primary language. These populations can be harder to reach with preparedness and mitigation information materials. They are less likely to be prepared if special attention is not given to language and culturally appropriate outreach techniques. In the Oregon Coast Region, most citizens speak English as their primary language. However, in every

county in Oregon, Spanish is the second most prominent language. Table 5 shows the percentage of the individuals in the Oregon Coast region who do not speak English as their primary language. On average, 3% of the total population in the Oregon Coast region speaks a language other than English as a primary language.

Table 5. Oregon Coast Region Population over age 5 that Speaks English less than "Very Well", 2009

County	%Population
Clatsop	3%
Coos	1%
Curry	1%
Douglas*	1%
Lane*	3%
Lincoln	4%
Tillamook	3%
Regional Average:	**3%**

*Figures only include the coastal areas of Douglas and Lane Counties.

Source: U.S. Census Bureau. 2005-2009. American Community Survey – 5 year estimates.

Housing and Development

To accommodate rapid growth, communities engaged in mitigation planning should address infrastructure and service needs, specific engineering standards and building codes. Eliminating or limiting development in hazard prone areas, such as floodplains, can reduce vulnerability to hazards, and the potential loss of life and injury and property damage. Oregon has been successful in developing land use goals that incorporate mitigation while preserving rural and protected lands within urban growth areas. Communities in the process of developing land for housing and industry need to ensure that land-use and protection goals are being met to prevent future risks.

The urban and rural growth pattern impacts how agencies prepare for emergencies as changes in development can increase risks associated with hazards. The Oregon Coast Region is growing more urban, with 10% population growth in incorporated areas between 2000 and 2010, versus a 2% population loss in unincorporated areas during the same time period. Table 6 illustrates the trend in urban area population growth in the Oregon Coast counties between 2000 and 2010.

Table 6. Urban/Rural Populations, Oregon Coast Region, 2000-2010

County	% Incorporated Population 2000	2010	% Change 2000-2010
Clatsop	63%	65%	2%
Coos	58%	62%	4%
Curry	40%	47%	7%
Douglas*	45%	49%	3%
Lane*	70%	74%	4%
Lincoln	57%	62%	3%
Tillamook	36%	38%	1%
Regional Average:	**53%**	**63%**	**10%**

*Data for only the coastal portions of the Counties were not available.

Source: Portland State University Population Estimates, 2010

In addition to location, the character of the housing stock also affects the level of risk that communities face from natural hazards. Table 7 provides a breakdown by county of the various housing types available in 2009. Mobile homes and other non-permanent housing structures, which account for over 15% of the housing in Coos, Curry, Douglas, and Lincoln counties, are particularly vulnerable to certain natural hazards, such as windstorms, and special attention should be given to securing these types of structures.

Table 7. County Housing Profile, Oregon Coast Region, 2009

County	Single-Family	Multi-Family	Mobile Homes	Boat, RV, Van, etc.
Clatsop	70.0%	23.0%	6.7%	< 1.0%
Coos	68.3%	13.5%	17.2%	< 1.0%
Curry	61.3%	11.5%	24.5%	2.6%
Douglas*	68.5%	11.4%	19.2%	1.0%
Lane*	67.3%	22.8%	9.5%	< 1.0%
Lincoln	67.3%	16.2%	15.6%	< 1.0%
Tillamook	77.3%	8.6%	13.8%	< 1.0%

*Data for only the coastal portions of the Counties were not available.

Source: U.S. Census Bureau. 2005-2009. American Community Survey – 5 year estimates.

Table 7 shows that the majority of the housing stock is in single-family homes and this trend is continuing with new construction. In 2010, an estimated 84% of new housing was single-family units.[7] This trend suggests that hazard mitigation efforts should provide outreach and information that specifically addresses preparedness in detached housing units.

Aside from location and type of housing, the year housing structures were built has implications for community vulnerability. The older a home is, the greater the risk of damage from natural disaster. This is because structures built after the late 1960s in the Northwest and California used earthquake resistant designs and construction techniques. In addition, FEMA began assisting communities with

floodplain mapping during the 1970s, and communities developed ordinances that required homes in the floodplain to be elevated to one foot over Base Flood Elevation. Knowing the age of a structure is helpful in targeting outreach regarding retrofitting and insurance for owners of older structures. Table 8 illustrates the percentage of homes built per county during certain periods of time.

Table 8. Housing, Year Built, Oregon Coast Region

County	1939 or earlier - 1959	1960-1979	1980-2009
Clatsop	44%	24%	32%
Coos	35%	35%	30%
Curry	20%	30%	50%
Douglas*	29%	35%	36%
Lane*	25%	40%	35%
Lincoln	24%	34%	42%
Tillamook	31%	30%	40%

*Figures only include the coastal areas of Douglas and Lane Counties.

Source: U.S. Census Bureau. 2005-2009. American Community Survey – 5 year estimates

Section 3: Infrastructure Profile

This section of the report describes the infrastructure that supports Oregon Coast Region communities and economies. Transportation networks, systems for power transmission, and critical facilities such as hospitals and police stations are all vital to the functioning of the region. Due to the fundamental role that infrastructure plays both pre- and post-disaster it deserves special attention in the context of creating more resilient communities. The information that is provided in this section of the profile can provide the basis for informed decisions about how to reduce the vulnerability of Oregon Coast Region infrastructure to natural hazards.

TRANSPORTATION

There are two primary modes of transportation in the region: highways and railroad. There are also many small airports scattered throughout the region that are used for passenger and freight service.

Roads and Bridges

There is one major highway that runs through the Oregon Coast region. US-101 is a major transportation corridor that runs north-south through the Oregon Coast Region. This is an important transportation corridor along the Oregon Coast. A variety of highways connect coastal communities to inland communities.

- US Highway 26, intersects US-101 in Clatsop County and near Cannon Beach, respectively, on its way through the Portland Metropolitan area and points farther east;
- US Highway 42 intersects with US-101 and connects Coos Bay with Roseburg, and Interstate 5 and points north and south;
- Highway 28 intersects with US-101 and connects Reedsport with the Interstate 5 corridor just south of Cottage Grove;
- Highway 18 intersects with US-101 and connects Lincoln City with Salem and Interstate 5 and points farther north, south, and east;

- US Highway 30 intersects with US-101 and connects Astoria with the Portland Metropolitan area;
- Route 20 intersects with US-101 and connects Newport with Corvallis and Interstate 5 and points farther north, south and east; and
- US State highway 126 intersects with US-101 and connects Florence with Eugene/ Springfield, and Interstate 5 and points farther north, south and east.

Highways are also heavily utilized by local traffic. According to the 2009 American Community Survey, 73% of workers in the Oregon Coast Region commute by driving alone. The average commute for workers in the Oregon Coast Region is just over nineteen minutes each way.[8] Additionally, in 2009, 21% of employees living in counties in the Oregon Coast Region worked outside of their home county.[9] A severe winter storm or tsunami has the potential to disrupt the daily driving routine of thousands of people.

Over the last decade, the population growth in the region has contributed to an increase of automobiles on the roads:

- Average daily traffic volume on U.S. 101 recorded at the intersection of 25th Street in Newport increased by 2% between 2000 and 2009.[10]
- On U.S. 101 recorded 2.2 miles south of Rockaway, the average daily traffic between 1996 and 2010 increased by 1%.[11]
- Average daily traffic counts also increased by 5.5% between 1996 and 2010 on OR 126, 2.6 miles west of Elmira in Lane County. Judging from these trends, traffic levels will continue to increase [12]

A large increase of automobiles can place stress on roads, bridges and infrastructure within the cities, and also in rural areas where there are fewer transit roads. Natural hazards can disrupt automobile traffic and shut down local transit systems across the area or region and make evacuations difficult.

The condition of bridges in the region is also a factor that affects risk from natural hazards. Most bridges are not seismically retrofitted, which is a particularly important issue for the Oregon Coast region because of its risk from earthquakes. Incapacitated bridges can disrupt traffic and exacerbate economic losses because of the inability of industries to transport services and products to clients. Table 9 shows the number of state, county, and city maintained bridges and culverts, and the number of historic covered bridges in the region. The bridges in the region are part of the state and interstate highway and maintained by the Oregon Department of Transportation.

Table 9. Bridges and Culverts

County	State Highway Bridges	State Highway Culverts	County Highway Bridges	County Highway Culverts	City/ Municipal Highway Bridges	City/ Municipal Highway Culverts	Historic Covered Bridges	2011 Total
Clatsop	129	72	54	78	18	4	0	355
Coos	69	49	113	159	2	2	1	395
Curry	29	29	30	39	0	1	0	128
Douglas*	176	71	253	276	23	1	6	806
Lane*	288	112	417	347	68	3	18	1253
Lincoln	68	105	85	170	2	4	4	438
Tillamook	86	81	84	147	1	4	0	403

*Data for only the coastal portions of the Counties were not available.

Source: Oregon Department of Transportation, 2011, Oregon Department of Fish and Wildlife, Statewide Culvert Inventory, 2005

Railroads

Railroads are major providers of regional and national cargo and trade flows. Railroads that run through the Oregon Coast region provide vital transportation links from the Pacific to the rest of the country. There are five major coastal railroads: Willamette and Pacific (W&P), Central Oregon and Pacific (CORP), Longview Portland & Northern (LPN), Portland and Western (P&W), and Port of Tillamook Bay (POTB). These railroad lines connect to the Union Pacific (UP), CORP, and P&W north-south lines that run through the Willamette Valley farther east.[13]

Sixteen million tons of goods produced in Oregon are shipped out of state by railroad per year. The goods include lumber and wood products, pulp and paper, and miscellaneous mixed shipments.[14] Over 23 million tons of products originating in other states are annually shipped into Oregon by rail including wood, farm products, coal, and waste materials.[15] More than 22 million tons of products are shipped through Oregon annually by rail. More than 6 million tons of these products include grains and soybeans transported from the Northern Midwest to Washington.[16]

Rails are sensitive to icing from the winter storms that are common in the Oregon Coast region. For industries in the region that utilize rail transport, these disruptions in service can result in economic losses. As mentioned above, the potential for rail accidents caused by natural hazards can also have serious implications for the local communities if hazardous materials are involved.

Airports

The Oregon Coast Region has several airports. North Bend Municipal and Astoria Regional are the two largest airports in the region. Other airports in the region include Bandon State, Florence Municipal, Gold Beach Municipal, Newport Municipal, Seaside Municipal, Siletz Bay State, Tillamook, Cape Blanco State,

Lakeside State, Nehalem Bay State, Pacific City State, Vernonia Airfield and Wakonda Beach State.[17] North Bend Municipal, the largest airport in the region, transported 200 tons of freight in 2003.[18]

Flights face the potential for closure from a number of natural hazards that are common in the Oregon Coast Region, including windstorms and winter storms. Airports have strict guidelines regarding when conditions are safe for flight.

Ports

Ports in the Oregon Coast Region are a major contributor to the local, regional, and national economies. There are three major deep draft ports in the region – Coos Bay/North Bend, Newport, and Astoria. In 1998, the port in Coos Bay shipped 3 million tons of goods, 97% of which were forest products. [19]

Critical Facilities

Critical facilities are those facilities that are essential to government response and recovery activities (e.g., police and fire stations, public hospitals, public schools). Critical facilities in the Oregon Coast Region are displayed in Table 10 by county.

Table 10. Oregon Coast Region Critical Facilities by County

	Hospitals			Fire &	
County	# of Hospitals	# of Beds	Police Station	Rescue Station	School Districts & Colleges
Clatsop	2	50	8	11	5 SDs, 1 Community College
Coos	3	173	8	17	6 SDs, 1 Community College
Curry	1	24	4	10	3 SDs
Douglas*	2	157	9	26	14 SDs, 1 Community College
Lane*	5	578	10	23	16 SDs, 1 Community College, 1 State University, 3 Private Universities
Lincoln	2	50	5	8	1 SD, 1 Community College
Tillamook	1	29	8	7	3 SDs, 1 Community College

*Data for only the coastal portions of the Counties were not available.

Sources: State Hospital Licensing Department, USAcops.com, Oregon State Fire Marshall, Oregon Department of Education.

In addition to those listed in Table 10, there are other critical and essential facilities that are vital to the continued delivery of key governmental services or that may significantly impact the public's ability to recover from emergencies. Some of these facilities, such as correctional institutions, public services buildings, law enforcement centers, courthouses, juvenile services buildings, public works facilities, and other public facilities should be detailed in local and regional mitigation plans.

Power Generation and Transmission

Most of the Oregon Coast's oil and gas pipelines are connected to main lines that run through the Willamette Valley. The infrastructure associated with power generation and transmission plays a critical role in supporting the regional economy, and is therefore crucial to consider during the natural hazard planning process.

There are no major dams in the Oregon Coast region, but just east of the region, there are several major dams: Bonneville, Round Butte, Lookout Point, Carmen-Smith, Detroit, and Pelton dams all have maximum generating capacities of over 100 megawatts (mw's) of electricity.[20]

Dam failures can occur at any time and are quite common. Fortunately, most failures result in minor damage and pose little or no risk to life safety. However, the potential for severe damage and fatalities does exist, and the National Inventory of Dams (NID) has developed a listing of High Threat Potential Hazard dams for the nation. The state has developed a complementary inventory of dams in Oregon. Table 11 lists the dams included in the state inventory.

Table 11. Oregon Coast Region Power Plants and Dams by County

		Dams	
County	Power Plants	Dams‡ (State)	Threat Potential
Clatsop	0	6	4 High Threat
Coos	0	26	2 High Threat
Curry	0	8	0 High Threat
Douglas*	0	86	13 High Threat
Lane*	1 - 51.2 MWs	58	13 High Threat
Lincoln	0	7	5 High Threat
Tillamook	0	8	0 High Threat

*Data for only the coastal portions of the Counties were not available.

Sources: Oregon Department of Energy, Oregon State Water Resources

The electric, oil, and gas lines that run through the Oregon Coast region are privately owned. A network of electricity transmission lines, owned by Bonneville Power Administration and Pacific Power run through the Oregon Coast region.[21] Most of the natural gas Oregon uses originates in Alberta, Canada. Northwest Natural Gas serves the central region of the Oregon Coast.[22] These electric, oil, and gas lines may be vulnerable to severe, but infrequent natural hazards, such as

‡ Note: The National Inventory of Dams includes all dams with either:

a) a high or significant hazard rating

b) a low hazard dam that exceeds 25 feet in height AND 15 acre-feet storage

c) a low hazard dam that exceeds 6 feet in height AND 50 acre-feet storage

earthquakes. There are three Liquid Natural Gas (LNG) projects currently being proposed in the Region – 2 in Clatsop County and one in Coos County.[23]

Section 4: Economic Profile

The following economic profile addresses the regional economy and its sensitivities to natural hazards. The sensitivities that are relevant to the Oregon Coast Region are a function of the types and diversity of industries and the composition of businesses that are present. To highlight key industries, this report will look at:

The largest revenue sectors, since interruptions to these industry sectors would result in significant revenue loss for the region.

The largest employment industries, since interruptions to these industry sectors would result in high unemployment in the region.

The industry sectors with the most businesses, since interruptions to these industry sectors would result in damage to the most businesses regionally.

By examining these key industry sensitivities and other economic sensitivities, such as industry diversity and the number of small businesses that exist in the Oregon Coast Region, informed decisions can be made about how to mitigate risk.

Economic Overview

The Oregon Coast Region enjoys some economic advantages due to its coastal location. In addition, the region's close proximity to the Coast Range, California, Washington, and the beach itself provide year-round sporting and tourism activities.

According to the Oregon Employment Department, the Oregon Coast Region economy is stabilizing after a downturn. Construction and Manufacturing are declining in all coastal counties. Tillamook, Lane and Lincoln have experienced moderate growth in the Education and Heath industries. Unemployment had decreased an average of 2% for all coastal counties between October 2010 and October 2011.[24] As of 2010, the region employed 238,546 people with a combined payroll of over eight billion dollars. Table 12 displays the payroll and employee figures per county.

Table 12. Oregon Coast Employment and Payroll by County, 2010

County	# of Employees	Annual Payroll	Average Pay
Clatsop	16,515	$517,591,154	$31,341
Coos	21,299	$665,782,970	$31,259
Curry	6,164	$184,465,719	$29,926
Douglas*	34,322	$1,143,674,197	$33,322
Lane*	134,572	$4,829,633,517	$35,889
Lincoln	17,207	$516,448,205	$30,014
Tillamook	8,426	$263,013,141	$31,063
Total	**238,546**	**$8,120,608,903**	**$34,042**

*Data for only the coastal portions of the Counties were not available.

Source: Oregon Employment Department[25]

In 2010, there were 19,333 private sector businesses in the Oregon Coast Region. Of these, 90%, or 17,448 were small businesses with less than 20 employees.[26§] The prevalence of small businesses in the Oregon Coast region is an indication of sensitivity to natural hazards because small businesses are more susceptible to financial uncertainty.[27] When a business is financially unstable before a natural disaster occurs, financial losses (resulting from both damage caused and the recovery process) may have a bigger impact than they would for larger and more financially stable businesses.[28]

The economic diversity of the businesses in the Oregon Coast Region varies markedly between counties. Lane County has the third highest statewide economic diversity, while the other counties have more homogenous economies. Low economic diversity means that certain industries are dominating the economic structure of the community, and are therefore extremely important to the Oregon Coast Region. Table 13 displays the diversity ranking for each county with 1 being the most diverse economic county in Oregon, 36 being the least diverse economic county in Oregon.

§ This data includes the number of private sector businesses for all of Lane and Douglas Counties, not just the coastal portions.

Table 13. County Economic Diversity Ranking, 2009

	Economic Diversity Index	
County	**Ranking**	**Value**
Clatsop	21	0.310
Coos	26	0.268
Curry	16	0.363
Douglas*	14	0.446
Lane*	3	0.827
Lincoln	22	0.319
Tillamook	25	0.286

*Data for only the coastal portions of the Counties were not available.

Source: Oregon Employment Department[29]

An economy that is heavily dependent upon a few key industries may have a more difficult time recovering after a natural disaster than one with a more diverse economic base. While a community with a diverse economic base may suffer from an industry sector being damaged during a natural disaster, they have a broader base of operating industry sectors to continue to rely upon. However, a community that relies upon specific key industry sectors may have a harder time recovering their economic base if one of those key industry sectors is damaged. Recognizing that economic diversification is a long-term issue, more immediate strategies to reduce vulnerability should focus on risk management for the dominant industries.

Key Industries

Key industries are those that represent major employers, major revenue generators, and for the purposes of hazard mitigation planning, industries that are represented by a high number of businesses. Different industries face distinct vulnerabilities to natural hazards, as illustrated by the industry specific discussions below. Identifying key industries in the region enables communities to target mitigation activities towards those industries specific sensitivities.

It is important to recognize that the impact that a natural hazard event has on one industry can reverberate throughout the regional economy. The effect is especially great when the businesses concerned belong to a basic sector industry. Basic sector industries are those that are dependent on sales outside of the local community; they bring money into a local community via employment. The farm and ranch, information, and wholesale trade industries are all examples of basic industries. Non-basic sector industries are those that are dependent on local sales for their business, such as retail trade, construction, and health and social assistance.

Basic sector businesses have a multiplier effect on a local economy, whereby the jobs and income they bring to a community allow for the creation of new non-basic sector jobs. Their presence can therefore help speed the recovery process following a natural disaster. If, on the other hand, basic sector industry production is hampered by a natural hazard event, the multiplier effect could be experienced in reverse. In this case, a decrease in basic sector purchasing power results in lower profits (and potentially job losses) for the local non-basic businesses that are dependent on them.

High Revenue Sectors

The Oregon Coast Region's top revenue generating industries are a mix of basic and non-basic sectors. In 2007, the three sectors in the Oregon Coast Region with the highest revenue were Manufacturing (38%), Retail Trade (34%), and Healthcare/Social Assistance (12%).[30] **

Within individual counties in the Oregon Coast Region, however, the industries' relative contribution to revenue differs. For instance, in Coos County, the Health Care and Social Assistance sector garners the second highest amount of revenue. Table 14 shows the percent of total county revenue that is contributed by various sectors.

Table 14. Percent of Revenue in Oregon Coast Counties by Industry, 2007

County	Retail Trade	Accommodation and Food Services	Health Care/ Social Assistance	Professional, Scientific and Technology	Other (except Public Admin)	Real Estate and Rental and Leasing	Arts/ Entertainment	Administrative/ Waste Services	Manufacturing
Clatsop	35%	9%	8%	1%	2%	2%	1%	1%	40%
Coos	45%	5%	21%	3%	4%	2%	n/a	3%	17%
Curry	39%	10%	11%	2%	2%	2%	1%	2%	33%
Douglas*	32%	6%	14%	2%	2%	1%	0%	2%	41%
Lane*	29%	4%	13%	4%	3%	2%	1%	2%	41%
Lincoln	34%	13%	10%	n/a	2%	3%	n/a	2%	36%
Tillamook	22%	5%	7%	1%	2%	1%	n/a	1%	61%

*Data for only the coastal portions of the Counties were not available.

Source: U.S. Census 2007

** Note: US Census Total Sales figures were not available for all sectors and counties in Region 1. These figures represent the closest estimate.

Table 15. Gross in Oregon Coast Counties for Farm and Ranch Industry, 2007

County	Dollar amount
Clatsop	16,752,000
Coos	55,256,000
Curry	32,388,000
Douglas*	81,601,000
Lane*	139,004,000
Lincoln	12,307,000
Tillamook	120,309,000

*Data for only the coastal portions of the Counties were not available.

Source: USDA National Agriculture Statistics Service[31]

In 2007, the *Manufacturing sector* generated 38% of all revenue in the Oregon Coast Region, making it the largest earning sector.[32] Manufacturers are highly dependent upon the transportation network in order to access supplies and send finished products to outside markets. As base industries they are not, however, dependent on local markets for sales, which contributes to the economic resilience of this sector.

The *retail trade sector* in the Oregon Coast region generated 34% of all revenue, making it the second-largest earning sector.[33] Retail trade is largely dependent on wholesale trade and the transportation network for the delivery of goods for sale. Disruption of the transportation system could have severe consequences for retail businesses. Retail trade typically relies on local residents and tourists and their discretionary spending ability. Residents' discretionary spending diminishes after a natural disaster when they must pay to repair their homes and properties. In this situation, residents will likely concentrate their spending on essential items that would benefit some types of retail (e.g. grocery) but hurt others (e.g. gift shops). The potential income from tourists also diminishes after a natural disaster as people are deterred from visiting the impacted area. In summary, depending on the type and scale a disaster could affect specific segments of retail trade, or all segments.

Wholesale trade is closely linked with retail trade but it has a broader client base than retail trade, with local and non-local businesses as the typical clientele. Local business spending will be likely to diminish after a natural disaster, as businesses repair their properties and wait for their own retail trades to increase. Distanced clients may have difficulty reaching local wholesalers due to transportation disruptions from a natural disaster. Both would adversely impact the profitability of this sector.

The *farm and ranch* sector is inherently dependent on the weather and is susceptible to a variety of natural hazards that afflict the Oregon Coast region, including flood, drought, and summer and winter storms. These natural hazards have the capacity to devastate seasonal crops, representing a significant financial loss for the year.

Major employment sectors

Economic resilience to natural disasters is particularly important for the major employment sectors in the region. If these sectors are negatively impacted by a natural hazard, such that employment is affected, the impact will be felt throughout the regional economy. Thus, understanding and addressing the sensitivities of these sectors is a strategic way to increase the resiliency of the entire regional economy.

The five sectors in the Oregon Coast region with the most employees in 2011 were Government (21%), Retail Trade (13%), Accommodation and Food Services (11%), Health Care and Social Assistance (13%), and Manufacturing (9%).[34]

Within the six Oregon Coast counties, the percent of county employment by various sectors differs. For example, in Clatsop and Lincoln counties, Accommodation and Food Services is a large employer, though across the region, Accommodation and Food Services accounts for a medium percentage of total employment. Table 16 shows the distribution of each county's employees across the five largest regional employment sectors.

Table 16. Percent of County Employment by the Five Largest Regional Employment Sectors, Oregon Coast Region, 2011

	Industry				
County	Government	Health Care and Social Services	Retail Trade	Manufacturing	Accommodation and Food Services
Clatsop	17%	13%	15%	11%	21%
Coos	28%	10%	13%	7%	10%
Curry	22%	n/a	16%	9%	15%
Douglas*	25%	12%	12%	12%	8%
Lane*	19%	15%	13%	9%	9%
Lincoln	23%	10%	15%	6%	22%
Tillamook	23%	10%	11%	15%	14%

*Data for only the coastal portions of the Counties were not available.

Source: Oregon Employment Department, 2011.[35]

Sectors that are anticipated to be major employers in the future also warrant special attention in the hazard mitigation planning process. Between 2005 and 2014, the largest job growth in the Oregon Coast Region is expected to occur in Professional and Business Services, Health and Educational Services and Construction.[36]

The *professional and business services* sector is sensitive to a loss of power from a disaster and to disruptions of physical transmission cables (phone lines, etc.). There may also be a disruption of employees' ability to work as a result of damages/problems at home. If prepared and organized, however, this sector has the potential to have moderate resilience to many disasters. Some of the targeted consumers of this sector's services are located outside the region and their

purchasing power would not be impacted by a localized natural disaster. The sector may also be more insulated from disruptions to the transportation network than others because there is a potential for many of the employees to work from home and because some services are offered via internet and phone.

The *health and education service* sector includes medical facilities and schools, both of which are considered critical facilities. This sector is vital in the response and recovery phases of an event. If these critical facilities are not prepared, the ability of the community to recover can be diminished.

Common Business Types

Identifying sectors that are represented by a large number of businesses can guide the development of targeted mitigation strategies for those sectors. Approximately 32% of all businesses in the Oregon Coast Region fall into three industry sectors. In the Oregon Coast Region, 12% (2,539) of all businesses are engaged in *retail trade*, 10% (2,109) of all businesses are engaged in *accommodations and food services*, and another 10% (1,999) of all businesses are engaged in the health care and social assistance industry.[37]

In the event of wildfires, floods, earthquakes, or other types of destructive natural disasters, the demand for reconstruction services may be expected to increase. Business from local residents looking to re-build their homes and businesses may boost construction revenue. If transportation routes have been affected, construction businesses may have difficulty accessing necessary supplies from outside the impacted area. Protecting infrastructure and transportation will help to enable the construction sector to continue operating and re-building communities after a natural disaster.

Regional Profile and Sensitivity Conclusion

Information presented in the Community, Infrastructure, and Economic Profiles can be used to help communities identify areas of sensitivity and vulnerability to natural hazards. Once the areas of sensitivity are identified, communities should identify appropriate, corresponding action items.

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REGION 1

Oregon Coast[1]

Hazards Assessment

[1] Region 1 includes all of Oregon's coastal counties: Clatsop, Coos, Curry, Douglas (coastal section), Lane (coastal section), Lincoln, Tillamook. The lower estuarine Columbia River is also included in Region 1 (Clatsop County).

DROUGHT

Characteristics and Brief History

Droughts are not uncommon in the State of Oregon, nor are they just an "east of the mountains" phenomenon. They occur in all parts of the state, in both summer and winter months. Droughts appear to be cyclic, and can have a profound effect on the State's economy, particularly the hydropower and agricultural sectors. The environmental consequences also are far-reaching, including insect infestations in Oregon forests and a reduction in the stream flows that support endangered fish species. Severe drought conditions preceded the four disastrous Tillamook fires (1933, 1939, 1945, 1951) and pitted farmer against fish protection groups during the Klamath County drought of 2001. In recent years, the State has addressed drought emergencies through the Oregon Drought Council. This interagency (state/federal) council meets to discuss climate outlooks, water and soil conditions, and to advise the Governor as the need arises. Significant droughts are depicted in Table 1.

TABLE 1. SIGNIFICANT DROUGHTS

DATE	DESCRIPTION
1904-1905	A drought period of about 18 months throughout Oregon
1917-1931	A very dry period, punctuated by brief wet spells in 1920-21 and 1927 throughout Oregon
1939-1941	A three-year intense drought in Oregon
1976-1981	Intense drought in western Oregon; 1976-77 single driest year of century
1985-1997	Generally a dry period, capped by statewide droughts in 1992 and 1994
2000-2001	General statewide drought
2005	Federal drought declaration issued in Coos County

Source: Taylor, George H., and Ray Hatton, 1999, *The Oregon Weather Book.*

Probability

Oregon's drought history reveals many short-term and a few long-term events. The average recurrence interval for severe droughts in Oregon is somewhere between 8 and 12 years. Table 1 provides an overview of severe droughts in Oregon.

The probability that Region 1 will experience droughts is depicted in Table 2 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration. These cases are noted with a dash (-) in the table below.

TABLE 2. Probability Assessment of Drought

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	-	H	-	-	-	H	L

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

Region 1 is less vulnerable to drought impacts than most of Oregon, but droughts can still be problematic. Potential impacts to community water supplies are the greatest threat. Long-term drought periods of more than a year can impact forest conditions and set the stage for potentially devastating wildfires.

The region's vulnerability to drought is depicted in Table 3 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration. These cases are noted with a dash (-) in the table below.

TABLE 3. Vulnerability Assessment of Drought

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	-	M	-	-	-	L	L

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

EARTHQUAKE

Characteristics and Brief History

The geographical position of Region 1 makes it susceptible to earthquakes from three sources: (1) the off-shore Cascadia Fault Zone, (2) deep intra-plate events within the subducting Juan de Fuca plate, and (3) shallow crustal events within the North America Plate. All have some tie to the subducting or diving of the dense, oceanic Juan de Fuca Plate under the lighter, continental North America Plate. Stresses occur because of this movement. (See Oregon Technical Resource Guide: Seismic Hazards.)

When crustal faults slip, they can produce earthquakes with magnitudes (M) up to 7.0 and can cause extensive damage, which tends to be localized in the vicinity of the area of slippage. Deep intraplate earthquakes occur at depths between 30 and 100 kilometers below the earth's surface. They occur in the subducting oceanic plate and can approach M7.5. Subduction zone earthquakes pose the greatest hazard. They occur at the boundary between the descending oceanic Juan de Fuca Plate and the overriding North American Plate. This area of contact, which starts off the Oregon coast, is known as the Cascadia Subduction Zone (CSZ). The CSZ could produce an earthquake up to 9.0 or greater.

There is no historic record of crustal earthquakes centered in this region in the past 156 years, although Oregon has experienced crustal earthquakes that originated outside the region. The geologic record shows that movement has occurred along numerous offshore faults as well as a few onshore faults in Coos and Tillamook counties. The faulting has occurred over the last 20,000 years. Intraplate earthquakes are very rare in Oregon, although such earthquakes originating outside of the state have been felt in this region. It is believed that the M7.3 near Brookings in 1873 was an intraplate quake.

In Region 1, earthquake hazards include severe ground shaking, liquefaction of fine-grained soils, landslides and flooding from local and tele-tsunamis. The severity of these effects depend on several factors, including the distance from the earthquake source, the ability of soil and rock to conduct seismic energy and the degree (angle) and composition of slope materials.

Since Oregon adopted the International Building Code 2003 (IBC 2003), it no longer uses the seismic zones to define the hazard. The IBC 2003 uses the maps from the USGS earthquake program, which depict a much more accurate spatial distribution of the hazard. The old Uniform Building Codes (UBC) maps displayed the hazard as spatially changing along county boundaries.

Table 4 describes significant earthquakes that have affected the region.

TABLE 4. SIGNIFICANT EARTHQUAKES

DATE	LOCATION	MAGNITUDE (M)	Comments
Approximate Years 1400 BCE* 1050 BCE 600 BCE 400 750 900	Offshore, Cascadia Subduction Zone	Probably 8-9	Based on studies of earthquake and tsunami at Willapa Bay, Washington. These are the mid-points of the age ranges for these six events.
01/1700	Offshore, Cascadia Subduction Zone	Approximately 9.0	Generated a tsunami that struck Oregon, Washington, and Japan; destroyed Native American villages along the coast
11/1873	Brookings area	7.3	Chimneys fell at Port Orford, Grants Pass, and Jacksonville. No aftershocks. Origin probably Gorda block of the Juan de Fuca plate. Intraplate event
11/1962	Portland	5.2 to 5.5	Damage to many homes (chimneys, windows, etc.). Crustal event
03/1993	Scotts Mills	5.6	$28 million in damage. Damage to homes, schools, businesses, state buildings (Salem). Crustal Event (FEMA-985-DR-OR)
09/1993	Klamath Falls	5.9 to 6.0	Two earthquakes causing two deaths and extensive damage. $7.5 million in damage to homes, commercial, and government buildings. Crustal event (FEMA-1004-DR-OR)

Source: Wong, Ivan and Bolt, Jacqueline, November 1995, A Look Back at Oregon's Earthquake History, 1841-1994, *Oregon Geology,* p.125-139.

Notes: *BCE: Before the Common Era

Probability

Scientists estimate the chance in the next 50 years of a great subduction zone earthquake is between 10 and 20 percent, assuming that the recurrence is on the order of 400 +/- 200 years.[2]

Paleoseismic studies along the Oregon coast indicate that the state has experienced seven Cascadia Subduction Zone events possibly as large as M9 in the last 3500 years. These events are estimated to have an average recurrence interval between 500 and 600 years, although the time interval between individual events ranges from 150 to 1000 years. The last CSZ event occurred approximately 300 years ago.

The following probability estimates are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 5. Probability Assessment of Earthquakes

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	M	M	M	M	M	H	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

Region 1 is especially vulnerable to earthquake hazards. This is because of the built environment's proximity to the Cascadia Subduction Zone (CSZ), regional seismicity, topography, bedrock geology and local soil profiles. For example, a large number of buildings are constructed of unreinforced masonry (URM) or are constructed on soils that are subject to liquefaction during severe ground shaking. Also, some principal roads and highways are susceptible to earthquake-induced landslides. Bridges and tunnels need to be retrofitted to withstand ground shaking and the ability of dams to withstand earthquake forces should be considered. This is especially important as 12 dams in Region 1 have been designated as "high hazard." Problem areas within the region are readily identifiable on earthquake hazard maps prepared by the Oregon Department of Geology and Mineral Industries (DOGAMI).

In 2007, DOGAMI completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify,

[2] Oregon Geology, 2002

inventory, and rank buildings that are potentially vulnerable to seismic events. DOGAMI surveyed a total of 3,349 buildings, giving each a 'low,' 'moderate,' 'high,' or 'very high' potential of collapse in the event of an earthquake. It is important to note that these rankings represent a probability of collapse based on limited observed and analytical data and are therefore *approximate* rankings.[3] To fully assess a building's potential of collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to survey.

Table 6 below shows the number of buildings surveyed in each county with their respective rankings.

TABLE 6. REGION 1 BUILDING COLLAPSE POTENTIAL

County	Level of Collapse Potential			
	Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100 %)
Clatsop	24	19	20	1
Tillamook	19	9	23	5
Lincoln	30	18	12	3
Lane*	8	4	5	-
Douglas**	3	2	10	-
Coos	41	11	48	7
Curry	15	10	10	2

Source: DOGAMI Seismic Needs Assessment, available at http://www.oregongeology.org/sub/projects/rvs/default.htm

* Includes only the Lane County coastal communities of Deadwood, Florence, Mapleton, and Swisshome

**Includes only the Douglas County coastal communities of Gardiner, Reedsport, and Winchester Bay

In addition to the RVS study, DOGAMI has also developed two earthquake loss models for Oregon based on the two most likely sources of seismic events: (1) the Cascadia Subduction Zone (CSZ), and (2) combined crustal events (500-year Model). Both models are based on HAZUS, a computerized program, currently used by the Federal Emergency Management Agency (FEMA) as a means of determining potential losses from earthquakes. The CSZ event is based on a potential 8.5 earthquake generated off the Oregon coast. The model does not take into account a tsunami, which probably would develop from the event. The

[3] State of Oregon Department of Geologic and Mineral Industries, Implementation of 2005 Senate Bill 2 Relating to Public Safety, Seismic Safety and Seismic Rehabilitation of Public Building, May 22, 2007, iv.

500-Year crustal model does not look at a single earthquake (as in the CSZ model); it encompasses many faults, each with a 10% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time. Neither model takes unreinforced masonry buildings into consideration

DOGAMI investigators caution that the models contain a high degree of uncertainty and should be used only for general planning purposes. Despite their limitations, the models do provide some approximate estimates of damage. Results are found in Tables 7-9.

Other useful resources for planning for earthquakes include the following:

- **Maps of earthquake hazard areas:** DOGAMI has mapped urban areas and relative Environmental Quality hazard maps for all of the Region 1 counties except Lane and Lincoln counties. DOGAMI has only mapped urban areas for these two counties.
- **Map of coastal critical facilities vulnerable to hazards:** DOGAMI has developed these maps for all Region 1 counties.
- **Environmental Geology of Land Use Geology maps:** DOGAMI has developed these maps for all Region 1 counties.
- **Nuclear energy/hazardous waste sites inventories**: No Region 1 counties have nuclear facilities.

TABLE 7. PROJECTED DOLLAR LOSSES BASED ON A M8.5 SUBDUCTION EVENT AND A 500-YEAR MODEL

REGION 1 COUNTIES	ECONOMIC BASE IN THOUSANDS (1999)	GREATEST ABSOLUTE LOSS IN THOUSANDS (1999) FROM AN M8.5 CSZ EVENT[1]	GREATEST ABSOLUTE LOSS IN THOUSANDS (1999) FROM A 500-YEAR MODEL[1,2]
Clatsop	$2,198,000	$549,000	$760,000
Coos	$3,263,000	$1,339,000	$1,429,000
Curry	$1,093,000	$371,000	$388,000
Douglas[3]	$4,631,000	$275,000	$546,000
Lane[3]	$15,418,000	$1,614,000	$3,044,000
Lincoln	$2,668,000	$624,000	$793,000
Tillamook	$1,539,000	$226,000	$364,000

Source: DOGAMI, 1999, Special Paper 29: Earthquake Damage in Oregon.

Table 7 Notes:

[1] "...there are numerous un-reinforced masonry structures (URMs) in Oregon, the currently available default building data does not include any URMs. Thus, the reported damage and loss estimates may seriously under-represent the actual threat" (page 126 – 1998, DOGAMI)

[2]Every part of Oregon is subject to earthquakes. The 500-year model is an attempt to quantify the risk across the state. The estimate does not represent a single earthquake. Instead, the 500-year model includes many faults, each with a 10% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time. More and higher magnitude earthquakes than used in this model may occur (DOGAMI, 1999).

[3]Entire county

TABLE 8. ESTIMATED LOSSES ASSOCIATED WITH A M8.5 SUBDUCTION EVENT

	Region 1 Counties							
	Clatsop	Coos	Curry	Douglas[1]	Lane[1]	Lincoln	Tillamook	Remarks
INJURIES	298	854	221	151	1,036	358	132	Cascadia Subduction Zone (CSZ) is the most dangerous fault in Oregon. The entire coastline is essentially the epicenter. The earthquake could have a magnitude 8.5 (or M9.0). The event might last as long as four minutes. Within a few minutes, a tsunami would follow. (Tsunami damages are not included in the estimates for this earthquake, and would dramatically increase losses for coastal counties). A CSZ earthquake could affect a very large area. If the entire fault ruptures, destruction could occur from northern California to Canada. The number of deaths and injuries depends on the time of day, building type, occupancy class, and traffic pattern. (DOGAMI, Special Paper 29, 1999, p.4).
DEATHS	6	16	3	2	19	7	3	
DISPLACED HOUSEHOLDS	788	2,069	430	255	2,345	592	158	
OPERATIONAL THE DAY AFTER THE QUAKE[2]:								
Fire stations	16%	10%	9%	66%	49%	26%	31%	
Police stations	15%	6%	5%	57%	42%	22%	44%	
Schools	16%	8%	6%	44%	46%	19%	32%	
Bridges	58%	44%	34%	74%	76%	51%	58%	
ECONOMIC LOSSES TO[2]:								
Highways	$18 mil	$44 mil	$48 mil	$43 mil	$39 mil	$16 mil	$25 mil	
Airports	$5 mil	$20 mil	$11 mil	$5 mil	$11 mil	$9 mil	$7 mil	
Communications	$6 mil	$25 mil	$18 mil	$7 mil	$11 mil	$9 mil	$5 mil	
DEBRIS GENERATED (thousands of tons)	383	853	267	222	1,341	446	158	

Source: DOGAMI, 1999, Special Paper 29: Earthquake Damage in Oregon.

Table 8 Notes:

[1]Entire county

[2]"...there are numerous un-reinforced masonry structures (URMs) in Oregon, the currently available default building data does not include any URMs. Thus, the reported damage and loss estimates may seriously under-represent the actual threat" (page 126 – 1998, DOGAMI).

TABLE 9. ESTIMATED LOSSES ASSOCIATED WITH A 500-YEAR MODEL[1]

COUNTIES	Clatsop	Coos	Curry	Douglas[2]	Lane[2]	Lincoln	Tillamook
INJURIES	397	845	212	294	2,254	436	181
DEATHS	8	16	3	4	45	9	4
DISPLACED HOUSEHOLDS	1,182	2,521	486	534	4,543	847	275
ECONOMIC LOSSES FOR BUILDINGS[3]	$760 mil	$1.4 bil	$328 mil	$546 mil	$3 bil	$792 mil	$364 mil
OPERATIONAL THE DAY AFTER THE QUAKE							
Fire stations	N/A[4]	N/A	N/A	N/A	N/A	N/A	N/A
Police Stations	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Schools	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bridges	N/A	N/A	N/A	N/A	N/a	N/A	N/A
ECONOMIC LOSSES TO:[3]							
Highways	$33 mil	$49 mil	$44 mil	$69 mil	$74 mil	$22 mil	$39 mil
Airports	$7 mil	$20 mil	$12 mil	$9 mil	$20 mil	$12 mil	$8 mil
Communications	$8 mil	$2 mil	$15 mil	$12 mil	$20 mil	$10 mil	$6 mil
DEBRIS GENERATED (thousands of tons)	474	864	261	411	2,424	525	224

Source: DOGAMI, 1999, Special Paper 29: Earthquake Damage in Oregon.

Table 9 Notes:

[1]Every part of Oregon is subject to earthquakes. The 500-year model is an attempt to quantify the risk across the state. The estimate does not represent a single earthquake. Instead, the 500-year model includes many faults, each with a 10% chance of producing an earthquake in the next 50 years. The model assumes that each fault will produce a single "average" earthquake during this time. More and higher magnitude earthquakes than used in this model may occur. (DOGAMI, 1999)

[2]Entire county

[3] "...there are numerous un-reinforced masonry structures (URMs) in Oregon, the currently available default building data does not include any URMs. Thus, the reported damage and loss estimates may seriously under-represent the actual threat" (page 126 – 1998, DOGAMI)

[4]NA - Because the 500-year model includes several earthquakes, the number of facilities operational the "day after" cannot be calculated

The region's vulnerability to earthquakes is depicted in Table 10 below. The scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 10. Vulnerability Assessment of Earthquakes

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	H	H	H	H	H	M	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

FIRES IN THE WILDLAND/URBAN INTERFACE

Characteristics and Brief History

Oregon has a very lengthy history of fire in the undeveloped wildlands and in the developing wildland/urban interface. In recent years, the cost of fire suppression has risen dramatically; a large number of homes have been threatened or burned, more fire fighters have been placed at risk, and fire protection in wildland areas has been reduced. These factors have prompted the passage of Oregon Senate Bill (SB) 360 (Forestland / Urban Interface Protection Act, 1997). This bill: (1) establishes legislative policy for fire protection, (2) defines urban/wildland interface areas for regulatory purposes, (3) establishes standards for locating homes in the urban/wildland interface, and (4) provides a means for establishing an integrated fire protection system.

Coastal and Lower Columbia River counties are heavily timbered and have a long history of devastating forest fires. Some of the history is derived from Native Americans who recall extensive forest fires before the arrival of Euro-Americans. Fires involving the wildland interface occur in portions of the state where urbanization and natural vegetation fuels allow a fire to spread rapidly from natural fuels to structures and vice versa. Especially in the early stage of such fires, structural fire suppression resources can be quickly overwhelmed increasing the number of structures destroyed. Such fires are known for the large number of structures that are simultaneously exposed to fire, increasing the total losses per structure ignited. Nationally, wildland interface fires commonly produce widespread, extreme losses. Thus far, Oregon has escaped the level of property losses experienced by neighboring states.

Table 11 describes the history of some of the significant wildland fires experienced in Region 1 and Oregon.

TABLE 11. SIGNIFICANT WILDFIRES

DATE	NAME OF FIRE	LOCATION	CHARACTERISTICS	REMARKS
1846	Yaquina	Lincoln & Lane counties	Burned over 450,000 acres.	Event related by Native American hunters
1853	Nestucca		Burned over 320,000 acres	
1868	Coos Bay	Coos	296,000 acres burned	
1922	Astoria	Downtown, City of Astoria	Many Buildings (32 city blocks burned!)	Early December structural fire most likely not related to wildfire
1933	Tillamook		240,000 acres burned	The Tillamook Forest burned every six years between 1933 and 1951. Total acreage burned was over 350,000 acres. Together, the four events are called the Tillamook Burn. Dry forest conditions seems to have been a major factor (Taylor)
1936	Bandon		143,000 acres burned	
1939	Saddle Mountain	Clatsop County	207,000 acres burned	
1945	Wilson River / Salmonberry	Tillamook County	173,000 acres	
1951	North Fork / Elkhorn	Tillamook County	33,000 acres burned	
2002	Florence/Biscuit	S.W. Oregon	Almost 500,000 acre (perimeter) burned	Largest forest fire in Oregon since arrival of Euro-Americans (FEMA Fire Suppression Authorization on 7/29/02). The perimeter contained many unburned islands within the overall acreage.

Source: Brian Ballou, 2002, A Short History of Oregon Wildfires, Oregon Department of Forestry, unpublished; and Oregon Emergency Management, State Natural Hazard Mitigation Plan, 2003, Wildland/Urban Interface chapter.

Probability

The natural ignition of forest fires is largely a function of weather and fuel; human-caused fires add another dimension to the probability. Dry and diseased forests can be mapped accurately and some statement can be made about the probability of lightning strikes. Each forest is different and consequently has different probability/recurrence estimates.

This document defines wildfire as an uncontrolled burning of forest, brush, or grassland. Wildfire always has been a part of these ecosystems and sometimes with devastating effects. Table 9 (above) provides an overview of the significant wildfires in Region 1. Wildfire results from natural causes (e.g., lightening strikes), a mechanical failure (Oxbow Fire), or human-caused (unattended campfire, debris burning, or arson). The severe fire season of 1987 resulted in a record setting mobilization of fire fighting resources. Most wildfires can be linked to human carelessness.

The intensity and behavior of wildfire depends on a number of factors including fuel, topography, weather, and density of development. There are a number of often-discussed strategies to reduce the negative impacts of these phenomena. They include land-use regulations, management techniques, site standards, building codes, and a recently passed Oregon Forestland-Urban Interface Fire Protection Act (1997). All of these things have a bearing on a community's ability to prevent, withstand, or recover from a wildfire event.

The probability that Region 1 will experience wildfires in interface areas is depicted in Table 12 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 12. Probability Assessment of Fires in Interface Areas

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	H	M	H	H	L	H	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

An understanding of risk begins with the knowledge that wildfire is a natural part of forest and grassland ecosystems. Past forest practices included the suppression of all forest and grassland fires. This practice, coupled with hundreds of acres of dry brush or trees weakened or killed through insect infestation, has fostered a dangerous situation. Present state and national forest practices include the reduction of understory vegetation through thinning and prescribed (controlled) burning.

Each year a significant number of people build homes within or on the edge of the forest (urban/wildland interface), thereby increasing wildfire hazards. Many Oregon communities (incorporated and unincorporated) are within or abut areas subject to serious wildfire hazards. In Oregon, there are about 240,000 homes worth around $6.5 billion within the urban/wildland interface. Such development has greatly complicated firefighting efforts and significantly increased the cost of fire suppression. These communities have been designated "Interface Communities" and include those in Table 13.

A detailed community inventory of factors that affect vulnerability is important in assessing risk and is beyond the scope of the statewide assessment.

When assessing the risks from natural hazards, established mitigation practices already provide benefits in reduced disaster losses. It is important for communities to understand the benefits of past mitigation practices when assessing their risks, being mindful of opportunities to further reduce losses.

Possible mitigation practices include:

- Identify and map current hazardous forest conditions such as fuel, topography, etc.;
- Identify forest / urban interface communities - List of interface communities, Federal Register, 08/17/01. V. 66, N. 160;
- Identify and map Forest Protection Districts;
- Identify and map water sources;
- Implement effective addressing system in rural forested areas;
- Clearly mark evacuation routes;
- Identify and locate seasonal forest users. Initiate information program through schools, summer camps, forest camping grounds, lodges, etc;
- Identify and map bridges that can (and cannot) support the weight of emergency vehicles. This is a basic requirement for fire suppression;
- Form committees to implement Oregon Senate Bill 360. This is required in Oregon Senate Bill 360; and
- Create road standards in interface areas to reflect fire suppression needs. Roads must be wide enough for fire suppression vehicles to turn around. Road grades cannot be too steep for large, heavy vehicles.

TABLE 13. WILDLAND/URBAN INTERFACE COMMUNITIES

COUNTIES							
Clatsop	**Coos**	**Curry**	**Douglas**	**Lane**	**Lincoln**	**Tillamook**	
Arch Cape	Bandon	Agness	Gardiner	Dunes City	Depoe Bay	Bay City	Oceanside
Astoria	Charleston	Brookings	Reedsport	Florence	E. Lincoln Co.	Beaver	Oretown
Brownsmead	Coos Bay	Gold Beach	Winchester Bay	Mapleton	Elk City	Blaine	Pacific City
Cannon Beach	Coquille	Langlois		Swisshorne	Lincoln City	Cape Meares	Pleasant Valley
Coastal Strip	Dora	Nesika Beach		Triangle Lake	Newport	Cloverdale	Rockaway
Elsie-Vinemaple	Fairview	Port Orford			Otter Rock	Foley Creek	Sandlake
Fern Hill	Green Acres				Rose Lodge	Garibaldi	Siskeyville
Ft. Clatsop	Lakeside				Seal Rock	Hebo	Tierra del Mar
Hamlet	Millington				Siletz	Hemlock	Tillamook
Hewell	Myrtle Point				Tidewater	Jordan Creek	Winema Beach
Knappa-Svensen	North Bend				Toledo	Lees Camp	Woods
Lewis & Clark	Powers				Waldport	Nehalem Bay	
Necanicum	Saunders Lake				Yachats	Neskowin	
Olney	Sumner					Netarts	
West Port							

Source: August 17, 2001, *Federal Register*: V.66, N.160.

The region's vulnerability to wildfires is depicted in Table 14 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 14. Vulnerability Assessment of Fires in Interface Areas

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	M	M	H	H	L	M	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

FLOOD

Riverine Flooding

Characteristics and Brief History

In general, three types of flooding occur in this region: (1) riverine, (2) ocean flooding from high tides and wind-driven waves, and (3) flooding associated with a tsunami event. There are two distinct periods of riverine flooding in this region, winter and late spring. The most serious flooding occurs during December, January, and February. The situation is especially severe when riverine flooding, caused by prolonged rain and melting snow, coincides with high tides and coastal storm surges. In short, the rivers back up and flood the lowlands. This type of flooding is especially troublesome in the Tillamook Bay area where homes and livestock can be isolated for several days. There are other circumstances, as well. Several coastal rivers carry heavy silt loads that originated in areas burned during the "Tillamook Burn" fires (1933 to 1951) or from areas covered with volcanic ash during the Mt. St. Helens eruption (1980). Consequently, some rivers actually may be elevated above local floodplains, which increases flood hazards. The costs and long-term benefits of dredging these rivers have not been determined.

Table 15 describes the history of significant floods in the region. Table 16 describes flood sources.

TABLE 15. SIGNIFICANT FLOODS

DATE	LOCATION	DESCRIPTION	TYPE OF FLOOD
1813	NW Oregon	Said to exceed "Great Flood" of 1861 (Source: Native Americans)	unknown
12/1861	Coastal rivers	The "Great Flood"; largest flood of known magnitude on the Rogue	Rain on snow
02/1890	Coastal rivers	Widespread flooding; Siuslaw River dammed by a large debris flow	Rain on snow
01/1923	Lower Columbia	Mild temperatures; large amount of rain. Flooded roads / railroads	Rain on snow
03/1931	Western Oregon	Extremely wet and mild; saturated ground	Rain on snow
12/1933	Northern Oregon	Intense warm rains; Clatskanie River set record	Rain on snow
12/1937	Western Oregon	Heavy coastal rain; large number of debris flows	Rain on snow
10/1950	SW Oregon coast	Heavy October rain	Rain on snow
12/1953	Western Oregon	Heavy rain accompanied major windstorm; serious log hazards on Columbia	Rain on snow
12/1955	Columbia & coastal streams	Series of storms; heavy, wet snow; many homes and roads damaged	Rain on snow
12/1962	SW Oregon	Severe flooding, especially the Rogue River	Rain on snow
03/1964	Coast & Columbia River estuary	Ocean flooding	Tsunami
12/1964	Entire state	Two storms; intense rain on frozen ground	Rain on snow
01/1972	Northern coast	Severe flooding and mudslides; 104 evacuated from Tillamook	Rain on snow
01/1974	Western Oregon	Series of storms with mild temperatures; large snowmelt; rapid runoff	Rain on snow
12/1978	Coastal streams	Intense warm rain; two fatalities on Yaquina River; widespread flooding	Rain on snow
02/1986	Entire state	Warm rain and melting snow; numerous homes evacuated	Rain on snow
02/1987	Western Oregon	Heavy rain; mudslides; flooded highways; damaged homes	Rain on snow

Source: Taylor and Hannon, 1999, *The Oregon Weather Book*, pp.96-103

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org; National Climatic Data Center, Storm Events, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms.

TABLE 15. SIGNIFICANT FLOODS (con't.)

DATE	LOCATION	DESCRIPTION	TYPE OF FLOOD
12/1989	Clatsop, Tillamook & Lincoln	Warm Pacific storm system. High winds. Fatalities. Mudslides	Rain on snow
01/1990	W. Oregon	Significant damage in Tillamook Co. Many streams had all-time records	Rain on snow
04/1991	Tillamook County	48-hour rainstorm. Wilson River 5 ft. above flood stage. Businesses closed	Rain on snow
02/1996	NW Oregon	Deep snow pack. Warm temperatures. Record-breaking rains.	Rain on snow
11/1996	W. Oregon	Record-breaking precipitation. Flooding. Landslides. (FEMA-1149-DR-OR)	Rain on snow
12/2005	Coos County Curry County Douglas County	$2,840,000.00 in property damage *figure also includes Jackson and Josephine Counties	Riverine
11/2006	Tillamook County	Heavy rains caused major flooding in Nehalem and Tillamook, causing $1 million in damage in Nehalem and $15 million in Tillamook	Riverine
11/2006	Lincoln County	Siletz River crested at 7 feet above flood stage	Riverine
12/2006	Coos County	Two floods in Coos County on the Coquille River inundated several roads, including Highways 42 and 42S.	Riverine
12/2007	Clatsop County	Storm total of 7.3 inches of rain, causing many rivers to overflow their banks. $9.15 million in damages	Riverine
12/2007	Tillamook County	Heavy rains led to flooding in Tillamook along the Wilson River damaging businesses, homes, the railroad to the Port. County-wide damages total 26 million.	Riverine
12/2007	Lincoln County	Siletz River had moderate flooding, causing flood damage near Siletz and Lincoln City. Total county-wide damages include $124,000 in damages inland, and $31,000 damages for coastal property.	Riverine
12/2007	Lane County	Flooding along cost, $31,000 in property damage.	Riverine
12/2007	Curry County	Rogue river exceeds flood stage, but no known damages.	Riverine
12/2008	Tillamook County	Heavy rainfall caused flooding in downtown Tillamook. Estimate of $3.8 million in damages throughout Tillamook County.	Riverine

Source: Taylor and Hannon, 1999, *The Oregon Weather Book*, pp.96-103

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org; National Climatic Data Center, Storm Events, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms.

TABLE 16. PRINCIPAL RIVERENE FLOOD SOURCES

CLATSOP	COOS	CURRY	DOUGLAS	LANE	LINCOLN	TILLAMOOK
Lewis & Clark R	Coquille R	Chetco R	Umpqua R	Siuslaw R	Alsea R	Kilchis R
Little Walluski R	Willicoma R	Elk R	Smith R	Munsel Cr	Salmon R	Miami R
Necanicum R	Ten Mile Cr	Pistol R	Scholfield Cr		Siletz R	Nehalem R
Nehalem R	Palouse Cr	Rogue R			Yachats R	Nestucca R
Bear Cr	Larson Cr	Sixes R			Yaquina R	Three Rivers
Beerman Cr	Kentuck Sl	Winchuck R			Drift Cr	Tillamook R
Big Cr	Willanch Sl	Hunter Cr			Depot Cr	Trask R
Cow Cr	Pony Cr				Ollala Cr	Wilson R
Fishhawk Cr					Schooner Cr	Dogherty Sl
Humbug Cr						Hoquarten Sl
Little Cr						
Neacoxi Cr						
Neawanna Cr						
Northrup Cr						
Plymton Cr						

Sources: Federal Emergency Management Agency (FEMA), Clatsop County Flood Insurance Study (FIS), 7/17/01, FEMA, Coos County FIS, 5/15/84, FEMA, Curry County FIS, 2/04/98, FEMA, Douglas County FIS, 4/21/99, FEMA, Lane County FIS, 06/02/99, FEMA, Lincoln County FIS, 3/01/80, FEMA, Tillamook County FIS, 8/20/02.

Probability

FEMA has mapped the streams listed in Table 13 for 10, 50, 100, and 500-year flood events, with the probability of flooding in a year being 10%, 2%, 1%, and 0.2%, respectively. Areas subject to these floods are depicted on FEMA Flood Insurance Rate Maps (FIRMs), and profiled in an accompanying Flood Insurance Study (FIS). Recurrence intervals can differ between reaches of the same stream. For example, certain reaches of the Wilson River may experience a 100-year (1%) flood while other sections of the river may be having a 50-year (2%) or perhaps a 500-year (0.2%) flood event.

Flood Insurance Rate Maps (FIRM) depict flood conditions; however, many old maps are inaccurate. Communities may generate their own flood data with FEMA approval. The following is a list of Region 1 counties and the date of their most recent FIRM:

- Clatsop, June 16, 1999
- Coos, November 15, 1984
- Curry, February 04, 1998
- Douglas, April, 21, 1999
- Lane, June 02, 1999
- Lincoln, September 03, 1980
- Tillamook, August 20, 2002

Citizens of counties that participate in the Community Rating System (CRS) receive lower flood insurance rates. Douglas and Tillamook Counties participate in this program.

The probability that Region 1 will experience floods is depicted in Table 17 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 17. Probability Assessment of Riverine Flooding

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	H	H	H	H	H	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

Low-lying coastal areas in Region 1 are particularly vulnerable to flood hazards that can be exacerbated by high tides. The lower Siletz and Siuslaw rivers and the

rivers that feed Tillamook Bay all experienced significant flood losses in 1996 and on other occasions in the following years. In fact, the significance of the 100-year flood event was lost when repetitive flood events impacting the City of Tillamook exceeded the base flood elevation numerous times especially in 1996, 1998 and 1999. Many pre- and post-FIRM buildings have experienced repetitive flood losses along Highway 101 in north Tillamook City and will likely continue to experience losses without mitigation.

The northern half of Region 1 is more susceptible to riverine flood damage that that to the south. This is because the northern half of the region is more densely populated and consequently contains much of the region's infrastructure. Physical location also makes a difference. For example, five rivers empty into Tillamook Bay, thereby increasing risk from riverine flooding on the relatively flat valley floor. Prudent emergency managers will consider physical location and at-risk populations and facilities during the preparation of all-hazard mitigation plans. Considerations include:

Structures At-Risk from a 1% Flood Event (excluding tidal / wind effects):

Pre-FIRM structures (residential and commercial)

Pre-FIRM structures (state-owned / occupied)

Repetitive Loss structures

Manufactured Homes (inside and outside manufactured home parks)

Critical Facilities At-Risk from a 1% Flood to include:

Hospital, Police, Fire, National Guard, Emergency Management (Ingress /Egress);

Transportation to include highway, rail, and airport;

Sewer and water treatment plants;

Energy facilities;

Communications

Economic Activities At- Risk from a 1% Flood to include:

Motel / hotel operations

Highway oriented businesses (especially in Tillamook area)

Buoyant materials storage (e.g., logs, fuel drums)

Food outlets (e.g., grocery stores)

Special Considerations to include:

Special populations (e.g., minority, handicapped, non-English speaking)

Institutions / incarceration facilities

Schools / Day-Care

Hazardous materials sites

The physical condition of dams

The physical condition of dams on the Umpqua and Rogue rivers warrants special consideration. These two large rivers rise in the Cascade Mountains and consequently are subject to heavy snow packs at higher elevations. Rapid snowmelt in the upper watershed can produce serious flood conditions. The flood potential is somewhat mitigated by several impoundments. Dam failure, for whatever reason, seriously threatens downstream communities --- and this is a consideration for Region 1 emergency managers. High hazard dams are discussed in the section dealing with Critical Facilities, Infrastructure, and High Hazard Installations.

The region's vulnerability to floods is depicted in Table 18 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 18. Vulnerability Assessment of Riverine Flooding

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	M	H	H	M	H	L	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

A number of local governments in Region 1 have initiated and accomplished building elevation and /or buy-out programs. And the concept of a 100-year flood seems to have been replaced with that of a 1% flood. Also, dairy farmers and other businesses have made considerable progress in protecting their investments. Project Impact, which produced partnerships between local government and the business community, was probably more successful on the Oregon Coast (i.e., Region 1) than anywhere else in the state. But much remains to be done. Prudent Region 1 communities will:

Revisit the effectiveness of dikes and other hardened structures. This is especially noteworthy in the lower Rogue and Smith rivers where levees and riprap do not offer 100-year protection (Curry County FIS, pp. 6-7; Coos County FIS, p.10; Douglas Co. FIS, p.6);

Consider the costs and benefits of constructing dikes in vulnerable populated areas (e.g., City of Florence, Lane County FIS, p.12); and

Revisit problems associated with the accumulation of streamside debris. The accumulation of woody debris often forms dams which inevitability fail during periods of high water (Lane County FIS, p. 12). The result can be devastating. Much of the problem is linked to efforts to enhance fish habitat. Despite the availability of some fish-friendly floodplain ordinances, the streamside debris problem has not been resolved. There is a discernible need for county officials to discuss the problem with appropriate state and federal agencies.

Ocean Flooding / Wave Action

Characteristics and History

Flooding from wind-driven waves is a common event on the Oregon coast. This is particularly true during the winter storm season, during El Niño events, and when spring and perigean tides occur. The Federal Emergency Management Agency has identified and mapped coastal areas subject to direct wave action (V zones) and sand dune over-topping (AH and AO zones). Direct wave action was especially severe during the winter storm events of 1972 (Siletz Spit), 1978 (Nestucca Spit), and the El Niño events of 1982-83 and 1997-98. Beach and cliff erosion were significant during these periods and a number of homes were destroyed. The following lessons were learned (and oftentimes forgotten between damaging events):

- Oregon coastal processes are complex and dynamic, sometimes eroding, sometimes aggrading;
- Some sections of the Oregon coast are rising in relation to ocean levels, others remain fairly constant or are becoming lower (Komar 1992, 40-41);
- Primary frontal dunes provide protection from ocean storms;
- Sand spits are not permanent features;
- Erosion rates vary and are dependent on several factors including storm duration and intensity, composition of sea cliff, time of year, and impact of human activities (e.g., altering the base of sea cliffs, interfering with the natural movement of beach sand).

Probability

Ocean storms can be expected every year. El Niño effects, which tend to raise ocean levels, occur about every three to five years (Taylor and Hannan, 1999). V (wave velocity) zones, depicted on FEMA's Flood Insurance Rate Maps, are areas subject to 100-year events (i.e., 1% chance in any given year). The Flood Insurance Rate Maps show areas vulnerable to wave action (V zones), ponding and sheet-flow from waves over-topping dunes (AO and AH zones). All of the counties in Region 1 have hazardous areas identified on the maps. DOGAMI and FEMA also provide information about wave action.

Vulnerability

A number of buildings, parks, infrastructure, and critical facilities in Region 1 are vulnerable to ocean storms. This is most obvious in low-lying areas adjacent to bays or the ocean; It is also evident at higher elevations where buildings and infrastructure have been located on readily erodable materials (e.g., consolidated sand, weakly cemented sandstone, siltstone, etc.). The problem is historic. There are numerous examples of buildings and infrastructure destroyed by wave attack / erosion --- some of which are classic (e.g., Bay Ocean development, Salishan Spit, Jumpoff Joe, Rogue Shores, The Capes development, etc.). Buildings and infrastructure probably will continue to be built in harm's way despite stringent building requirements and enlightened planning commissions.

Unlike the East and Gulf coasts, only a few of Oregon's coastal developments are within FEMA-designated Velocity (V) zones. Those that are appear to be constructed according to V-zone standards.

A number of coastal developments are protected by primary frontal dunes (as defined in 44 CFR) that are in various stages of accretion or erosion. In some situations, FEMA has allowed accreting dunes to be lowered in order for property owners to retain unobstructed ocean views. The vulnerability of the homes has not been increased. This policy would change, however, should erosion surpass accretion. Many residential structures are located in areas subject to flooding from wave over-topping (e.g., AO and AH zones). However, very few appear to have been flooded, probably because of elevation requirements.

Region 1 counties have not inventoried all buildings that are vulnerable to wave action (i.e., in V zones); however some pertinent information is available from the National Flood Insurance Program (NFIP). These data are provided to the state and include the address of buildings insured through the NFIP, flood zones in which they are located, claims, and location of repetitive loss structures.

Coastal highways are always problematic. In Region 1, much of the problem is linked to the local geology. This has been mapped as part of DOGAMI's environmental geology series. Bedrock conditions can and do change abruptly within very short distances. This results in an inconsistent highway foundation; some sections are more susceptible to wave action than others and require continuous maintenance. There is no practical solution outside of relocation of the highway; this option is not financially feasible at this point in time. On the positive side, the State Highway Division and Region 1 counties are adept in rerouting traffic. This will continue to be part of the solution.

LANDSLIDES / DEBRIS FLOWS

Characteristics and Brief History

Landslides and debris flows always have and always will shape Oregon's landscape. Landslides become problematic, however, when people place buildings and infrastructure in harm's way. Additionally, development practices can cause or contribute to the severity of landslides.

There are several categories of landslides, based on configuration (slide mechanism), slide materials, and rate of movement. Some slides are ancient, deep-seated, and slow moving. Others move rapidly as a mass of rock, mud, and large woody debris. All can be problematic when in the vicinity of buildings and infrastructure. Fast-moving landslides, or debris flows, occur throughout Oregon, but are especially noteworthy in the Cascade and Coast Ranges.

Debris flows (mudslides, mudflows, debris avalanches) are a common type of rapidly moving landslide that generally occur during intense rainfall on previously saturated ground. They usually begin on steep hillsides as slumps or slides that liquefy, accelerate to speeds as great as 35 mph or more, and flow down slopes and channels onto gently sloping ground. Their consistency ranges from watery mud to thick, rocky, mud-like wet cement, dense enough to carry boulders, trees, and automobiles. Debris flows from different sources can combine in canyons and channels, where their destructive power is greatly increased. In general, slopes that are over 25% or have a history of landslides might signal a landslide problem.

Landslides / debris flows probably accompany every major storm system that impacts western Oregon. In recent events, particularly noteworthy landslides accompanied storms in 1964, 1982, 1966, and 1996. Two major landslide producing winter storms occurred in Oregon during November 1996. Intense rainfall on recently and past logged land as well as previously un-logged areas triggered over 9,500 landslides and debris flows that resulted directly or indirectly in eight fatalities. Highways were closed and a number of homes were lost. The fatalities and losses resulting from the 1996 landslide events brought about the passage of Oregon Senate Bill 12, which set site development standards, authorized the mapping of areas subject to rapidly moving landslides and the development of model landslide (steep slope) ordinances.

Counties with the highest percentage of reported landslides are: Lane (24%), Douglas (11%), Linn (10%), Tillamook (9%), Lincoln (8%), and Multnomah (7%).[4] Table 19 describes the history of more significant landslides and debris flows in the area.

TABLE 19. NOTABLE LANDSLIDE / DEBRIS FLOWS

DATE	INCIDENT
02/1926	Landslide closed Roosevelt Highway between Coos Bay and Coquille causing at least $25,000 in damages.
02/1961	A large section of Ecola State Park slid into the Pacific Ocean.

[4] Hofmeister, YEAR, *Slope Failures in Oregon*; and DOGAMI, 2000, Special Paper 34.

02/1996	Heavy rains and rapidly melting snow contributed to hundreds of landslides/debris flows across the state. Many occurred on clear cuts that damaged logging roads. (FEMA-1099-DR-OR)
11/1996	Heavy rain triggered mudslides in Lane and Douglas Counties. Five fatalities and several injuries in Douglas County. (FEMA-1149-DR-OR)
02/1999	Two timber workers killed in a mud and rockslide south of Florence.
01/2000	A landslide north of Florence closed Highway 101 for 3 months, resulting in major social and economic disruption to nearby communities.
12/2004	Lane, Polk, and Lincoln Counties – $12,500 in property damage
12/2007	Clatsop and Tillamook Counties - $300,000 in property damage

Source: Taylor and Hatton, 1999, *The Oregon Weather Book;* and FEMA After-Action Report, 1996 events; and interviews, Oregon Department of Transportation representatives.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from: http://www.sheldus.org.

Probability

The probability of rapidly moving landslides occurring depends on a number of factors; these include steepness of slope, slope materials, local geology, vegetative cover, human activity, and water. There is a strong correlation between intensive winter rainstorms and the occurrence of rapidly moving landslides (debris flows). Given the correlation between precipitation / snow melt and rapidly moving landslides, it would be feasible to construct a probability curve. The installation of slope indicators or the use of more advanced measuring techniques could provide information on slower moving slides.

The Department of Forestry has mapped debris flow hazards for all of the counties in Region 1.

The probability that Region 1 will experience landslides is depicted in Table 20 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank the hazard or did not find it to be a significant consideration. These cases are noted with a dash (-) in the table below.

TABLE 20. Probability Assessment of Landslides

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	H	H	H	H	H	-	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

Rain-induced landslides and debris flows can potentially occur during any winter in Region 1. Fortunately, little developed property is exposed to the hazard; the greatest impacts occur to the east-west roadways that carry traffic to and from the coast ... with the potential for injuries and loss of life from rapidly moving landslide events. However, to minimize future landslide impacts to new development, hazards areas must be identified and siting standards applied.

Since 1950, at least 21 deaths have been attributed to rapidly moving landslides (i.e., debris flows). Statistically, the risk of being killed is relatively low (about .02 fatalities per 1,000 people/ year). However, the risk would be greater for that segment of the population that lives, works, or commutes through high hazard debris flow areas.

The region's vulnerability to landslides/debris flows is depicted in Table 21 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, counties either did not rank the hazard or did not find it to be a significant consideration. These cases are noted with a dash (-) in the table below.

TABLE 21. Vulnerability Assessment of Landslides

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	M	L	L	M	M	-	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

TSUNAMI

Characteristics and Brief History

Tsunami waves are infrequent events, but can be extremely destructive. They may be generated by earthquakes, submarine volcanoes, or landslides, and travel hundreds of miles before striking land. Hardly discernible at sea, tsunami waves travel as fast as 500 mph across open water until, at landfall, they slow-down significantly and can reach heights up to 20 feet or more. Seward, Alaska, experienced tsunami waves as high as 25 feet during the 1964 earthquake-tsunami event.

Most tsunami waves have been described as an onrushing, rapidly rising tide, which can be seen in the few motion pictures that have captured the tsunami phenomenon. The size and behavior of tsunamis depend on a number of factors, including distance traveled, submarine topography and the shape and orientation of the coastline. Much of the damage results from water-borne debris, which can act as battering rams against on-shore development. Wave-borne fuel drums are especially hazardous because of their propensity to cause or exacerbate fires.

All Region 1 counties are susceptible to tsunami hazards. Oregon's 60 coastal communities have experienced, to various degrees, tsunamis that have originated in the oceanic regions near Russia's Kamchatka Peninsula, Japan, Chile, Hawaii, the Gulf of Alaska and northern California. Additionally, the geologic record implies that several tsunamis have been generated locally off the Oregon Coast along the Cascadia Subduction Zone. This is the region's greatest concern (see earthquake section). An anticipated M8-9 earthquake along the Cascadia Subduction Zone could generate tsunamis that would reach the Oregon coast in a very short period of time – between 15 and 30 minutes. This underscores the need to plan for such an event.

Table 22 describes some of the tsunami history of Region 1.

TABLE 22. NOTABLE TSUNAMIS

DATE	ORIGIN OF EVENT	AFFECTED COMMUNITY	DAMAGE	REMARKS
04/1868	Hawaii	Astoria		Observed
08/1868	N. Chile	Astoria		Observed
08/1872	Aleutian Is	Astoria		Observed
11/1873	N. California	Port Orford		Debris at high tide line
04/1946	Aleutian Is	Bandon		Barely perceptible
04/1946		Clatsop Spit		Water 3.7m above MLLW
04/1946		Depoe Bay		Bay drained. Water returned as a wall
04/1946		Seaside		Wall of water swept up Necanicum River
11/1952	Kamchatka	Astoria		Observed
11/1952		Bandon	Log decks broke loose	
05/1960	S. Cent. Chile	Astoria		Observed
05/1960		Seaside	Bore on Necanicum River damaged boat docks	
05/1960		Gold Beach		Observed
05/1960		Newport		Observed for about four hours
05/1960		Netarts	Some damage observed	
03/1964	Gulf of Alaska	Cannon Beach	Bridge and motel unit moved inland. $230,000 damage	
03/1964		Coos Bay	$20,000 damage	
03/1964		Depoe Bay	$5,000 damage; 4 children drowned at Beverly Beach	
03/1964		Florence	$50,000 damage	
03/1964		Gold Beach	$30,000 damage	
03/1964		Seaside	1 fatality (heart attack); Damage to city: $41,000; Private: $235,000; Four trailers, 10-12 houses, two bridges damaged	
05/1968	Japan	Newport		Observed
04/1992	N. California	Port Orford		Observed
10/1994	Japan	Coast		Tsunami warning issued, but no tsunami observed

DATE	ORIGIN OF EVENT	AFFECTED COMMUNITY	DAMAGE	REMARKS
3/2011	Japan	Coast	$6.7 million. Extensive damage to the Port of Brookings.	Tsunami warning issued, observed ocean surges. and

Source: NOAA, 1993, Tsunamis Affecting the West Coast of the United States: 1806-1992.

Source: FEMA, 2011, Federal Disaster Declaration

Probability

With respect to distant sources, Oregon has experienced 10 tsunamis in the last 144 years with only 3 causing measurable damage (Table 19). Thus, the average recurrence interval for tsunamis on the Oregon coast from distant sources would be about 15 years. However, the time interval between events has been as little as one year and as much as 73 years. The two most destructive tsunamis occurred only four years apart (1960 and 1964) and originated from two different source areas (south central Chile and the Gulf of Alaska). Since only a few tsunamis caused measurable damage, a recurrence interval for distant tsunamis does not have much meaning for this region.

Geologists predict a 10-14 percent chance that a Cascadia tsunami will be triggered by a shallow, undersea earthquake offshore Oregon in the next 50 years, causing a tsunami that will affect the Oregon coast. This forecast comes from evidence for large but infrequent earthquakes and tsunamis that have occurred at the Oregon coast every 500 years, on average.[5]

A tsunami originating from a Cascadia Subduction Zone (CSZ) event could be exceedingly destructive and thus is of greater concern than distant tsunamis. The average recurrence interval for a CSZ event is between 500 and 600 years. There have been seven CSZ events in the last 3500 years with time between individual events varying from 150 to 1000 years. It is assumed that all Cascadia tsunamis would cause extensive damage. The last CSZ event occurred approximately 300 years ago.[6]

The following probability estimates are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 23. Probability Assessment of Tsunami

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	M	H	H	H	M	H	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores

[5] Department of Geologic and Mineral Industries. *Oregon Geology Factsheet: Tsunami Hazards in Oregon.* http://www.oregongeology.org/pubs/fs/tsunami-factsheet_onscreen.pdf.

[6] Kenji Satake et al., 1995.

Vulnerability

The Oregon coast is at risk from tsunamis that originate from local and distant sources. All communities in low-lying coastal areas in Region 1 are especially vulnerable to tsunamis because of its coastal setting and the location of many of its communities in low-lying areas. Seaside is the most vulnerable city due to its low elevation and high numbers of residents and tourist population. Although many communities have evacuation maps and evacuation plans, many casualties are expected. The built environment in the inundation zone will be especially hard hit.

In 2008, the United States Geological Survey (USGS) completed a comprehensive study of coastal cities' exposure and sensitivity to tsunami hazards in Oregon. Results indicate that the Oregon tsunami-inundation zone contains approximately 22,201 residents (four percent of the total population in the seven coastal counties), 14,857 employees (six percent of the total labor force), and 53,714 day-use visitors on average every day to coastal Oregon State Parks within the tsunami-inundation zone. The tsunami-inundation zone also contains 1,829 businesses that generate approximately $1.9 billion in annual sales volume (seven and five percent of study-area totals, respectively) and tax parcels with a combined total value of $8.2 billion (12 percent of the study-area total). Although occupancy values are not known for each facility, the tsunami-inundation zone also contains numerous dependent-population facilities (for example, adult-residential-care facilities, child-day-care facilities, and schools), public venues (for example, religious organizations and libraries), and critical facilities (for example, police stations).

Additionally, results indicate that vulnerability, described in the study by exposure (the amount of assets in tsunami-prone areas) and sensitivity (the relative percentage of assets in tsunami-prone areas) varies considerably among 26 incorporated cities in Oregon. City exposure and sensitivity to tsunami hazards is highest in the northern portion of the coast. The City of Seaside in Clatsop County has the highest exposure, the highest sensitivity, and the highest combined relative exposure and sensitivity to tsunamis. Results also indicate that the amount of city assets in tsunami-prone areas is weakly related to the amount of a community's land in this zone; the percentage of a city's assets, however, is strongly related to the percentage of its land that is in the tsunami-prone areas.[7]

Communities can engage in the following activities to prepare for tsunamis:

- **Map areas subject to tsunami inundation** – DOGAMI has mapped all Region 1 counties.
- **Establish NOAA warning system** – All counties have a warning system established.
- **Participate in NOAA's Tsunami-Ready program** – Participating communities include: Coos, Douglas, and Tillamook Counties, as well as the cities of Cannon Beach, Lincoln City, Manzanita, Nehalem, Rockaway Beach, and Wheeler.

[7] Wood, N. 2007. *Variations in City Exposure and Sensitivity to Tsunami Hazards in Oregon.* US Geological Survey. Scientific Investigations Report 2007-5283.

The region's vulnerability to tsunamis is depicted in Table 24 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 24. Vulnerability Assessment of Tsunami

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	H	H	H	M	H	M	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

VOLCANO-RELATED HAZARDS

Characteristics and Brief History

The volcanic Cascade Mountain Range is not within Region 1 counties; consequently, the risk from local volcano-associated hazards (e.g., lahars, pyroclastic flows, lava flows, etc.) is not a priority consideration. However, there is some risk from air-borne tephra (volcanic ash). This fine-grained material, blown aloft during a volcanic eruption, can travel many miles from its source. The cities of Yakima and Spokane, Washington, were inundated with ash during the May 1980, Mt. Saint Helens eruption. Air borne tephra can reduce visibility to zero, and bring street, highway, and air traffic to an abrupt halt. The material is noted for its abrasive properties and is especially damaging to machinery. It would be prudent for vulnerable communities to identify disposal areas for large quantities of tephra.

Part of Clatsop County borders the Columbia River -- which in theory makes it vulnerable to lahars or mudflows carried by the river. Although remote, such an event cannot be dismissed out of hand. A lahar or mudflow that traveled down Washington's Cowlitz River following the eruption of Mt. Saint Helens, filled the Columbia River channel overnight from its previous 40-foot depth to a mere 14 feet. This delayed ship movements in the vicinity of the Cowlitz for months.[8]

Probability

Mt. St. Helens is a probable source of air borne tephra and lahar mudflows that can reach the Columbia River. The probability of coastal counties receiving air-borne tephra is about 1 in 10,000 --- with a large portion of Curry County being even less.[9] A lahar mudflow that traveled down Washington's Cowlitz River following the 1980 eruption of Mt. Saint Helens filled the Columbia River channel overnight from its previous 40-foot depth to a mere 14 feet. This delayed ship movements for months.

The probability that Region 1 will experience volcanic activity is depicted in Table 25 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

In some cases, counties either did not rank the hazard or did not find it to be a significant consideration. These cases are noted with a dash (-) in the table below.

[8] USGS Open File Report 95-497, 1995, pp.5-6.

[9] Sherrod, David et al, 1997.

TABLE 25. Probability Assessment of Volcano Related Hazards

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	L	-	L	-	-	L	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

Vulnerability

The region's vulnerability to volcano-related hazards is depicted in Table 26 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

In some cases, counties either did not rank the hazard or did not find it to be a significant consideration. These cases are noted with a dash (-) in the table below.

TABLE 26. Vulnerability Assessment of Volcano Related Hazards

	Clatsop	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	H	-	H	-	-	L	M

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores.

WINDSTORMS

Characteristics and Brief History

High winds can be expected throughout Region 1. Destructive wind storms are less frequent, and their pattern is fairly well known. They form over the North Pacific during the cool months (October through March), move along the coast and swing inland in a northeasterly direction. Wind speeds vary with the storms. Gusts exceeding 100 miles per hour have been recorded at several coastal locations (Table 27), but lessen as the storm moves inland. These storms can be very destructive as documented in the now infamous Columbus Day Storm of October, 1962. Less destructive storms usually topple trees, power lines, and cause building damage. Flooding can be an additional problem. A large percentage of Oregon's annual precipitation comes from these events.[10]

[10] Taylor and Hatton, 1999, *The Oregon Weather Book*, p. 139; and FEMA-1405-DR-OR, YEAR, Reducing Windstorm Damage to Property and Electrical Utilities.

TABLE 27. SIGNIFICANT WINDSTORMS

DATE	LOCATION	DESCRIPTION	REMARKS
01/1880	Western Oregon	Very high winds. 65-80 mph near Portland	Flying debris; fallen trees
01/1921	Oregon coast / Lower Columbia	Winds 113 mph at mouth of Columbia. Gusts at Astoria, 130 mph	Widespread damage
04/1931	Western Oregon	Unofficial reports of wind speeds up to 78 mph	Widespread damage
11/1951	Most of Oregon	Winds 40-60 mph with 75-80 mph gusts	Widespread damage, especially to transmission lines
12/1951	Most of Oregon	Winds, 60-100 mph, strongest along coast	Many damaged buildings. Telephone / power lines down
12/1955	Western Oregon	Wind gusts at North Bend 90 mph	Significant damage to buildings and farms
01/1956	Western Oregon	Heavy rains, high winds, mud slides	Estimated damage: $95,000 (1956 dollars)
11/1958	Most of Oregon	Wind gusts to 75 mph at Astoria. Gusts to 131 mph at Hebo	Damage to buildings and utility lines
11/1962	Statewide	Wind speeds of 131 mph on the Oregon coast (Columbus Day Windstorm Event)	Oregon's most destructive storm. 23 fatalities. Damage at $170 million
03/1963	Coast and N.W. Oregon	100 mph gusts (unofficial)	Widespread damage
10/1967	Western and N. Oregon	Winds on Oregon Coast 100-115 mph	Significant damage to buildings, agriculture, and timber
03/1971	Most of Oregon	Notable damage in Newport	Falling trees took out power lines. Building damage
01/1986	N and Cent. Oregon Coast	75 mph winds	Damaged trees, buildings, power lines
01/1987	Oregon Coast	Wind gusts to 96 mph at Cape Blanco	Significant erosion (highways and beaches). Several injuries

Source: Taylor and Hatton, 1999, *The Oregon Weather Book*, p.151-157.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

TABLE 27. SIGNIFICANT WINDSTORMS (con't.)

DATE	LOCATION	DESCRIPTION	REMARKS
12/1987	Oregon Coast / N.W. Oregon	Winds on coast 60 mph	Saturated ground enabled winds to uproot trees
03/1988	N. and Central Coast	Wind gusts 55-75 mph	One fatality near Ecola State Park. Uprooted trees
01/1990	All of Oregon	100 mph winds in Netarts and Oceanside	One fatality. Damaged buildings. Falling trees (FEMA-853-DR-OR)
02/1990	Oregon Coast	Wind gusts of 53 mph at Netarts	Damage to docks, piers, boats
01/1991	Most of Oregon	Winds of 63 mph at Netarts. 57 at Seaside	75 foot trawler sank NW of Astoria
11/1991	Oregon Coast	Slow-moving storm. 25- foot waves off shore	Buildings, boats, damaged. Transmission lines down.
01/1992	Southwest Oregon	Wind gusts of 110 mph at Brookings	Widespread damage
01/1993	Oregon coast / N. Oregon	Tillamook wind gusts at 98 mph	Widespread damage, esp. Nehalem Valley
12/1995	Statewide	Wind gusts over 100 mph. Sea Lion Caves: 119 mph. Followed path of Columbus Day Storm (12/1962)	Four fatalities; many injuries. Widespread damage (FEMA-1107-DR-OR)

Source: Taylor and Hatton, 1999, *The Oregon Weather Book*, p.151-157.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

TABLE 27. SIGNIFICANT WINDSTORMS (con't.)

DATE	LOCATION	DESCRIPTION	REMARKS
11/1997	Western Oregon	Winds of 89 mph at Florence. 80 mph at Netarts and Newport	Severe beach erosion. Trees toppled
2/2002	SW Oregon	75-100 mph on the SW Coast (Douglas, Coos and Curry counties)	Widespread loss of electricity and damage to public utility infrastructure (FEMA-1405-DR-OR)
4/2004	Lane County		$5,000 in property damage *figure includes damages outside of Lane County
12/2004	Lane County		$6,250 in property damage *figure includes damages outside of Lane County
12/2004	Lincoln County		$6,250 in property damage *figure includes damages outside of Lincoln County
12/2004	Tillamook County		$6,250 in property damage *figure includes damages outside of Tillamook County
12/2004	Clatsop County		$6,250 in property damage *figure includes damages outside of Clatsop County
1/2006	Clatsop, Tillamook, Lincoln, Lane	Two storm events with high winds of 86 mph and 103 mph.	$244,444 and $144,444 in estimated property damage among all four coastal counties. The storm also impacted 5 other counties outside Region 1. Total damages equal $300,000 and $200,000 respectively.
2/2006	Clatsop, Tillamook, Lincoln, Lane	Wind storm event with winds measured at 77 mph	$150,000 and $91,600 in estimated property damage among all four coastal counties. The storm also impacted nine other counties outside of Region 1. Total damages equal $300,000 and $275,000
3/2006	Clatsop, Tillamook, Lincoln, Lane	Two wind storm events with winds measured at 60 mph and 75 mph	$75,000 and $211,000 in estimated property damage among all four coastal counties. The storms also impacted ten other counties outside of Region 1. Total damages equal $75,000 and $475,000

Source: Taylor and Hatton, 1999, *The Oregon Weather Book*, p.151-157.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

TABLE 27. SIGNIFICANT WINDSTORMS (con't.)

DATE	LOCATION	DESCRIPTION	REMARKS
11/2006	Coos, Curry, Douglas	Storm with winds measured at 70 mph.	Total of $10,000 in damages.
12/2006	Coos, Curry, Douglas	Storm with winds measured at 90 mph.	Total of $225,000 in estimated damages for Coos, Curry, and Douglas Counties. The storm also impacted Josephine County, leading to a total storm damage of $300,000.
12/2006	Clatsop, Tillamook	Storm with high winds	Total of $10,000 in damages.
11/2007	Clatsop, Tillamook	Storm with high winds	Total of $10,000 in damages.
12/2007	Clatsop, Tillamook	Series of powerful Pacific storms	Resulted in Presidential Disaster Declaration. $180 million in damage in the State, power outages for several days, and 5 deaths were attributed to the storm.
12/2008	Clatsop, Lane, Tillamook, Lincoln	Intense wind and rain events	Resulted in nearly $8 million in estimated property and crop damages for Clatsop, Lane, Tillamook, and Lincoln Counties.

Source: Taylor and Hatton, 1999, *The Oregon Weather Book*, p.151-157.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

Tornadoes

Most people do not associate tornadoes with the State of Oregon, and certainly not in coastal areas. Nevertheless, they have occurred in Region 1, the first of which was recorded in 1897. They are characteristically brief and small, but also damaging. The recurrence interval, based on the list compiled by Taylor and Hatton (1999, pp. 130-137), is about every nine years. In some cases, events are separated over 20 or 30 years (Table 28 below).

TABLE 28. TORNADOES RECORDED

DATE	LOCATION	REMARKS
June, 1897	Bay City	Observed, but no damage recorded
October, 1934	Clatskanie	Observed. No damage
April, 1960	Coquille	Accompanied by heavy rain. No damage
November, 1965	Rainier	Crossed Columbia River. Two buildings damaged
October, 1966	Seaside	Windows broken, telephone lines down, outdoor signs destroyed
October, 1967	Near Astoria airport	Began over ocean and moved inland. Several homes and commercial buildings damaged
December, 1973	Newport	Some roof damage
December, 1975	Tillamook	90 mph wind speed. Damage to several buildings
August, 1978	Scappoose	Manufactured home destroyed; Other damage
March, 1983	Brookings	Minor damage
November, 1984	Waldport	Damage to automobiles and roofs
February, 1994	Near Warrenton	Damage in local park
November, 2002	Curry County	$500,000.00 in property damage

Source: Taylor and Hatton, 1999, The Oregon Weather Book, pp. 130-137

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available frm http://www.sheldus.org

Probability

High windstorms occur yearly. More destructive storms occur once or twice per decade. High wind events on the order of the 1962 Columbus Day storm are thought to have a 100-year recurrence interval.

The probability that Region 1 will experience windstorms is depicted in Table 29 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The probability scores below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = One incident likely within a 10 to 35 year period.

Moderate = One incident likely within a 35 to 75 year period.

Low = One incident likely within a 75 to 100 year period.

TABLE 29. Probability Assessment of Windstorms

	Clatsop*	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Probability	H	H	H	H	H	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores

* Probability and vulnerability scores are for severe weather which combines both wind and winter storms.

Vulnerability

Many buildings, utilities, and transportation systems within Region 1 are vulnerable to wind damage. This is especially true in open areas, such as along the Oregon Coast, natural grasslands, or farmland. It also is true in forested areas, along tree-lined roads and electrical transmission lines, and on residential parcels --- where trees have been planted or left for aesthetic purposes. Oregon's history of wind damage underscores the need for a comprehensive wind-hazard mitigation program. The necessity of such an action is partly supported in an after-action report focusing on western Oregon's high wind event of February 7, 2002 (Hazard Mitigation Survey Team Report, FEMA-1405-DR-OR). Other historic events (e.g., 1962 Columbus Day Storm) provide additional insights.

Structures most vulnerable to high winds in Region 1 include insufficiently-anchored manufactured homes and older buildings in need of roof repair. Section 307 of the Oregon Building Code identifies high wind areas along the Oregon Coast and sets anchoring standards for manufactured homes located in those areas. It is essential that coastal counties ensure that the standards are enforced. The Oregon Department of Administrative Service's inventory of state-owned and operated buildings includes an assessment of roof conditions as well as the overall condition of the structure. Oregon Emergency Management has arranged this information by county.

Fallen trees are especially troublesome. They can block roads and rails for long periods, which can affect emergency operations. In addition, uprooted or shattered trees can down power and/or utility lines, effectively bringing local economic activity and other essential activities to a standstill. Much of the problem may be attributed to a shallow or weakened root system in saturated ground. Many roofs have been destroyed by uprooted ancient trees growing next to a house. In some situations, strategic pruning may be the answer. Prudent counties will work with utility companies in identifying problem areas and establishing a tree maintenance / removal program.

Tree-lined coastal roads and highways present a special problem. This is because much of the traveling public enjoys the beauty of forested corridors and most certainly would be concerned with any sort of tree removal program. In short,

any "safety" program involving tree removal must be convincing, minimal, and involve a variety of stakeholders.

Wind-driven waves are common along the Oregon coast and are responsible for road and highway wash-outs and the erosion of beaches and headlands. These problems are addressed under Flood Hazards (i.e., Ocean flooding and wave action). Unlike Oregon's Willamette Valley (Regions 2 and 3), there are no water-borne ferry systems in Region 1 whose operations would be affected by high winds. Bridges spanning bays or the lower Columbia River would be closed during high wind periods.

The region's vulnerability to windstorms is depicted in Table 30 below. These scores are based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials.

The vulnerability scores address the percentage of population or region assets likely to be affected by a major emergency or disaster, as follows:

High = More than 10% affected

Moderate = 1-10% affected

Low = Less than 1% affected

TABLE 30. Vulnerability Assessment of Windstorms

	Clatsop*	Coos	Curry	Douglas	Lane	Lincoln	Tillamook
Vulnerability	H	H	H	M	H	H	H

Source: Oregon Emergency Management, November 2008, County Hazard Analysis Scores

* Probability and vulnerability scores are for severe weather which combines both wind and winter storms.

REGION 1

Oregon Coast[1]

State Owned Building Inventory

[1] Region 1 includes all of Oregon's coastal counties: Clatsop, Coos, Curry, Douglas (coastal section), Lane (coastal section), Lincoln, Tillamook. The lower estuarine Columbia River is also included in Region 1 (Clatsop County).

Region 1 Oregon Coast State Owned Building Inventory

Building Name	County	Replacement Value	Contents Value	Total Bldg Value	Usage	Earthquake		Fire/WUI		Flood		Landslide		Tsunami		Windstorm		Winterstorm	
						Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.	Prob.	Vuln.
CMA SEAFOOD CONSUMER CTR	Clatsop	1,392,000	31,074	1,423,074	INSTRUCTIO N/ADMIN/RES	M	H	H	M	H	M	H	M	M	H	H	H	H	H
CMA SEAFOOD RESEARCH LAB	Clatsop	3,172,020	532,721	3,704,741	INSTRUCTIO N/ADMIN/RES	M	H	H	M	H	M	H	M	M	H	H	H	H	H
CAMP RILEA ARMORY	Clatsop	3,768,977	7,146	3,776,123	ARMORY	M	H	H	M	H	M	H	M	M	H	H	H	H	H
CAMP RILEA	Clatsop	2,376,160	0	2,376,160	EXCHANGE	M	H	H	M	H	M	H	M	M	H	H	H	H	H
CAMP RILEA	Clatsop	3,860,443	5,000	3,865,443	DMS/FITNESS CTR	M	H	H	M	H	M	H	M	M	H	H	H	H	H
CAMP RILEA HQ	Clatsop	1,926,223	5,000	1,931,223	BN HQ	M	H	H	M	H	M	H	M	M	H	H	H	H	H
SIMULATION CENTER	Clatsop	1,950,000	0	1,950,000	SIMULATION TRAINING CENTER	M	H	H	M	H	M	H	M	M	H	H	H	H	H
MCCALL HALL	Clatsop	3,618,180	0	3,618,180	BARRACKS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
STRAUB HALL	Clatsop	2,972,673	0	2,972,673	BARRACKS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
ATIYEH HALL	Clatsop	3,618,180	0	3,618,180	BARRACKS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
HATFIELD HALL	Clatsop	2,972,673	0	2,972,673	BARRACKS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
ANDERSON HALL	Clatsop	3,570,469	0	3,570,469	BARRACKS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
WHITE HALL	Clatsop	2,972,673	0	2,972,673	BARRACKS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
VEHICLE STORAGE	Clatsop	2,521,583	0	2,521,583	VEHICLE STORAGE	M	H	H	M	H	M	H	M	M	H	H	H	H	H
VEHICLE STORAGE	Clatsop	2,810,663	0	2,810,663	VEHICLE STORAGE	M	H	H	M	H	M	H	M	M	H	H	H	H	H
STORAGE BLDG-DEPOT	Clatsop	1,262,222		1,262,222	STORAGE	M	H	H	M	H	M	H	M	M	H	H	H	H	H
ADMINISTRATION/MOTOR POOL	Clatsop	2,219,161	0	2,219,161	OMS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
CP RILEA/CONTROLS HUM WAREHOUSE	Clatsop	1,840,080	0	1,840,080	CHP WAREHOUSE	M	H	H	M	H	M	H	M	M	H	H	H	H	H
CP RILEA MESS HALL	Clatsop	1,591,450	0	1,591,450	DINING	M	H	H	M	H	M	H	M	M	H	H	H	H	H
TRANSIENT HOUSE	Clatsop	2,175,858	0	2,175,858	BARRACKS	M	H	H	M	H	M	H	M	M	H	H	H	H	H
NORTH COAST YCF	Clatsop	12,744,000	420,542	13,164,542	CORRECTION FACILITY	M	H	H	M	H	M	H	M	M	H	H	H	H	H
Warrenton Maint Station Building	Clatsop	758,841	379,421	1,138,262	Maintenance Station Bldg	M	H	H	M	H	M	H	M	M	H	H	H	H	H
Astoria Office D1 Bldg	Clatsop	747,325	373,662	1,120,987	Office, Administrative	M	H	H	M	H	M	H	M	M	H	H	H	H	H
COOS BAY ARMORY	Coos	3,511,049	6,664	3,517,713	ARMORY	M	H	M	M	H	H	H	L	H	H	H	H	-	-
COOS BAY SPECIALTY CREWS	Coos	1,315,956	657,978	1,973,934	OFFICE/ADMI N	M	H	M	M	H	H	H	L	H	H	H	H	-	-
SEGREGATION BUILDING	Coos	1,226,925	4,162	1,231,087	INMATE HOUSING	M	H	M	M	H	H	H	L	H	H	H	H	-	-

Source: DAS data 2005

Region 1 Oregon Coast State Owned Building Inventory

Building Name	County	Replacement Value	Contents Value	Total Bldg Value	Usage	Earthquake		Fire/WUI		Flood		Landslide		Tsunami		Windstorm		Winterstorm	
DORMITORY A	Coos	1,015,280	0	1,015,280	INMATE HOUSING	M	H	M	M	H	H	H	L	H	H	H	H	-	-
DORMITORY B	Coos	1,015,280	3,706	1,018,986	INMATE HOUSING	M	H	M	M	H	H	H	L	H	H	H	H	-	-
OIMB DINING HALL/DORM - UO	Coos	1,007,050	0	1,007,050	HOUSING	M	H	M	M	H	H	H	L	H	H	H	H	-	-
Coquille Maint Station Building	Coos	920,369	460,184	1,380,553	Maintenance Station Bldg	M	H	M	M	H	H	H	L	H	H	H	H	-	-
SSNER INTERPRETIVE CTR	Coos	1,620,972	375,950	1,996,922	PUBLIC ED/OFFICE	M	H	M	M	H	H	H	L	H	H	H	H	-	-
OIMB TERWILLIGER RESEARCH	Coos	508,288	973,131	1,481,419	Instruction, Admin, Research	M	H	M	M	H	H	H	L	H	H	H	H	-	-
Port Orford Maint Station Bldg	Curry	1,896,796	948,398	2,845,194	Maintenance Station Bldg	M	H	H	H	H	H	H	L	H	H	H	H	-	-
Reedsport Maint Station Bldg	Douglas	750,139	375,069	1,125,208	Maintenance Station Bldg	M	H	H	H	H	M	H	M	H	M	H	M	-	-
CAMP FLORENCE	Lane	1,731,264	105,704	1,836,968	SECURE BUILDING	M	H	L	L	H	H	H	M	M	H	H	H	-	-
HONEYMAN CLEAWOX DAY USE STORE	Lane	2,383,993	50,000	2,433,993	STORE	M	H	L	L	H	H	H	M	M	H	H	H	-	-
NEWPORT ARMORY	Lincoln	2,391,168	4,243	2,395,411	ARMORY	H	M	H	M	H	L	-	-	H	M	H	H	-	-
MARINE SCIENCE LAB	Lincoln	10,199,280	516,271	10,715,551	RESEARCH	H	M	H	M	H	L	-	-	H	M	H	H	-	-
MSC EDUCATION	Lincoln	1,397,000	59,185	1,456,185	LIBRARY	H	M	H	M	H	L	-	-	H	M	H	H	-	-
POTTS-GUIN LIBRARY	Lincoln	3,507,900	147,174	3,655,074	LIBRARY	H	M	H	M	H	L	-	-	H	M	H	H	-	-
MARINE REGIONAL HEADQUARTERS	Lincoln	1,120,000	750,000	1,870,000	LABORATORY/OFFICE	H	M	H	M	H	L	-	-	H	M	H	H	-	-
ROSE LODGE MAINT BLDG	Lincoln	1,366,877	550,040	1,916,917	OFFICE/ADMIN	H	M	H	M	H	L	-	-	H	M	H	H	-	-
Ona Beach MS HQ Office	Lincoln	730,536	365,268	1,095,804	Office, Administrative	H	M	H	M	H	L	-	-	H	M	H	H	-	-
ADMINISTRATION	Tillamook	1,158,500	53,599	1,212,099	ADMINISTRATION	M	H	M	H	H	H	H	H	M	H	H	H	-	-
TILLAMOOK YCF	Tillamook	4,281,300	333,496	4,614,796	CORRECTIONAL FACILITY	M	H	M	H	H	H	H	H	M	H	H	H	-	-
CAMP TILLAMOOK	Tillamook	1,913,024	329,074	2,242,098	SECURE BUILDING	M	H	M	H	H	H	H	H	M	H	H	H	-	-
TILLAMOOK OFFICE	Tillamook	4,240,000	848,549	5,088,549		M	H	M	H	H	H	H	H	M	H	H	H	-	-
Regional Totals		**118,050,800**	**9,672,411**	**127,723,211**															

Source: DAS data 2005

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APPENDIX E:
Household Survey

Region 1: Oregon Coast Household Natural Hazards Preparedness Survey

Survey Report for Counties of:
Clatsop
Tillamook
Lincoln
Lane
Douglas
Coos
Curry

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Natural Hazard Household Preparedness Survey

The Oregon Partnership for Disaster Resilience *(Partnership,* OPDR) is a coalition of public, private, and professional organizations working collectively toward the mission of creating a disaster resilient and sustainable state. The *Partnership* is recognized by the Institute for Business & Home Safety (IBHS) as a Showcase State for Disaster Resilience. Developed and coordinated by the Community Service Center (CSC) at the University of Oregon the *Partnership* employs a service learning model to increase community capacity and enhance disaster safety and resilience statewide.

The *Partnership's* current planning initiatives cover over two-thirds of the geographic area of Oregon. It is working with Central Oregon, Southeast Oregon, Northeast Oregon, and the Oregon Coast through Pre-Disaster Mitigation Planning Grants to support staff in developing local natural hazard mitigation plans. CSC staff serves as the lead project coordinator providing plan development support, technical resources, and a proven planning process/framework for each county.

As part of the PDM Program, OPDR is assisting the Coastal region of Oregon with the citizen involvement components of the natural hazard mitigation planning process. Citizen involvement is a key component in the natural hazard mitigation planning process. Citizens have the opportunity to voice their ideas, interests and concerns about the impact of natural disasters on their communities. To that end, the Disaster Mitigation Act of 2000[1] requires citizen involvement in the natural hazard mitigation planning process. It states:

> "An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
>
> 1. An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.
> 2. An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process."

The benefits of citizen involvement, according to Bierle[2], include the following: (1)

[1] National Archives and Records Administration. 2002. Federal Emergency Management Agency 44 CFR Parts 201 and 206 Hazard Mitigation Planning and Hazard Mitigation Grant Program; Interim Final Rule in Federal Register.

[2] Bierle, T. 1999. "Using social goals to evaluate public participation in environmental decisions." *Policy Studies Review.* 16(3/4) ,75-103.

educate and inform public; (2) incorporate public values into decision making; (3) improve substantially the quality of decisions; (4) increase trust in institutions; (5) reduce conflict; and (6) ensure cost effectiveness. To gather public input into the planning process, OPDR administered a survey to randomly selected households.

This report summarizes the results of the Oregon Coast Household Natural Hazards Preparedness Survey. The survey helps the counties of the Coastal region-- Clatsop, Tillamook, Lincoln, Lane (only coastal portion), Douglas (only coastal portion), Coos, and Curry Counties-- realize Bierle's five benefits of citizen involvement in the natural hazard mitigation planning process.

Methodology

To conduct the household survey, OPDR used a modified version of a survey administered statewide in 2002. The purpose of the 2002 survey was to better understand the perceptions of risk to natural hazards held by citizens, as well as the level of preparedness and types of risk reduction activities in which citizens have engaged. The primary goal of the 2002 survey was to gauge the overall perception of natural disasters and determine a baseline level of loss reduction activity for residents in the community. OPDR adapted the statewide survey to include questions about citizens' support for different types of community planning actions. Planning actions mentioned included protecting critical facilities, disclosing natural hazard risks during real estate transactions, and the use of tax dollars to compensate land owners for not developing in hazardous areas.

This survey was sent to 1200 households in the Coastal region, which includes: Clatsop, Tillamook, Lincoln, Lane (only coastal portion), Douglas (only coastal portion), Coos, and Curry Counties. The households were randomly selected and population weighted based on registered voter lists provided to OPDR by each of the counties.

The mailing contained a cover letter, the survey instrument, and a postage- paid return envelope. Completed surveys were returned to OPDR at the University of Oregon. A second postcard was sent to remind households to send in the survey or to access an online version of the survey. OPDR received 206 valid responses from the mailed survey, for a 20% response rate. (Only 1034 of the 1200 addresses were valid addresses.) Only two people completed the online version of the survey; therefore, these responses were not analyzed because of the very low sample size.

Limitations

The study identifies key issues about how members of Coastal Oregon communities perceive their risk to natural hazards, providing a snapshot of those perceptions at a single point in time. As such, survey responses may reflect external issues, such as heightened concern about terrorism or the current state of the economy. This study was not intended to be representative of the perceptions of all residents, and cannot be generalized to the public.

SECTION I: Organization of Report

The survey results are organized into the following sections:

Characteristics of Survey Respondents: This section reports information about respondent characteristics including: educational attainment, age, and length of time as an Oregon resident.

Perception of Risk: This section identifies the general level of concern over natural hazards risk.

Household Preparedness and Risk Reduction: This section describes the types of structural and nonstructural measures that are being implemented by survey respondents, and the types of resources or programs that might increase risk reduction activities.

Community Natural Hazard Preparedness: This section describes citizens' priorities for planning for natural hazards and the community-wide strategies respondents support.

Written Responses to Open-Ended Questions: This section includes summarizes the responses of the open-ended questions and comments.

SECTION II: Characteristics of Survey Respondents

Demographic survey questions provide a statistical overview of the characteristics of the respondents. This section of the survey asked respondents about their age and gender, their level of education, and how long they have lived in Oregon. The survey also included questions regarding respondents' present housing.

There were 206 individuals who responded to the survey, giving the survey a 20% response rate. Of the seven counties the survey was mailed to, the majority of surveys (31%) returned came from residents of Coos County (Table 1). This is not surprising as Coos County has the greatest number of residents in the region with 62,905 of the total region residents (PSU population estimate). It is difficult to know the exact number of residents living in the region as only part of Lane and Douglas counties are included in the coastal region. If all of Lane and Douglas counties are included in the resident total, the region would contain 634,920 (2006 Region 1: Profile and Risk Assessment, OPDR).

Zip codes provide a more specific location of the survey respondents than the county level data. Of the 37 different zip codes indicated, the most respondents live in the 97103 zip code (Astoria) (Table 2).

Table 1. Per County Sample Distribution and Survey Response

County	Sample Distribution	Survey Responses
Coos	30%	31%
Lincoln	21%	19%
Clatsop	17%	17%
Tillamook	12%	12%
Lane	7%	9%
Curry	10%	9%
Douglas	3%	3%

Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007).

Table 2. Percent of Surveys by Zipcode

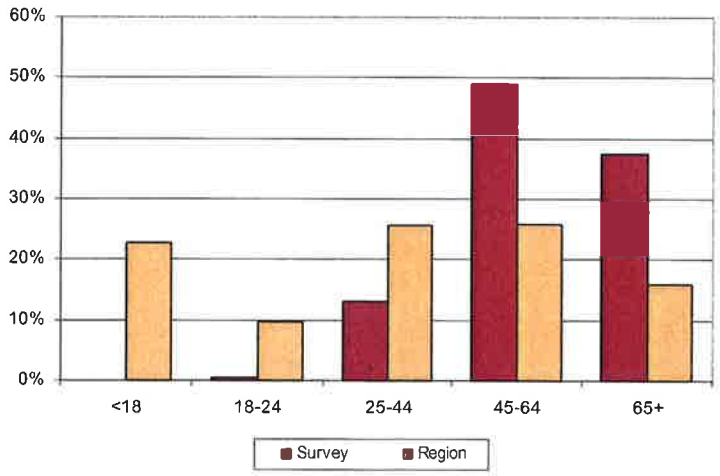
Zip Code	City	Percent
97103	Astoria	17.2
17420	Coos Bay	11.8
97439	Florence	8.3
97459	North Bend	6.9
97415	Brookings	6.4
97423	Coquille	5.4
97365	Newport	4.9
97141	Tillamook	4.4
Other		34.7

Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007).

Age and Gender

Figure 1 compares the ages of survey respondents to the 2000 U.S. Census. This shows that younger people were underrepresented while older people were overrepresented in the sample. Women accounted for 58% of survey respondents.

Figure 1. Percentage of Coastal Oregon Population and Survey Respondents by Age Category (persons 18 and over)

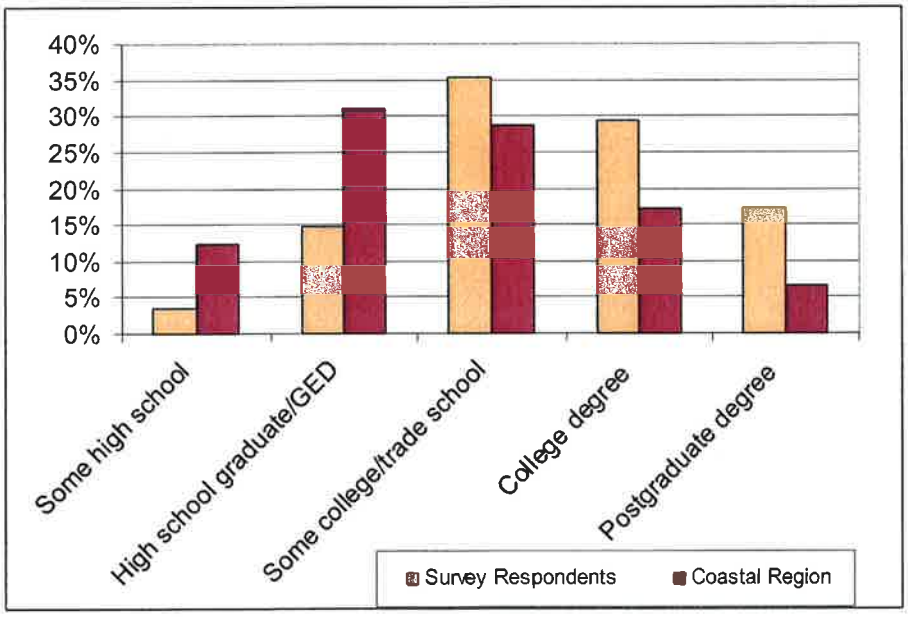


Source: U.S. Census Bureau: www.census.gov (2000) and Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007).

Level of Education

In general, survey respondents were relatively well educated. Figure 2 compares the level of education of survey respondents with the 2000 U.S. Census for the region. About 80% of survey respondents have attended some college or gone to a trade school, obtained a college degree, or have a postgraduate degree. In contrast, figures from the Census show that approximately 50% of Coastal residents have achieved this level of educational attainment. Survey respondents were much more likely to have completed a higher educational level than the overall population of the Coastal region.

Figure 2. Level of Education of Coastal Oregon Population and Survey Respondents

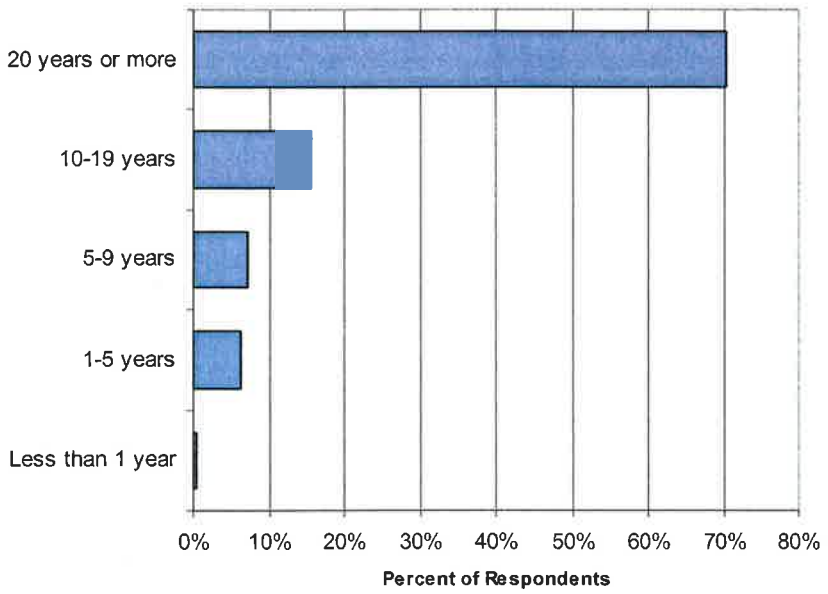


Source: U.S. Census Bureau: www.census.gov (2000) and Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Preparedness, (Nov. 2007)

Oregon Residency

Approximately 70% percent of survey respondents have lived in Oregon for 20 years or more (see Figure 3). Respondents who have lived in Oregon for fewer than 20 years have most commonly moved from California (17%).

Figure 3. Length of Time Survey Respondents Have Lived in Oregon



Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007)

Housing Characteristics

Housing characteristics are important variables in creating effective education and outreach programs. Knowledge of the percentage of homeowners in a community can help target the programs. Homeowners might be more willing to invest time and money in making their homes more disaster resilient. The majority of survey respondents own their own home (88%). Almost 79% of survey respondents live in single-family homes, 11% live in manufactured homes, 3% in apartments of 5 or more units, 2% live in duplexes, and less than 0.5% live in condominiums/townhomes or apartments with 3-4 units. In addition, 79% said they have access to the internet.

SECTION III.
Perception of Risk

It is helpful to understand community members' experiences and their perceptions of risk to natural hazards to make informed decisions about natural hazard risk reduction activities. The survey asked respondents about their level of concern for specific hazards in the Coastal region. The primary objective of this question was to create a "natural hazard profile" of respondents to better understand how Coastal residents perceive natural hazards.

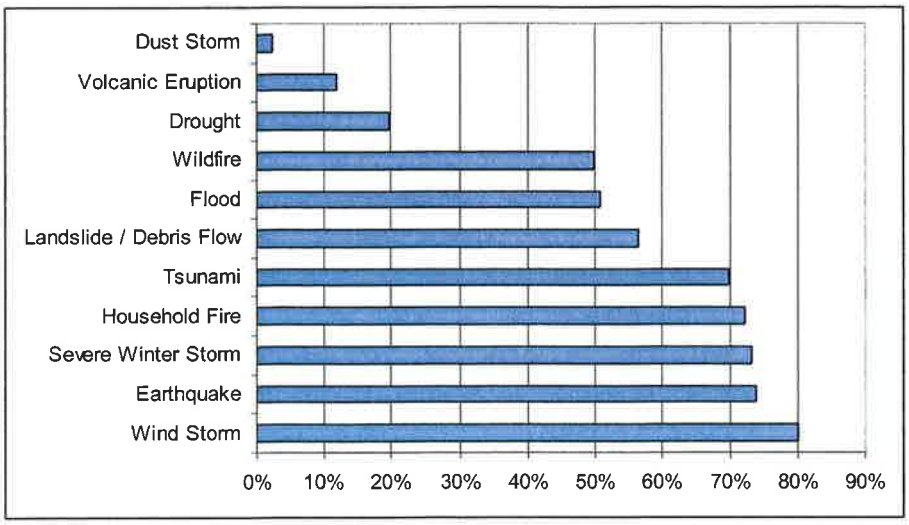
The survey asked respondents to rank their personal level of concern for specific natural disasters affecting their community (Table 3). The results show that respondents were most concerned about windstorm, earthquake, severe winter storm and household fire. The respondents are least concerned about volcanic eruptions and dust storm. Figure 5 shows the percent of respondents that identified their level of concern as either "Very Concerned" or "Somewhat Concerned".

Table 3. Survey Respondents' Level of Concern Regarding natural Hazards in the Coastal Region

Natural Disaster	Very Concerned	Somewhat Concerned	Neither Concerned nor Unconcerned	Not Very Concerned	Not Concerned
Drought	5.9%	13.7%	18.1%	22.5%	39.7%
Dust Storm	0.5%	2.0%	10.3%	17.2%	70.0%
Earthquake	19.7%	54.2%	9.9%	10.8%	5.4%
Flood	14.9%	35.8%	14.4%	16.4%	18.4%
Landslide / Debris Flow	20.8%	35.6%	10.9%	18.3%	14.4%
Wildfire	16.7%	33.0%	14.3%	20.2%	15.8%
Household Fire	21.9%	50.2%	11.4%	12.9%	3.5%
Volcanic Eruption	1.5%	10.4%	17.9%	16.9%	53.2%
Wind Storm	32.8%	47.3%	10.4%	5.5%	4.0%
Severe Winter Storm	24.3%	49.0%	11.4%	7.9%	7.4%
Tsunami	26.1%	43.8%	13.3%	6.4%	10.3%

Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007)

Figure 4. Percentage of Survey Respondents' Who Are "Very Concerned" or "Somewhat Concerned" about Natural Hazards



Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007)

Section IV. Household Preparedness and Risk Reduction

There are many steps people can take to prepare their households for a natural disaster or emergency. Preparing for a disaster can improve the safety and comfort of the members of a household immediately following a natural disaster or emergency. The survey asked respondents about what steps their households have taken or plan to take to increase their disaster preparedness.

Property Protection

Exactly half (50%) of the respondents considered the possible occurrence of a natural hazard when they bought or moved into their current homes. The need to have adequate provisions for financial and property recovery when natural disasters do occur is a necessary component of natural hazard preparedness. Only ten percent of the respondents indicated they have flood insurance leaving 90% without insurance. However, 65% of those who don't have flood insurance indicated the reason is because their home is not located in the floodplain and 15% felt it was not necessary. Many more respondents (37%) indicated they have earthquake insurance. The top two reasons given by those who don't have earthquake insurance were "not familiar with it/don't know" (30%) or "it is not necessary" (20%).

Table 4. Survey Respondents' Reasons For Not Having Flood and/or Earthquake Insurance

Flood Insurance		Earthquake Insurance	
Not located in the floodplain	64%	Not familiar with it/don't know	30%
Not necessary	14%	Not necessary	20%
Not familiar with it/don't know	7%	Too Expensive	19%
Too Expensive	6%	Deductible too high/not worth it	14%
Not available	3%	Other	10%
Other	3%	Not available	7%
Deductible too high/not worth it	3%		

Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007)

Over sixty percent of respondents have talked with members of their households about what to do in the case of a natural disaster or emergency whereas only twenty percent have braced unreinforced masonry, concrete walls and chimneys. Table 5 summarizes the activities respondents indicated they have done, plan to do, have not done, or were unable to do to prepare for natural disasters.

Table 5. Survey Respondents' Household Disaster Preparedness Activities

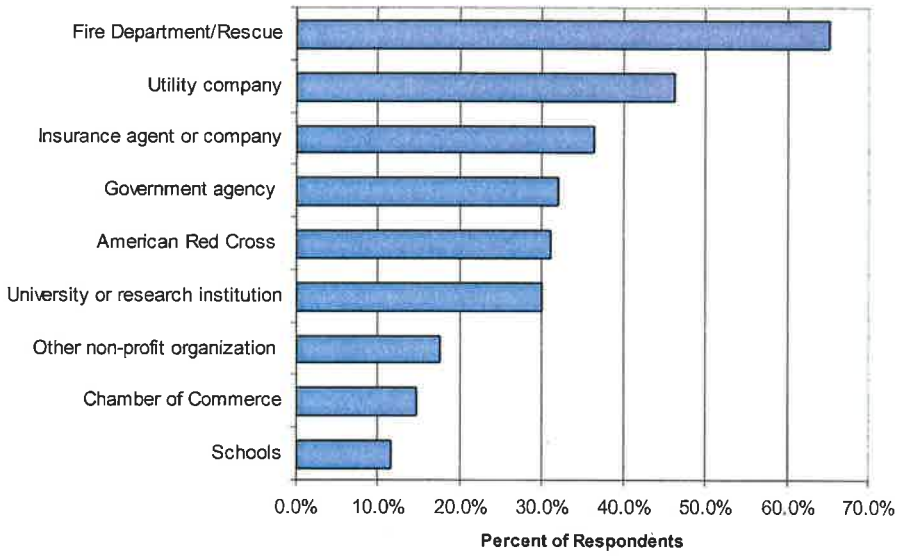
In your household, have you or someone in your household:	Have Done	Plan To Do	Not Done	Unable To Do	Does Not Apply
A. Attended meetings or received written information on natural disasters or emergency preparedness?	52.7%	5.4%	40.9%	1.0%	
B. Talked with members in your household about what to do in case of a natural disaster or emergency?	62.4%	13.9%	20.1%	3.6%	
C. Developed a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?	38.5%	24.6%	33.8%	3.1%	
D. Prepared a "Disaster Supply Kit" (Stored extra food, water, batteries, or other emergency supplies)?	46.2%	27.1%	26.1%	0.5%	
E. In the last year, has anyone in your household been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR)?	35.4%	3.1%	57.9%	3.6%	
F. Have you secured your water heater, cabinets and bookcases to the wall?	31.8%	6.0%	56.7%	3.0%	2.5%
G. Have you fit your gas appliances with flexible connections?	25.6%	1.0%	14.1%	2.0%	57.3%
H. Used fire-resistant building or roofing materials?	54.0%	2.5%	28.3%	6.1%	9.1%
I. Secured your home to its foundation?	54.4%	2.1%	26.4%	7.3%	9.8%
J. Braced unreinforced masonry, concrete walls, and chimney?	20.3%	2.0%	31.5%	9.1%	37.1%
K. Elevated your home in preparation for floods?	6.5%	1.0%	20.1%	9.5%	62.8%

Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (November 2007)

Preferred Sources and Formats of Information

To develop and implement effective outreach and education activities, it is important to understand the mechanisms for information dissemination. Of the listed organizations that might provide information to households about household preparedness for natural disasters, respondents most frequently preferred the fire department or rescue organization. Figure 5 shows that schools were the least preferred organization to be the primary information source.

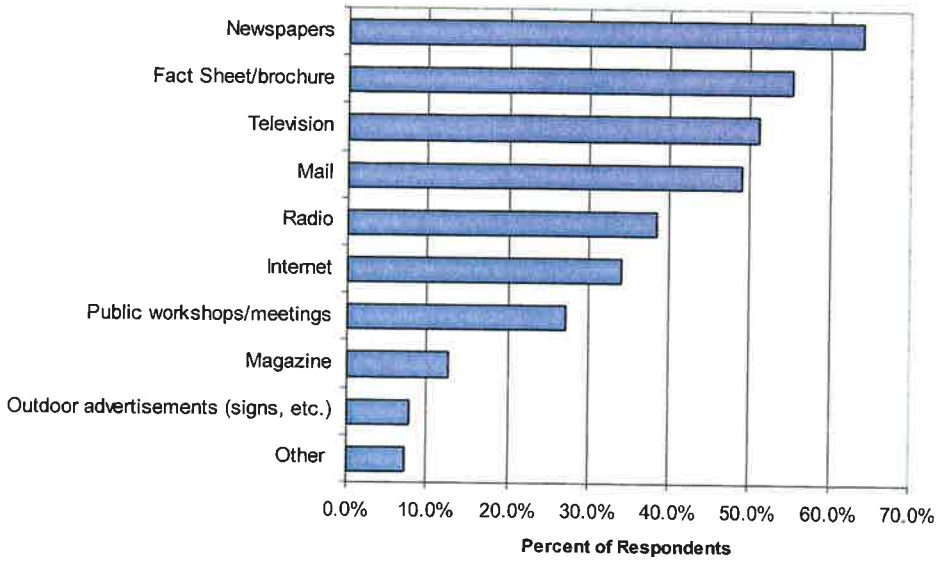
Figure 5. Survey Respondents' Preferred Sources of Information Regarding Household Preparedness



Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007)

When asked what the most effective way was to receive information, respondents indicated that the local newspaper (64%), fact sheet/brochure (55%), television (51%), and mail (49%) were the most effective. Figure 6 shows how survey respondents rated the effectiveness of dissemination methods presented in the survey.

Figure 6. Survey Respondents' Ranking of Effectiveness of Selected Preparedness Outreach Methods



Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (November 2007)

Section V. Community Natural Hazard Preparedness

To assist the preparation of natural hazard mitigation plans, it is essential to understand the importance community members place on specific community-level risk reduction actions. These questions could help Coastal communities determine their citizens' priorities when planning for natural hazards. They also provide an idea of which types of risk reduction strategies citizens would be willing support. Table 6 illustrates the importance respondents placed on each potential natural hazard goal.

Over 95% of respondents indicated that it is very important or somewhat important to protect private property, protect critical facilities, and protect and reduce damage to utilities. The statement with the lowest priority (74%) is to protect historical and cultural landmarks.

Table 6. Survey Respondents' Goal Prioritization

Statements	Very Important	Somewhat Important	Neither Important nor Unimportant	Not Very Important	Not Important
A. Protecting private property	66.0%	29.0%	2.0%	2.5%	0.5%
B. Protecting critical facilities (e.g., transportation networks, hospitals, fire stations)	90.5%	8.5%	0.5%	0.5%	0.0%
C. Preventing development in hazard areas	58.7%	28.9%	9.0%	2.0%	1.5%
D. Enhancing the function of natural features (e.g., streams, wetlands)	49.0%	32.0%	11.5%	5.0%	2.5%
E. Protecting historical and cultural landmarks	26.4%	48.3%	15.9%	5.0%	4.5%
G. Protecting and reducing damage to utilities	74.1%	24.4%	1.0%	0.0%	0.5%
H. Strengthening emergency services (e.g., police, fire, ambulance)	73.4%	20.7%	3.9%	1.5%	0.5%
I. Disclosing natural hazard risks during real estate transactions	64.9%	25.7%	6.4%	2.0%	1.0%

Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007)

There are a number of activities a community can undertake to reduce the risk from natural hazards. These activities can be both regulatory and non-regulatory. Table 7 shows respondents' general level of agreement regarding the community-wide strategies included in the survey.

Table 7. Survey Respondents' General Level of Agreement by Percentage Regarding Community-wide Strategies

Community-wide Strategies	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not Sure
A. I support a regulatory approach to reducing risk.	19.4%	36.7%	20.4%	9.2%	9.7%	4.6%
B. I support a non-regulatory approach to reducing risk.	15.1%	41.1%	27.6%	7.3%	3.1%	5.7%
C. I support a mix of both regulatory and non-regulatory approaches to reducing risk.	27.3%	37.9%	18.7%	7.1%	3.5%	5.6%
D. I support policies to prohibit development in areas subject to natural hazards.	37.0%	36.0%	15.0%	6.5%	2.0%	3.5%
E. I support the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards.	6.1%	8.1%	28.4%	33.5%	20.3%	3.6%
F. I support the use of local tax dollars to reduce risks and losses from natural disasters.	8.5%	46.3%	23.4%	9.0%	6.5%	6.5%
G. I support protecting historical and cultural structures.	12.5%	50.5%	27.0%	5.5%	2.5%	2.0%
H. I would be willing to make my home more disaster-resistant.	23.0%	52.0%	19.5%	2.0%	0.5%	3.0%
I. I support steps to safeguard the local economy following a disaster event.	21.6%	52.8%	18.6%	1.5%	1.5%	4.0%
J. I support improving the disaster preparedness of local schools.	39.8%	46.8%	10.9%	1.5%	0.0%	1.0%
K. I support a local inventory of at-risk buildings and infrastructure.	24.8%	46.5%	21.3%	2.5%	1.0%	4.0%
L. I support the disclosure of natural hazard risks during real estate transactions.	8.5%	46.3%	23.4%	9.0%	6.5%	6.5%

Source: Household Natural Hazards Preparedness Survey, Oregon Partnership for Disaster Resilience, (Nov. 2007)

As shown in Table 7, 87% of respondents indicated that they strongly agree or agree improving the disaster preparedness of local schools. Conversely, only 14% indicated that they strongly agree or agree to the use of tax dollars to compensate land owners for not developing in areas subject to natural hazards.

Summary

Survey respondents are most concerned about wind storms, earthquakes, and severe winter storms. Only half of them considered the possible occurrence of a natural hazard when they bought their homes. However, approximately sixty percent have talked with members of their household about what to do in the case of a natural hazard and twenty-five percent plan to develop a "Household/Family Emergency Plan". The best way to

communicate with these survey respondents is through the newspaper and they prefer information from the fire or rescue department. They think that the community should be involved in preparing for natural disasters, specifically by improving the preparedness of schools and developing a local inventory of at-risk buildings.

Open-ended Survey Responses

Q3.1 If "NO" for flood, what is the main reason your household doesn't not have insurance for flood events? (Other)

- Location not likely to be flooded
- The insurance companies use "act of god" as a clause for getting out of paying Insurers
- Located 200 ft above Col. River
- Had flood insurance 3 years. They did not send yearly bill around 2002. By the time I realized it my policy lapsed. To renew the premium doubled.

Q4.1 If "NO" for earthquake, what is the main reason your household does not have insurance for earthquake events? (Other)

- Never talked to insurance agent about it
- An insurance company likely not to pay out on large catastrophic widespread events...example is Katrina.
- Have not checked
- Rent
- The insurance companies use "act of god" as a clause for getting out of paying Insurers
- Would have to modify foundation
- Inspection rq'd not done
- Event unlikely
- Did not cover in the event of tsunami tidal surge
- No common earthquake action, but they expect a big one
- Faults offshore, homes on solid rock

Q12 County

- Clatsop (38)
- Coos (61)
- Curry (14)
- Douglas (5)
- Lane (18)
- Lincoln (36)
- Tillamook (24)

Q15 Please indicate your level of education (Other)

- Hotel-Motel MGMT
- Art

- State Certified CNA
- CDA
- Fire/police certified

Q17 Do you rent/own? (Other)

- Trailer (3)
- Single apartment over garage
- Cattle Ranch
- Mobile
- Farm
- Travel Trailer
- Business
- 2nd home/commercial
- Lakefront property

Q18 If you have lived in Oregon for less than 20 years, in what state did you live before you moved to Oregon? (Other)

- Arizona (2)
- Arkansas
- Florida (2)
- Louisiana
- Maine
- Maryland
- Minnesota
- Missouri
- Nevada (3)
- New York (3)
- North Carolina
- Ohio
- Pennsylvania
- Texas
- Utah (2)
- Vermont
- Wisconsin
- U.S.A.F-moved a lot
- 4th gen. Oregon
- Canada

Please feel free to provide any additional comments in the space provided below.

- Had earthquake insurance with Allstate, but the now no longer cover earthquakes. Terribly expensive to pick it up elsewhere!!!
- I do not believe the government (i.e. tax dollars) or insurance co. should be required to cover losses in areas known to be subjected to frequent natural risk.

- If building in known hazard area- any services needed in time of an emergency-should be paid by the builder/owner.
- Living on high hill in Astoria, Oregon. Have summer home at Cannon Beach, Oregon. Risky, as close to the ocean, but town has warning whistles, and good escape routes to high hills for safety.
- If this questionnaire is being used to assess individual preparedness in the event of a disaster, then I applaud it. I f it is going to be used to implement invasive, expensive gout programs to "safeguard" us, please reconsider. Political finger-pointing, has never been a good, substitute for well-trained, organized local efforts by police, fire, church, and individuals. Some will always be unprepared and some will be capable.
- Some areas of our valley (Hidden Valley-Toledo, OR) are in flood plain. I have neighbors with a great deal of their ranch -that is wetlands-for last several months-they have been spreading human waste over a large area. Water sources have been affected-Animals have been affected-also bringing in untreated animals-running them on human waste-they have brought in black-leg and pink eye-among other disasters in our area-including overuse of Round Up.
- I would be interested to hear your findings from this survey.
- I work for Oregon State Parks about 15 miles from our community. In order to take the job, I had to agree to have an emergency survival pack fro 2 persons, including an axe and first-aid kit for sutures, or sign a waiver stating OSP would not be responsible if I got stuck unprepared. I was amazed; given a list of necessary items I would need but never thought of (i.e. can opener, alcohol (whiskey), and H2O purification tabs). Educate.
- We took down a beautiful fir tree in front yard in 2006 because of possible falling hazard to house, wires and neighbors. More people should do more tree/shrub/brush trimming for falling/other hazards.
- New buildings should be required to be built to current knowledge for protection of feature occupants and hazards should be revealed on sale of any property.
- I hope you are using this information to educate. Non-regulatory education programs should be an incentive for home owners/land owners to get breaks on their insurance. Personally, I feel Insurance/other agencies use disasters to pump up economics (Disaster economics).
- With on degree in Geology and one in Biology, I'm painfully aware of where I live and I'm probably more prepared for an earthquake or tsunami than anyone living in my town. Enough said...
- Volunteer firefighter for 35 years. When possible, own generator.
- We live in a flood, fire, landslide, earthquake prone state...Most citizens are ignorant of that fact...That needs to change!
- Too many are either unaware or hazards or choose to disregard them, especially if doing so is more financially beneficial to them personally. Thank you for your efforts and interest pertaining to disaster preparedness.

- People who insist on developing in flood hazard and landslide hazard areas should not receive tax dollars to rebuild after a disaster.
- Since I live alone and in a very rural area, a lot of the questions do not necessarily affect me.
- Government intervention stops many projects near our small community. I am leery or our Willamette Valley. They control our communities with their uneducated ideas. What is happening in my community?
- Thank you.
- This state does not need more government to regulate citizens. LCDC is an excellent example of polarizing the public!
- A lot of planning needs to be done. We live in an area where there are many senior citizens who would need help in an emergency. With our tall trees, fire could easily cause a great problem, but no one seems to be concerned. We are! Thanks for your efforts. Keep it going.
- We need to plan to deal with the possibility that bridges along the Oregon coast might be damaged such as from an earthquake or tsunami. If bridges cannot be reinforced, then they should be replaced with more earthquake resistant structures. Also, if the coastal area would be cut off, can supplies be airlifted in? Is there such a plan in place? What about fuel supplies for emergency vehicles? How much medicine should one stockpile for emergencies?
- I would gladly do all I could to protect my family & home - cost is an obstacle, especially for home reinforcement. It is certainly hard to trust FEMA, et al - easier to trust local author. As more personally invested, but again, resources are a likely problem. Thanks for the chance to be involved.
- Disaster preparedness procedures for the disabled in resource poor areas.
- Preparing for natural disasters falls off the radar screen for most busy households! Unless it is in front of us (like the "Enter tsunami zone" signs) to remind us that we should be prepared, aware, plan for, etc. it just won't happen. The California wildfires showed us that recently.
- Living on the coast in Pacific City, the concern of a tsunami and its impact. How to deal with loss of roads, bridges, possibly home, etc.
- Our neighborhood has a disaster preparedness committee & information in our local phone book. We store water & water.
- The one disaster prep in this area is the tsunami warning. Every time they announce a trial run the locals all run to the ocean to see the "big wave" arrive. I can only envision more tax dollars wasted on such endeavors.
- I spent several hours reviewing this before answering. In my opinion it tells you nothing!! The information requested is too vague! It is biased in both political & financial concepts of the person filling it out. An example - I am totally opposed to development in hazard areas, but I support Measure 39 & oppose Measure 49. Government doesn't belong in this business because the wealthy are opposed can fight regulation,

but the middle & lower class cannot!! You have not dealt w/the interagency & intra-agency jurisdictional process that resulted in the Katrina fiasco. No one wants to be in charge (except egoist law enforcement) due to issues of liability & probably court & legal processes. No one has budgets for interagency tracking nor will agencies respond using the NIMNS structure. No agency is willing to release authority nor take on responsibility beyond what scope is provided by legislative action. I worked 27 years in emergency response in 4 different counties – you just can't make it happen. When the big one comes you better duck!!

- I believe it is unethical & often tragic to allow building on hazardous areas. Extremely short-sighted – self-defeating – to allow building on fragile ecosystems. I have to work to remember that the word "developer" is not a curse. Obviously, some developers are meticulous ethical. I feat that very few are & money motivates!
- Both husband & wife answered questions.
- Q-6. None of these choices are what I would describe as a "preferred choice!"
- I support any federal money to help/assist families upgrading homes and so on. Also, to assist emergency services (medical, FD), use of National Guard/Military to enforce public safety. DO NOT SUPPORT any spending for local gov. Private business, developers – these only help rich get richer at the expense of poor & middle class.
- Coastal communities are isolated by mountains to the east. Hwy 101 is the only link north & south and to roads leading east. Tsunamis are forecasted to hit Hwy 101, isolating many communities. I have seen nothing to indicate any planning to help isolated areas, nor plans to build additional roads.
- I think this subject is important and there are reasons why to bring it up. However, the chance of a natural disaster is very slim. I worry more about being in war with other nations. I also worry about issues like finding a better job, my son to go to a drug-free school, and to improve my financial and moral status for the good of my family!

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Appendix F: Natural Hazard Mitigation Plan Update Survey

Summary

The Clatsop County Natural Hazard Mitigation Plan Update Survey was conducted February through June of 2014 using the internet service SurveyMonkey, Inc. (www.surveymonkey.com). The survey was advertised at public meetings to include those for the Clatsop County Emergency Preparedness Committee, Clatsop County Board of Commissioners, and Clatsop County Planning Commission. Additionally, a press release was issued and an ad for the survey was placed the local newspaper *The Daily Astorian*.

Responses came from community members who either lived or worked in Astoria, Arch Cape, Lewis & Clark, Seaside, Sunset Beach, and Warrenton. Other communities were not represented (Q1). A majority (69%) of respondents were unaware of the original Clatsop County Multi-Hazard Mitigation Plan developed in 2008 (Q2), and 100% of respondents had not participated in the development of that plan (Q3).

The three natural hazards of most concern, in order of rank, were earthquake, tsunami, and wind/winter storm (Q4). Additional concerns listed loss of food, water, and shelter, and loss of civil order and public safety (Q6). A majority of respondents considered a tsunami to be the greatest threat to themselves and their communities (Q7).

A majority (75%) of respondents indicated that they or local organizations in their communities had taken actions to reduce or eliminate the impact of the hazard they considered most-threatening (Q9). Activities included personal preparedness and education, training and seminars, stockpiling supplies and emergency materials, and volunteering (Q10).

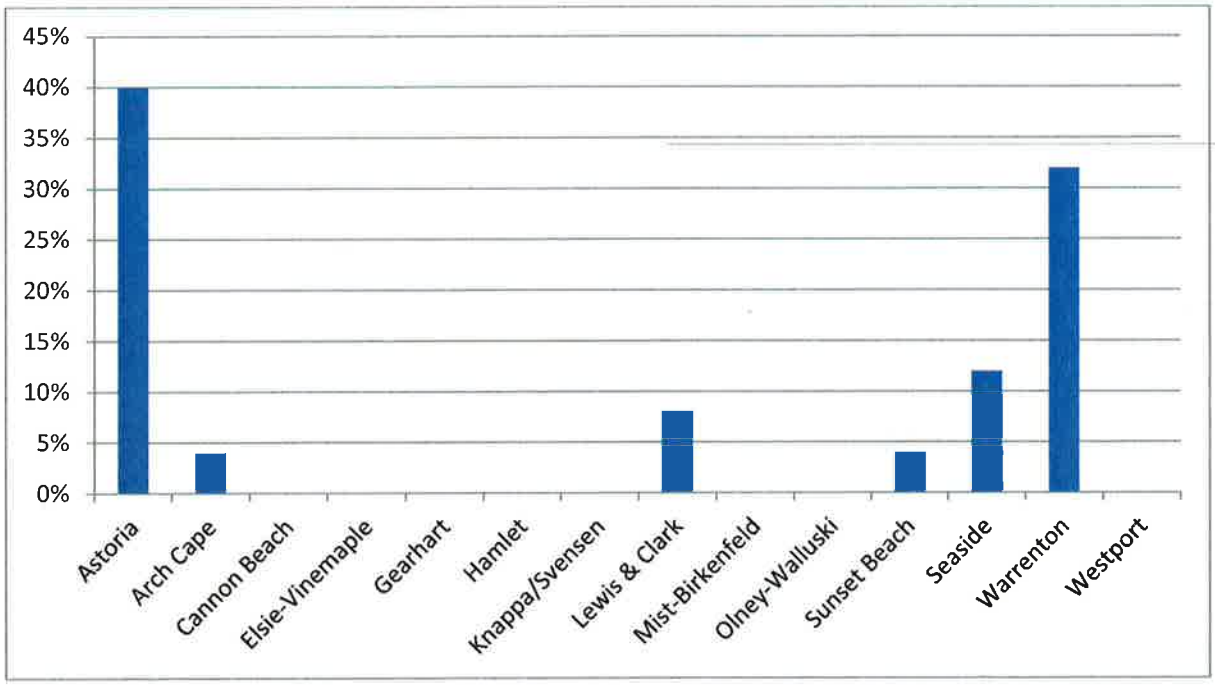
When asked what their local governments or Clatsop County could do to help reduce or eliminate the impact of natural hazards, respondents expressed wishes for more information and public education, public warning systems such as alarms or sirens, improvements to infrastructure, and programs that support local self-reliance (Q11). Additional comments recommended greater public visibility of emergency management efforts, and reducing urban sprawl.

Clatsop County Natural Hazard Mitigation Plan Update Survey & Responses

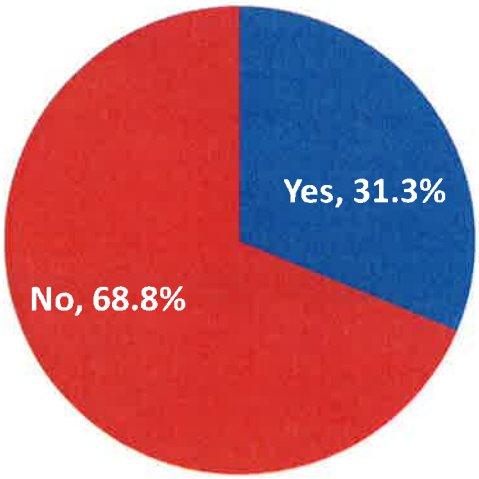
Thank you for participating in the Clatsop County Natural Hazard Mitigation Plan Revision survey. Our Plan is a framework that guides our communities in making decisions and developing policies to reduce or eliminate risk to life and property. It identifies the types of hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines a strategy to reduce or eliminate the risk posed by those threats. The state and federal governments often require communities to complete a Hazard Mitigation Plan in order to be eligible for certain types of disaster assistance and recovery funding. The Clatsop County Emergency Management Division and the Natural Hazard Mitigation Plan Steering Committee are now updating the plan originally developed in 2008.

This survey will help the Hazard Mitigation Planning Committee determine the concerns and questions the community has about the hazards we face and guide discussions throughout the revision process.

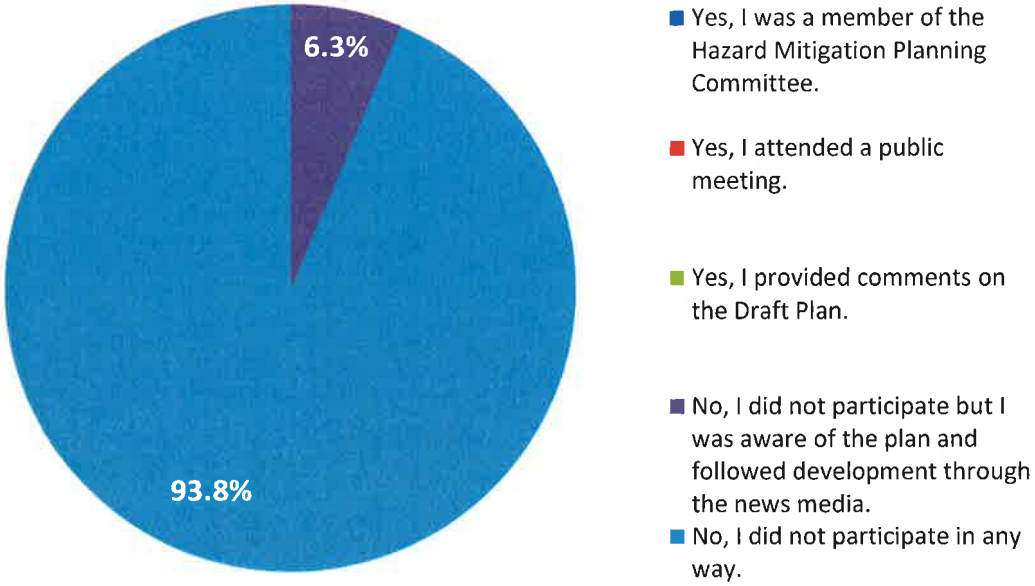
Q1. Select the jurisdictions in which you live and/or work. (Select all that apply)



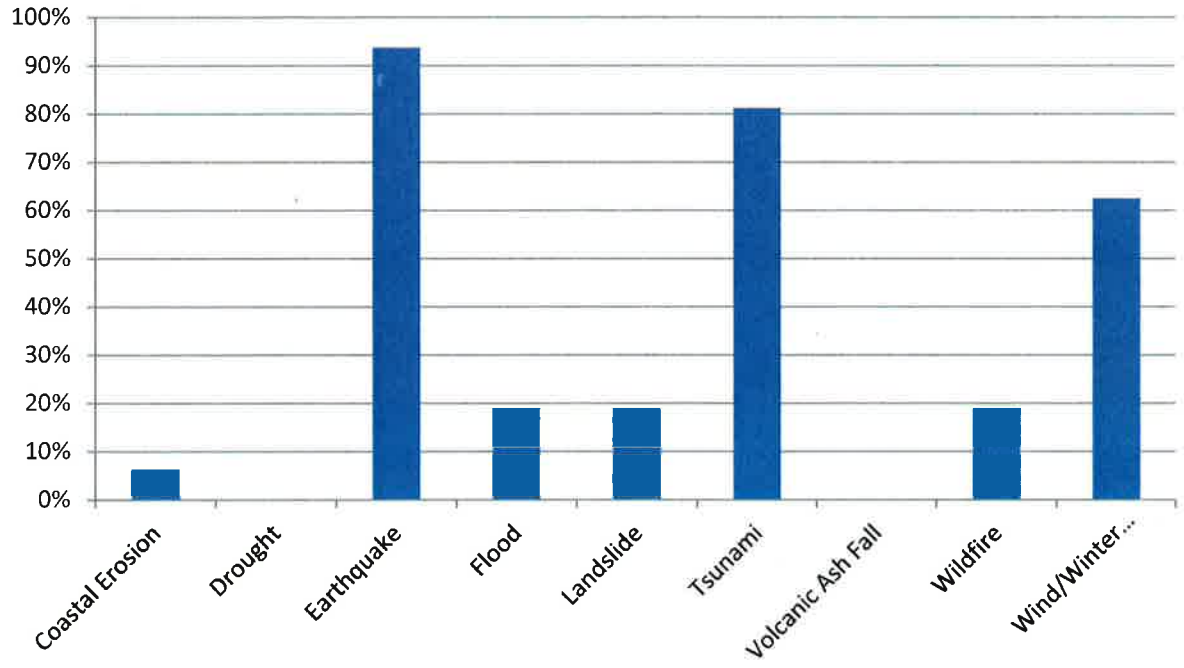
Q2. Are you aware of the Clatsop County Multi-Hazard Mitigation Plan developed in 2008?



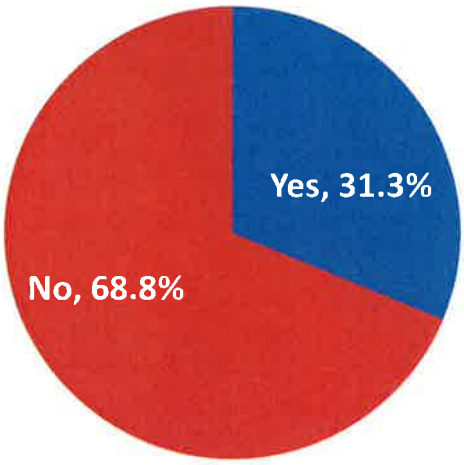
Q3. Did you participate in the development of the 2008 Clatsop County Multi-Hazard Mitigation Plan in any of the following ways? (Select all that apply)



Q4. Below is a list of hazards currently identified in the Clatsop County Multi-Hazard Mitigation Plan. Please select the three (3) hazards of most concern to you:



Q5. Are there any hazards not listed in Question 4 that you believe the Hazard Mitigation Planning Committee should consider?



Q6. If you answered 'Yes' to Question 5, what additional hazards do you believe the Hazard Mitigation Planning Committee should consider?

Climate Change impact to ocean, fisheries, crops, and human health
a. Rising sea level due to global warming. b. Rupture of natural gas storage tanks/lines explosion. c. Bridge/highway collapse d. Loss of police, medical services, e. Loss of water and food supplies f. Panic and breakdown of civil order - vulnerability to predators. g. Loss of shelter shelter, warmth, safety h. Loss of communications and loss of ways to keep phones and computers charged and useful i. Loss of transportation, fuel, etc.
Attacks on schools.
Fire on the Port/ Pier 39.
Increasing poverty & dislocation/homelessness, worsening economy, worsening weather, influx of "climate refugees"

Q7. Of all the hazards you have identified in Questions 4 and 6, which do you consider to be the greatest threat to you and your community?

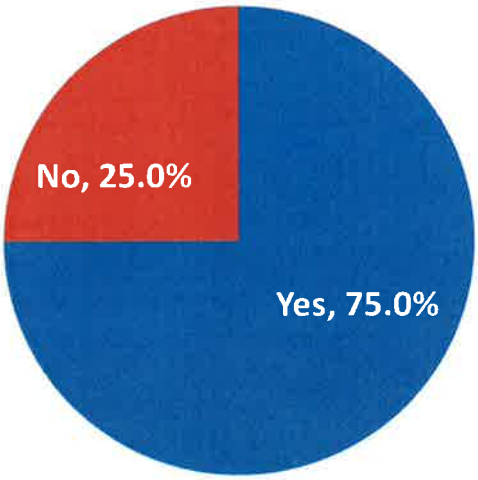
Earthquake
All
tsunami
Wind/winter storm
earthquake/tsunami
Wind/Winter Storm
Earthquake followed by fire. This will change if LNG is allowed to site a facility in Warrenton.
Tsunami
tsunami
EARTHQUAKE LANDSLIDE
Coastal Erosion
Tsunami
Earthquake/tsunami
Earthquake/Tsunami
wind/storms
Earthquake

Q8. If the hazard you identified in Question 7 as being the greatest threat to you and your community occurred in your neighborhood today, what would be the likely impact to you and your family?

unk, but not good. Depends on the amount of damage done.
Would depend upon where we were. If all in one place could act together. If scattered, worry and distraction re who was safe or not would impair. We would be isolated unless had car and fuel. Logging road map would help. Logging roads likely to be only ways to reach safety with other people. Otherwise, survive. Have camping gear - guns - game and birds and garden produce - firewood (know how to build fire)and clothing - medical training, CPR (family members). We would all find out whether going without some meds would make much of a

difference. Would scout for other people and help or bring together.
depends on event and specifics of locality
Loss of power for ip to several days
loss of essential services
loss of electricity and mobility due to downed trees
Displacement.
Immediate danger to life, second damage to home.
While we live outside the tsunami zone, our access to to neighboring towns would likely be destroyed (bridge/tunnel). Most of our community members would lose their homes and maybe even their lives.
EARTHQUAKE
Would not directly impact my family but would have great impact on the area in general.
Loss of life
That would depend on where we were at the time. If home, the impact would be less than for others.
Loss of life and/or property
loss of home and movement around Astoria, isolation from roads being damaged and landslides

Q9. In the past 5 years, have you or any local organizations in your community taken any actions to reduce or eliminate the impact of this hazard?



Q10. If you answered 'Yes' to Question 9, please describe the actions you or your community have taken to reduce or eliminate the impact of this hazard.

Personal preparedness
Practiced our outdoor skills, camping, working on our land, fishing (river near). Attended emergency response lectures.
seminars, training, preparedness drills and site preps
family emergency plan and supplies
Using the "Emergency Preparation" to address not just earthquakes and tsunamis, but wild fires and winter storms - building resources within neighborhoods to support ourselves and each other

Go bags and self-education about preparedness.
Fire station moved out of the tsunami zone, emergency cache developed, ham radio training, community education through meetings and newsletter
DISASTER PREPAREDNESS
Evacuation maps and drills
DOGAMI maps distribution, presentations, shelter preparations
State and local government has updated tsunami maps, added tsunami zone signs and evacuation signs and offered more education.
former volunteer ff and emt-b, also former member of first CERT team in Clatsop county, now a senior preparedness shelter volunteer for Clatsop county Red Cross. and ham radio operator

Q11. What actions do you believe your local government or Clatsop County can take to help reduce or eliminate the impact of these hazards?

Do more to develop personal preparedness
Move their police/ambulance services; city offices; schools, hospital, utilities services; high density housing; all to high ground. Hold regular educational meeting for public along with first aid courses and psychological toughening to decrease vulnerability to panic, confusion, counter-productive behaviors.
relocate critical infrastructure to safe zones
Nothing more.
Id and advertise pre planned support sites
I am not aware of planning for wildfires and appropriate resident response. And keep up the information about earthquakes and tsunamis, taking out the extreme element and also preparing people for lesser emergencies.
Continue to educate the community about these hazards. Keep the E-Prep committee going.
Test Tsunami audible alarm periodically.
Tsunami - Provide a staff person to coordinate different communities so that we have more robust and similar systems, allowing us to share information and resources. Flood- Disallow building in wetlands and floodplains.
DISASTER PREPAREDNESS
Implement development restrictions on shorelands affected by erosion.
Improve levees to increase available evacuation time. Strengthen bridges to make sure they are available for evacuation. Promote underground power in warrenton area to lessen the chance of electrocution during an evacuation. Make more local high areas available for neighborhoods for immediate safety.
Support local food growing, local small-scale production of needed goods, local self-reliance rather than building more box stores and roads
Warning sirens
The local government only appears to communicate with the Daily Astorian or KAST. I don't take the paper and you can't pick up KAST in south county.
keep people informed and do not hold back on any information let the citizens decide what they need to do when given the most up to date and accurate information

Q12. Please use this space to share any other comments, questions or concerns you would like the Hazard Mitigation Planning Committee to consider.

You seem to be invisible. People need to know at least about your existence and function as they do McDonalds. What is the maximum anticipated run-up of tsunami due to max subduction zone earthquake off Oregon coast
I have only lives here for three years. I think the greatest risks are fire, landslide, flood and winter weather. However, greatest consequence are eq and tsunami.
Where can I find the Hazard Mitigation Plan so that I can share it with others.
Thanks for asking.
If we focus development in already developed areas and reduce sprawl, it will be easier to provide help and for us to help ourselves. 1-5 acre lots in rural areas is highly problematic.
Thank you for all you are already doing.

Appendix G: Community Organizations

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 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 tables on the following pages highlight organizations that are active within the community and may be potential partners for implementing mitigation actions. The three involvement methods are defined below.

- **Education and outreach** - organization could partner with the community to educate the public or provide outreach assistance on natural hazard preparedness and mitigation.
- **Information dissemination** - organization could partner with the community to provide hazard-related information to target audiences.
- **Plan/project implementation** - organization may have plans and/or policies that may be used to implement mitigation activities or the organization could serve as the coordinating or partner organizations to implement mitigation actions.

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
4-H/OSU Extension Service 2001 Marine Drive Astoria, OR 97103 503/325-8573	4-H	Clatsop County		√						• Youth resources
American Red Cross 1054 Exchange Street Astoria, OR 97103 503/325-4721	Red Cross	Clatsop County								• CPR & First Aid Training • Comfort care to victims • Food & shelter • Crisis Counseling • Recovery planning • First Aid needs
Angel Adult Foster Home 3579 Harrison Avenue Astoria, OR 97103 503/325-6202	Disabled Adult Foster Home				√	√				Housing
Astor Hotel Apartments 342 14th Street Warrenton, OR 97146 503/325-0171	Disabled Housing	Warrenton			√				√	Housing

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Astoria Rescue Mission 62 W Bond Astoria, OR 97103 503/325-5243	Homeless Shelter	Clatsop County							√	• Emergency Shelter • Men only • Christian environment • Free clothing and food
Astoria Senior Center 1111 Exchange St Astoria, OR 97103 (503) 325-3231	Senior Center	Astoria			√					• Senior needs • Transportation
Clatsop Community Action 364 9th Street Astoria, OR 97103 503/325-1400	Community Services	Clatsop County		√	√	√		√	√	• Homeless housing • Emergency food boxes • Prescription assistance • Energy assistance • Rental assistance • Firewood assistance • Hygiene/infant items
Clatsop Community College 1653 Jerome Avenue Astoria, OR 97103 503/325-0910	Community College	Clatsop County					√			• Offers English as a Second Language (ESL) classes

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Clatsop County Public Health 820 Exchange Street, #100 Astoria, OR 97103 503/325-8500	Public Health Services	Clatsop County	√	√	√	√	√	√	√	• Public health response
Coast Rehabilitation Services 89451 Hwy 101 PO Box 760 Warrenton, OR 97146 503/861-3372	Developmental Disability Services	Clatsop County			√					• Residential group home • Disability services
Coastal Family Health Center 2055 Exchange Street, #210 Astoria, OR 97103 503/325-8315	Health Services	Clatsop County		√		√		√	√	• Case management • Pharmacy services • Immunizations • Laboratory services • Physicals
Columbia Co. Mental Health 503/397-5211	Mental Health Services	Clatsop & Columbia Counties		√	√	√		√	√	• DD Case Management • Service coordination • Crisis counseling • Addiction services

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Columbia Memorial Hospital 2111 Exchange Street Astoria, OR 97103 503/325-4321	Hospital	Clatsop County		√	√	√		√	√	• Health services
Dial-A-Ride / Northwest Ride Center 465 NE Skipanon Warrenton, OR 97146 www.ridethebus.org	Senior transportation	Clatsop County		√	√					Provides county-wide transportation for seniors & disabled persons
Elk Creek Terrace 357 Elk Creek Road Cannon Beach, OR 97110 503/436-9562	Housing	Cannon Beach			√	√			√	Housing for disabled
Elks 324 Ave. A Seaside, OR 97138 (503) 738-6651	Elks lodge	Seaside			√					Will loan wheelchairs, walkers & crutches.
Grace Emergency Food Pantry Grace Episcopal Church 1545 Franklin Astoria, OR 97103 (503) 325-4691	Food bank	Clatsop County							√	Emergency food

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Hearts Care 296 Tyee St. Hammond, OR 97121 (503) 861-2518	Disabled adult foster home	Hammond			√	√				
Joyce Graber 501 Railroad Ave. Gearhart, OR 97138 (503) 738-6714	Disabled adult foster home	Gearhart			√	√				
Loaves & Fishes Peace Lutheran Church 565 12th St. Astoria, OR 97103 (503) 325-9693	Meal services	Astoria		√	√					Meals-on-wheels
Medix Ambulance Service 2325 Dolphin Ave. Warrenton, OR 97146 (503) 861-1990	Private pre-hospital emergency care & ambulance transportation									Ambulance services
Meriweather Village 101 Madison Ave. Astoria, OR 97103 (503) 325-3072	Subsidized housing for people who meet HUD's median family income limits & who are at least 62 or disabled	Astoria			√	√			√	Subsidized housing

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Norblad Hotel & Hostel 443 14th St. Astoria, OR 97103 (503) 325-6989	Hostel / shelter	Astoria						√	√	Emergency housing available
Northwest Oregon Housing Authority 147 S Main Ave. Warrenton, OR 97146 (503) 861-0119 (800) 927-9275 www.araoha.org	Public housing management. Partners with local non-profits and businesses to build and preserve affordable housing.	Clatsop, Columbia, and Tillamook Counties			√			√	√	• Affordable housing • Housing for elderly, disabled, or mentally ill • Federal rent assistance
Oregon Disabilities Commission 500 Summer St NE Salem, OR 97301 (800) 282-8096	Advocate on behalf of Oregonians with disabilities	Oregon			√					Disability services
Our Lady of Victory Catholic Church 120 Oceanway St. Seaside, OR 97138 (503) 738-6161	Meal services	Seaside							√	Free meals on site

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Owens-Adair Apartments 1508 Exchange St. Astoria, OR 97103 (503) 325-4785	Subsidized housing for people who meet HUD's median family income limits & who are at least 62 or disabled	Astoria			√	√			√	Subsidized housing
Pioneer House 76 Bond St. Astoria, OR 97103 (503) 325-5510	Emergency & transitional housing for families, couples, men with children & single women	Astoria						√	√	Hostel / shelter
Providence Seaside Hospital 725 S Wahanna Rd. Seaside, OR 97138 (503) 717-7000 www.providence.org	Hospital	Clatsop County		√	√	√		√		Health services
Restoration House 208 N Holladay Seaside, OR 97138 (503) 717-1102	Men's halfway house	Seaside			√				√	Hostel / shelter

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Riverside Recovery Center Thugz Off Drugz 1530 S Roosevelt Dr. Seaside, OR 97138 (503) 440-9357	Housing, food, clothing, and structured living for drug addicts & homeless	Clatsop County							√	Drug rehabilitation services
Seaside Headstart 1225 2nd Ave. Seaside, OR 97138 (503) 738-0873	Child & family development preschool program who those who meet income limits	Seaside			√			√	√	Child & family services
Seaside Youth Center 1140 Broadway Seaside, OR 97138 (503) 738-3311	Youth & senior center	Seaside		√		√				Youth & senior services
Social Security Administration 115 Bond St. Astoria, OR 97103 (503) 325-8845 (503) 325-6262	Medicare enrolment. Issue Medicare cards, SSNs. Process applications for retirement, survivor & disability benefits, SSI.	Clatsop County			√	√			√	• Social Security • Medicare • Retirement services • Supplemental Security Income

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
South County Food Bank 880 Avenue A Seaside, OR 97138	Food bank	Seaside							√	Emergency food
St. Anne's AFH 1164 Irving Ave. Astoria, OR 97103 (503) 338-6922	Disabled adult foster home	Astoria			√	√				Foster home
Oregon State Dept. of Human Services, Self-Sufficiency Programs, Child Welfare Programs 450 Marine Dr., Suite 200 Astoria, OR 97103 (503) 325-2012 (503) 325-9179	Self-sufficiency & child welfare programs	Clatsop County		√				√		• Adoption services • Foster care • Food stamp program • Temporary Assistance for Needy Families • Oregon Health Plan • Family Health Insurance Assistance Programs (FHIAP)
Teresa Nichols 37671 Timber Lane Astoria, OR 97103 (503) 325-5634	Disabled adult foster home	Astoria			√	√				Foster home

Name and Contact Information	Description	Service Area	Populations Served							Involvement with Natural Hazard Mitigation
			Business	Children	Disabled	Elders	English Second Language	Families	Low Income	
Warrenton / Astoria Headstart 200 SW 3rd Warrenton, OR 97146 (503) 861-9681	Child & family development preschool program for those who meet income guidelines	Astoria, Warrenton		√				√	√	Child and family services
Winter Light 4777 Cedar St. Astoria, OR 97103 (503) 325-3177	Adult foster home	Astoria			√	√				Senior services