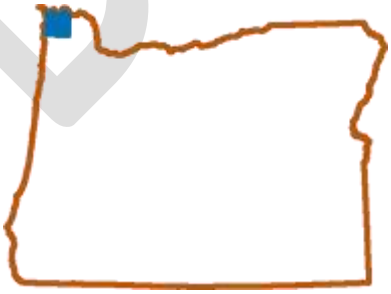
January 2021 DRAFT

Clatsop County

MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

- Clatsop County
- Astoria
- Cannon Beach
- Gearhart
- Seaside
- Warrenton
- Port of Astoria



- Arch Cape Domestic Water Supply District
- Arch Cape Sanitary District
- Cannon Beach Rural Fire Protection District
- Clatsop Community College
- Falcon Cove Beach Domestic Water Supply District
- Knappa-Svensen-Burnside Rural Fire Protection District
- Lewis and Clark Rural Fire Protection District
- Seaside School District
- Sunset Empire Transportation District

FEMA

Effective Month date, 2021 through Month date, 2026

The Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan update 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 and was comprised of representatives from the participating jurisdictions. This Update was funded by staff time provided by local jurisdictions, state match provided by DLCD, but primarily funded by the Federal Emergency Management Agency's Pre-Disaster Mitigation Competitive Grant Program grant #PDMC17-PL-002.

Cover photos clockwise from top left: Cannon Beach sea stacks (Oregon State Archives), Columbia River (Oregon State Archives), Ecola Creek after 1964 tsunami (Cannon Beach History Center and Museum), Arch Cape Fire (Daily Astorian).

The Point of Contact for information regarding the maintenance and implementation of this plan is:

Tiffany Brown, Emergency Manager
Clatsop County Emergency Management Division
800 Exchange Street, Suite 400
Astoria, OR 97103
503-325-8645 (Phone)
503-338-3605 (Fax)
tbrown@co.clatsop.or.us

Acknowledgments

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update Steering Committee

Clatsop County
Tiffany Brown, Gail Henrikson, Alejandro Bancke, Ted Mclean, Michael McNickle, Matt Phillips, Monica Steele, Leanne Thompson, Yvonne VonNostrum, Pamela Wev

City of Astoria
Rosemary Johnson, Barbara Fryer, Jeff Harrington, Nathan Crater Brett Estes, Bruce Jones

City of Cannon Beach
Jeff Adams, Rick Hudson, Karen LaBonte, Bruce St.Denis

City of Gearhart
Chad Sweet, Krysti Ficker, Carole O'Connell, Cheryl Lund

City of Seaside
Kevin Cupples, Anne McBride

City of Warrenton
Scott Hess, Collin Stelzig, Kevin Cronin

Port of Astoria
Susan Transue, Gary Kobes, Will Isom

Clatsop Community College
Stephanie Homer, Joanne Zahn, Shaun Martin

Seaside School District
Sheila Roley, Chuck Loesch, Justine Hill

Sunset Empire Transportation District
Jeff Hazen, Paul Lewicki

Arch Cape Domestic Water & Sanitary Districts
Bill Campbell, Ron Schiffman, Phil Chick

Cannon Beach Rural Fire Protection District
Matt Benedict, Marc Reckmann, Shaunna White

Falcon Cove Beach Water District
Charles Dice

Knappa-Svensen-Burnside Fire District
Kurt Donaldson, Paul Olheiser

Lewis & Clark Fire District
Jeff Golightly, Flint Helsigo

State and Federal Agencies

Oregon Department of Land Conservation and Development
Lisa Phipps, Meg Reed, Matt Crall

Oregon Department of Geology and Mineral Industries
Matt Williams, Deb Schueller

Oregon Department of Forestry
Paul Horning

Oregon Department of Transportation
Karen Christensen

Other Contributors

American Red Cross
DB Lewis

Clatsop Community Action
Dusten Martin

Columbia Memorial Hospital
Paula Larson

Clatsop Care
David Miller

Clatsop Soil & Water Conservation District
Chris Farrar

Columbia River Estuary Study Taskforce
Denise Lofman, Nancy Ferber

Columbia River Maritime Museum
Bruce Jones

Elsie-Vinemaple Rural Fire Protection District
Wayne Carmichael

Providence Seaside Hospital
Erik Meyer

Voluntary Organizations Active in Disaster
Charlene Larson

Project Managers

Oregon Department of Land Conservation and Development
Pamela Reber, Marian Lahav

Federal/State Guidance and Review Team

Federal Emergency Management Agency
John Schelling, Edgar Gomez

Oregon Military Department, Office of Emergency Management
Joseph Murray, Amie Bashant

Table of Contents

List of Figures

List of Tables

I. INTRODUCTION

Executive Summary

Hazard mitigation planning is a process that identifies actions to reduce the dangers to life and property from natural hazard events. People potentially impacted by a disaster are the priority of this plan. Buildings, equipment, and services that a community relies upon for survival are essential to human health, so they too are a plan priority. The information in the Risk Assessment section is intended to provide a snapshot of who and what faces risk so that communities can take action to protect themselves locally and state and federal partners can understand local priorities. This information can also be used to secure funding for hazard mitigation projects or to put other jurisdiction projects into perspective in terms of risk.

The 2021 update of the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan (Clatsop MJNHMP or Plan) meets the guidelines for the hazard mitigation planning program administered by the Federal Emergency Management Agency (FEMA). Earlier editions of the Clatsop County Natural Hazard Mitigation Plan were approved by FEMA in 2008 and 2013. This 2021 plan update provided the second, five-year update. The Clatsop MJNHMP has been developed to comply with the requirements of the Disaster Recovery Reform Act of 2018 and Federal Disaster Mitigation Act of 2000, current mitigation guidance built on the foundation of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 and the Disaster Relief Act of 1974.

While cities and special districts are not required to adopt hazard mitigation plans, the FEMA requires all jurisdictions 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. The completion of a FEMA-approved mitigation plan on a 5-year schedule ensures that participating jurisdictions can access Hazard Mitigation Assistance funding (https://www.fema.gov/hazard-mitigation-assistance).

The 2015 Clatsop Natural Hazard Mitigation Plan included Clatsop County and the cities of Astoria, Cannon Beach, Gearhart, Seaside and Warrenton. In the 2015 document, each of the jurisdictions had full plan sections appended as 'annexes' or 'sub-plans'. The 2021 plan update uses an integrated approach that brings information from each community and special district together, along with updates from new data sources. Building upon the Tillamook County Multi-Jurisdictional Natural Hazard Mitigation Plan update from 2016, the integrated approach reduces duplication of statistics and descriptions and instead uses that space to present a more unified picture of Clatsop County mitigation efforts.

The mission statement of the plan remains unchanged in the second Clatsop County NHMP update:

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 plan update fulfills its mission statement. Future efforts to evaluate and revise the plan will build upon this update.

The Plan has three main components: Risk Assessment, Mitigation Strategy, and Planning Process. The Risk Assessment has three components in this update: Community Profile, Natural Hazards, and Community Risk Profiles. The Appendix features the references and other important documentation.

Communities within Clatsop County continue to be subject to a number of natural hazards, including coastal erosion, drought, earthquake, flood, landslide, tsunami, volcanic events, wildfire, and wind/winter storm—each of these are sections within the Hazards chapter of the Risk Assessment. 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 natural hazard policies and programs that could mitigate some of the effects of natural disasters if sufficient resources were available.

The updated 2021 Risk Assessment includes two new sources of information coordinated to concur with the process by DLCD and agency partners:

- Williams, M. C., Anthony L. H., & O'Brien, F. E. (2020). *Natural Hazard Risk Report for Clatsop County, Oregon, Including the Cities of Astoria, Cannon Beach, Gearhart, Seaside, and Warrenton and the Unincorporated Communities of Arch Cape, Svensen-Knappa, and Westport* (Open-File Report O-20-16). Portland, OR: Oregon Department of Geology and Mineral Industries (DOGAMI). https://www.oregongeology.org/pubs/ofr/p-O-20-16.htm
- Dalton, M. M. (2020). *Future Climate Projections: Clatsop County*. Oregon Climate Change Research Institute, College of Earth, Ocean and Atmospheric Sciences, Oregon State University. https://www.oregon.gov/lcd/CL/Documents/Clatsop_County_Future_Projections_Report_02132020.pdf

Both of these reports are part of a vision to develop a risk assessment methodology that can be applied uniformly statewide. The Williams et al, 2020 (DOGAMI) *Natural hazard risk report for Clatsop County* was planned to be completed in advance of this project with Federal Emergency Management Agency (FEMA) Cooperating Technical Partners (CTP) funding in annual coordination efforts made between the Oregon Department of Land Conservation and Development (DLCD), Oregon Department of Geology and Mineral Industries (DOGAMI), US Army Corps of Engineers (USACE), and the University of Oregon, Oregon Partnership for Disaster Resilience (OPRD) starting in 2015. The Oregon Climate Change Research Institute (OCCRI) report was a specific contract component of the DLCD application for FEMA 2017 Pre-Disaster Mitigation funding, completed February 2020. Unfortunately, funding constraints and data availability limits or inconsistencies, like in LiDAR data, put this statewide vision off into the future. As such, these reports mean Clatsop County is relatively well-equipped with risk assessment data by comparison to much of the State.

The Community Profile provides a snapshot of the statistics of Clatsop County, the five cities, and the ten special districts which serve these communities. Detailed information about risk is available in the Community Risk Profile section by jurisdiction, where loss estimates are outlined, rounding out the Risk Assessment. Along with detailed descriptions of the hazards, this community information comprises the Risk Assessment.

The Mitigation Strategy identifies the plan goals and action items—built on twelve years of mitigation planning in Clatsop County and decades of knowledge brought by more than 30 individuals actively participating in the process. Clatsop County is a disaster-prone place, particularly in terms of wind, winter storms, and tsunami/earthquake risk. The community has very high exposure to tsunamis and has been on the forefront of using data, policies, and actions to mitigation this risk. 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 participating stakeholders and represent a sound approach to addressing 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, this plan update saw five public planning meetings and two additional in-person Steering Committee (and one online) meetings before COVID-19 pandemic restrictions went into effect. An online survey was released alongside plan review in order to foster feedback and engagement.

Plan Jurisdictions

The **Clatsop County** Emergency Management (CCEM) is the convener of this 2021 plan update.

The 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan website is available here:

https://www.co.clatsop.or.us/em/page/multi-jurisdictional-natural-hazards-mitigation-plan-mjnhmp-update-2021

The incorporated cities participating in this plan update are:

- **Astoria**
- **Cannon Beach**
- **Gearhart**
- **Seaside**
- **Warrenton**

In this 2021 plan update, the following special districts joined the mitigation planning process:

- **Port of Astoria**
- **Sunset Empire Transportation District**
- **Clatsop Community College**
- **Seaside School District**
- **Cannon Beach Rural Fire Protection District**
- **Lewis and Clark Rural Fire Protection District**
- **Knappa-Svensen-Burnside Rural Fire Protection District**
- **Arch Cape Domestic Water Supply District**
- **Arch Cape Sanitary District**
- **Falcon Cove Beach Domestic Water Supply District**

These ten new jurisdictions span many areas of service including: education, fire and emergency response, shipping, transit, sanitary, and domestic water supply.

Clatsop County's Natural Hazards

Each of Clatsop County's communities is subject to some or all of 9 natural hazards. The following is a brief overview of the hazards that can impact Clatsop County. Each of the hazards is described in more detail in the Natural Hazards section below.

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 Event: 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 may 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

Table I-1. Clatsop County Jurisdictions Subject to Natural Hazards

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Event	Wildfire	Wind/Winter Storm
Unincorporated Clatsop County (rural)	X	X	X	X	X	X	X	X	X
Astoria	X	X	X	X	X	X	X	X	X
Cannon Beach	X	X	X	X	X	X	X	X	X
Gearhart	X	X	X	X	X	X	X	X	X
Seaside	-	-	X	X	X	X	X	X	X
Warrenton	X	X	X	X	-	X	X	X	X
Port of Astoria	-	-	X	X	X	X	X	X	X
Sunset Empire Transit District	-	X	X	X	X	X	X	X	X
Clatsop Community College	-	X	X	X	X	X	X	X	X
Seaside School District	-	X	X	X	X	X	X	X	X
Cannon Beach RPFD	X	-	X	X	X	X	X	X	X
Knappa Fire District	-	X	X	X	X	X	X	X	X
Lewis & Clark Fire District	-	-	X	X	X	X	X	X	X
Arch Cape Water District	-	X	X	X	X	X	-	X	X
Arch Cape Sanitary District	-	X	X	X	X	X	-	X	X
Falcon Cove Beach Water	X	X	X	X	X	X	X	X	X

Source: Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan, 2015; Clatsop County Multi-Jurisdictional NHMP Update Steering Committee, Apr. 2019- Jan. 2021.

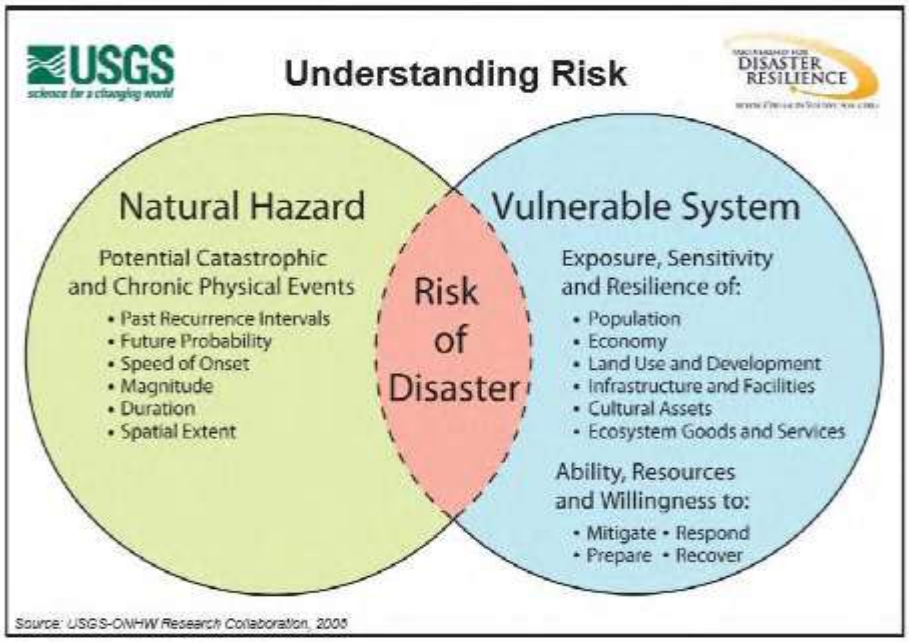
What is Hazard Mitigation?

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 evacuation facilities and plans that consider vulnerable populations like 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.

Clatsop County and local partners conduct natural hazard mitigation planning in an effort to reduce future loss of life and damage to property resulting from natural hazards. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the residents, businesses, and jurisdictions who manage county assets and services. 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 definition of risk is the intersection of a hazard and a vulnerable system. Mitigation means addressing the threat of the hazard on the vulnerable system.

Figure I-1. Understanding Risk



Source: USGS, Oregon Partnership for Disaster Resilience.

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, Droughts, Earthquakes, Floods, Landslides, Tsunamis, Volcanic Events, Wildfires, and Winter Storms/Windstorms. 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.

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 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.

II. RISK ASSESSMENT

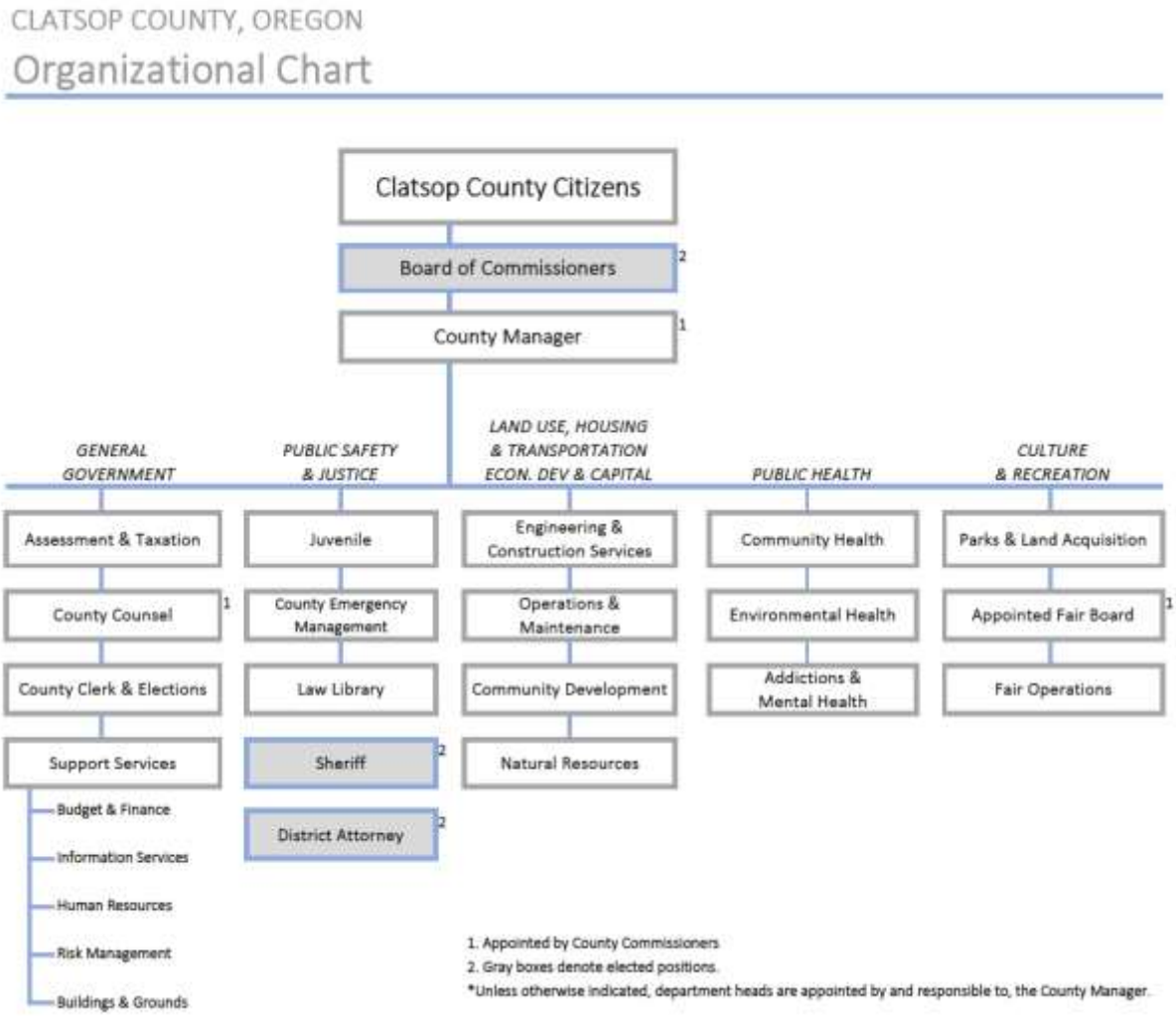
A. Community Profile

1. Government Organization

Clatsop County

Clatsop County is the policy making body for the unincorporated areas of the county. The County is also a coordinating entity for efforts that span across multiple jurisdictions or that intersect with state, federal, or regional efforts. 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 3% per year, except for new construction. The County Assessment & Taxation office collects and distributes these revenues to municipalities and special districts within its jurisdiction.

Figure II-1. Clatsop County Organizational Chart



Source: Clatsop County, 2020.

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 government. The County Manager oversees the Emergency Management Division (EMD). The EMD is responsible for planning, training, exercise and response to disasters and alerts. An organization chart of Clatsop County's government is seen above.

Clatsop County currently has ten departments:

- Assessments 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 and Finance is responsible for the finance, treasurer, payroll, and information & technology needs of Clatsop County. In addition, Budget & Finance oversees building and grounds maintenance and is responsible for maintaining the County's parks. The Department 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 supervises the investigation of child abuse and deaths and manages the local medical examiner program. 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.

- County Managers Office: Human Resources, Emergency Management, and Community Relations.
- Community Development: The Land Use Planning 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. The Building Codes Department within the Community Development Division issues building permits and manages the inspections.
- Public Health Department: The Public Health Department 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: Correctional Facility, Countywide Inter-agency Narcotics Task Force, Marine Patrol, High Angle Rescue, Search and Rescue and the Underwater Recovery (Dive) Team. In addition, the Clatsop County Sheriff's Office has administered the Community Corrections program since 1997 which it operates using state grants via an intergovernmental agreement between Clatsop County and the State of Oregon. The Community Corrections program offers an array of services, supervision, and sanctions to reform offenders and enhance safety of the community.
- 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 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

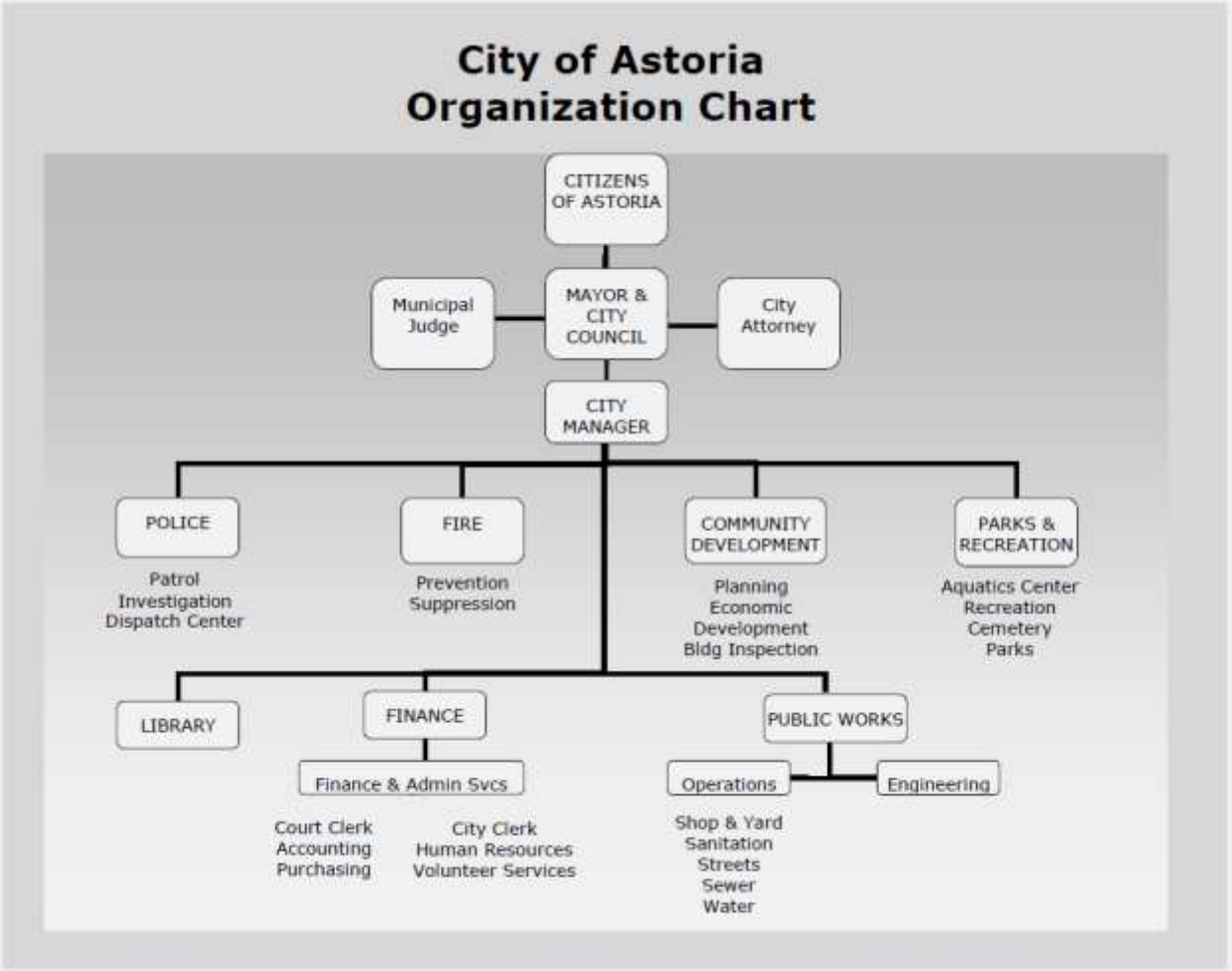
subdivisions, condominiums, and land partitions. The surveyor surveys County owned land and County roads. The surveyor is responsible for the recovery, restoration and preservation of public Land corners. These are section corners, quarter corners and donation land claim corners.

- Parks: The Parks program is responsible for the operation and maintenance of the County's parks and recreational areas.

City of Astoria

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.

Figure II-2. Astoria Organizational Chart



Source: City of Astoria.

The City of Astoria currently has the following departments:

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 Recreation, Library, Fire, Police, and Public Works/Engineering. The City Manager is responsible to the City Council. The staff consists of the City Manager and Executive Assistant, 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 Commission (DRC), Astoria Development Commission (ADC), and the Traffic Safety Advisory Committee (TSAC). 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, transient lodging tax collection, occupational tax collection, accounts receivable, payroll, accounts payable, financial planning and statement preparation, budget preparation, cash management, parking control, Oceanview Cemetery records, Human Resource administration including benefit management, Municipal Court administration and records, risk management, 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 has a contracts with Department of Labor for the Tongue Point Job Corps Center, US Coast Guard property at Tongue Point along with USCG cutters Alert and Steadfast to offer for 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 Recreation Department: The Parks and Recreation Department oversees parks and recreation activities for the City. The City has nine historic sites, one historic and one active cemetery, one caretaker home, three community halls, one maritime memorial park, six general use parks, one senior center, one indoor aquatic center, four indoor recreation centers, five public restroom buildings, three tennis courts, eight playgrounds, ten ball fields, one boat launch ramp/fishing dock, 6.4 mile long River Trail, and several miscellaneous locations and urban forest trails, all of which are maintained by this department. Youngs River Falls is a City Park located outside City limits within the County. Overall, the Department manages 301 acres of parkland, 9 acres of other lands, 71,300 square feet of building area, and 8.75 miles of trails. A chart of locations can be found on the next two pages. The Parks Board, appointed by the Mayor, assists with development of Parks policies.

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.

City of Cannon Beach

Cannon Beach is governed by an elected Council, consisting of a Mayor and four at-large councilors. Council meets regularly to consider important policy decisions, and to accept recommendations for action from staff and advisory committees, boards, and commissions. Council has the authority to set overall direction (policy) for the City, and City staff, under the direction of the City Manager, carry out Council's directives through the City's various programs and services.

City of Gearhart

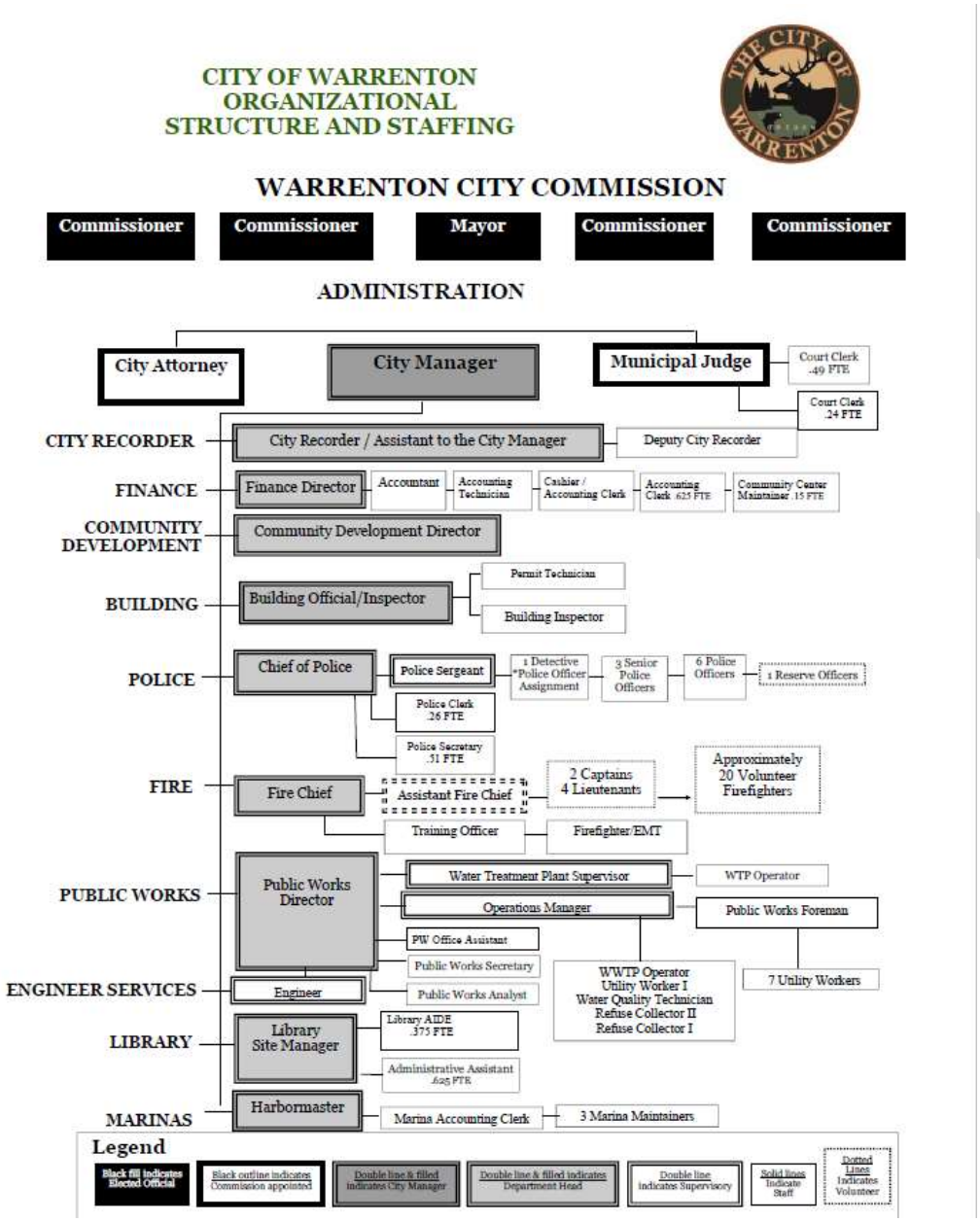
The City Council is the policy making body for the City of Gearhart. Members of the Council serve as Council representatives on many boards and commissions of the City, other local governments, agencies, and the State. The City Administrator is hired by and reports to the Council, and in turn, guides the hiring and management of all City employees.

City of Seaside

The City Council is the policy making body for the City of Seaside who hires a City Manager to operate the City and oversee staff. The responsibilities of the Seaside City Manager includes the provision of professional leadership in the administration and execution of policies and objectives formulated by City Council, the development and recommendation of alternative solutions to community problems for Council consideration, the planning, development, and goals of new programs to meet future needs of the City, preparation and monitoring of the annual budget including the expenditures by all departments in the City, responsibility and enforcement of all ordinances, franchises, leases, and contracts for the City.

City of Warrenton

Figure II-3. City of Warrenton Organizational Chart



The City Commission is the policy making body for the City of 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. City services include police, fire, city administration and regulation, and public works including domestic water and sanitary service. The City provides water service to the Clatsop Plains and Gearhart. The City supports fire protection for Warrenton, Hammond, and the Clatsop Plains. The City of Warrenton is home to the Operations Center for the Sunset Empire Transportation District and the Port of Astoria Regional Airport is located on the eastside of the city.

The City of Warrenton currently has the following departments.

City Manager: Under the general direction of the 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 the City 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.

Administration: The City Recorder/Assistant to the City Manager serves as the City's official records custodian, Clerk of the City Commission, Assistant Election Officer, and provides Web Site maintenance. The City Recorder coordinates with other city departments in the preparation of contracts, leases, deeds, easements, ordinances, 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: utilities, mooring basin, and grants and prepares the annual budget.

Planning/Building Department: The Planning Department is responsible for the development of short and long range plans, implementation of growth management, land use, economic development, utility, housing, transportation, park and open space, facilities, solid waste plans and codes, and issuing land use approval for construction plans. The Building Department reviews construction plans and issues building permits.

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 IV therapy, cardiac monitoring, cardiac medications, respiratory or broncho-dilator, and to insert PEAD airways.For emergency response, the Fire Department, and other key Warrenton City Departments, act as the initial emergency response and begin the incident command process until unified command is established or necessary.

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 four patrol officers, two senior patrol officers, one sergeant and the chief of police. Support staff consists of one half-time police secretary. On average there are five reserve officers who serve in a variety of support functions. . For emergency response, the Police Department, and other key Warrenton City Departments, act as the initial emergency response and begin the incident command process until unified command is established or necessary.

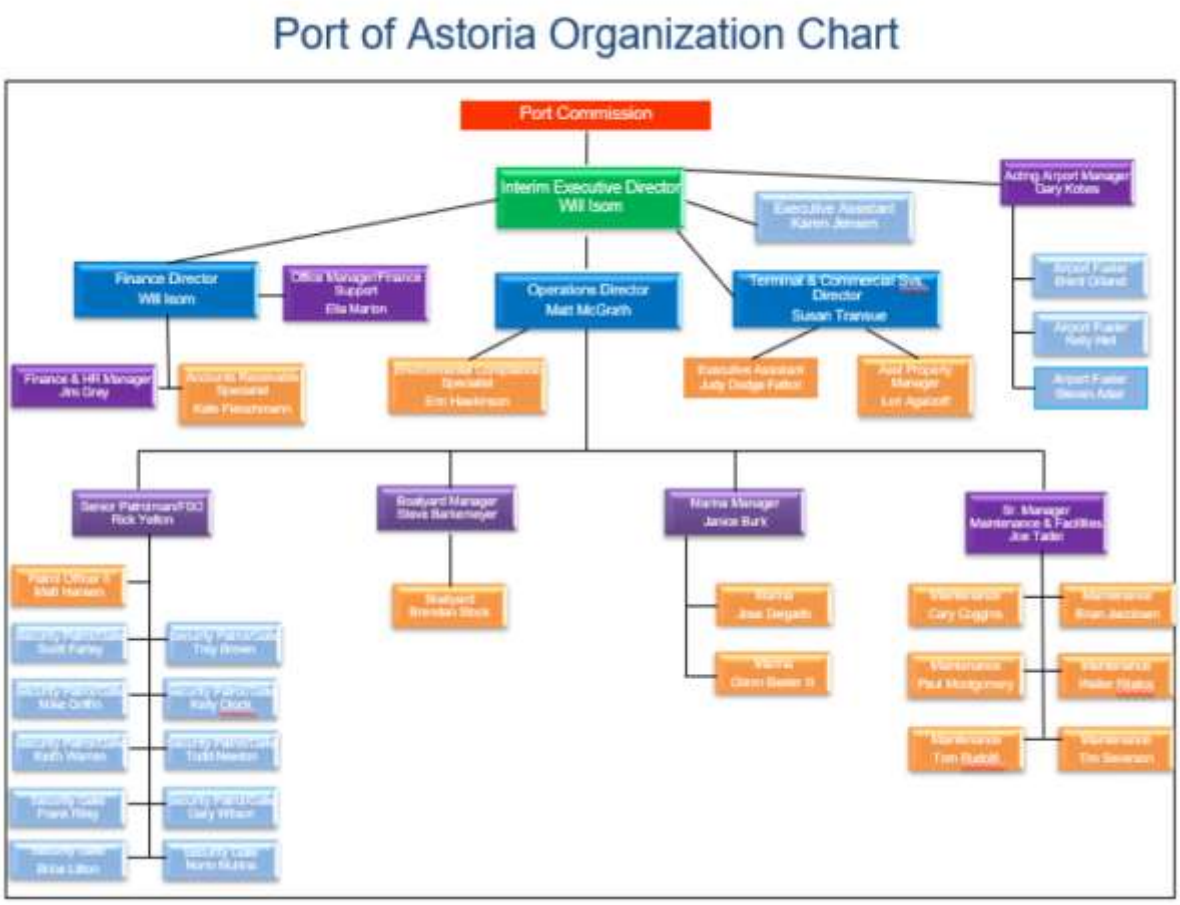
Public Works: The Public Works Department maintains and operates water distribution system, flushing, water sampling, meter reading, meter maintenance, meter replacement, water treatment plant, sanitary sewer main lines, sanitary sewer pump stations, storm lines, catch basins, repair water service leaks, replace water meters, plan review for private development, act as the project manager for city funded projects, maintain operating budget, and do minor repairs for streets. In addition, the department maintains, repairs, and replaces all the tide gates in the City. The care of the City's parks and

other public facilities are also the responsibility of the Public Works Department. The Sanitation Department, also under the Public Works Department, picks up the City's refuse collected by two route drivers. Recycling is contracted with Western Oregon Waste.

Port of Astoria

The Port of Astoria is funded, in part, by a county-wide tax and governed by a Port Commission who provide oversight to the Executive Director. This leadership is supported by directors overseeing the key components of the Port: Finance, Operations (maritime), Terminal and Commercial Services, and the Regional Airport.

Figure II-4. Port of Astoria Organizational Chart



Sunset Empire Transportation District

Sunset Empire Transportation District is funded, in part, by a county-wide tax and governed by a Board of Directors who provide oversight to the Executive Director. This leadership is supported by administrative staff and an Operations Manager.

Clatsop Community College

Clatsop Community College is funded, in part, by a county-wide tax and governed by a Board of Education, a President, and Vice President who provide oversight to staff and administration.

Seaside School District

Seaside School District (SSD) is funded by taxes from the tax lots served—based primarily in Seaside, Gearhart, Cannon Beach, and the surrounding County. SSD is governed by the Seaside School District Board who provide oversight to the Superintendent of Schools. Each school in the District has a Principal and an Assistant Principal and are supported by federal title grant coordinators, the District Student Achievement Steering Committee, program coordinators, District office staff, and additional administrators.

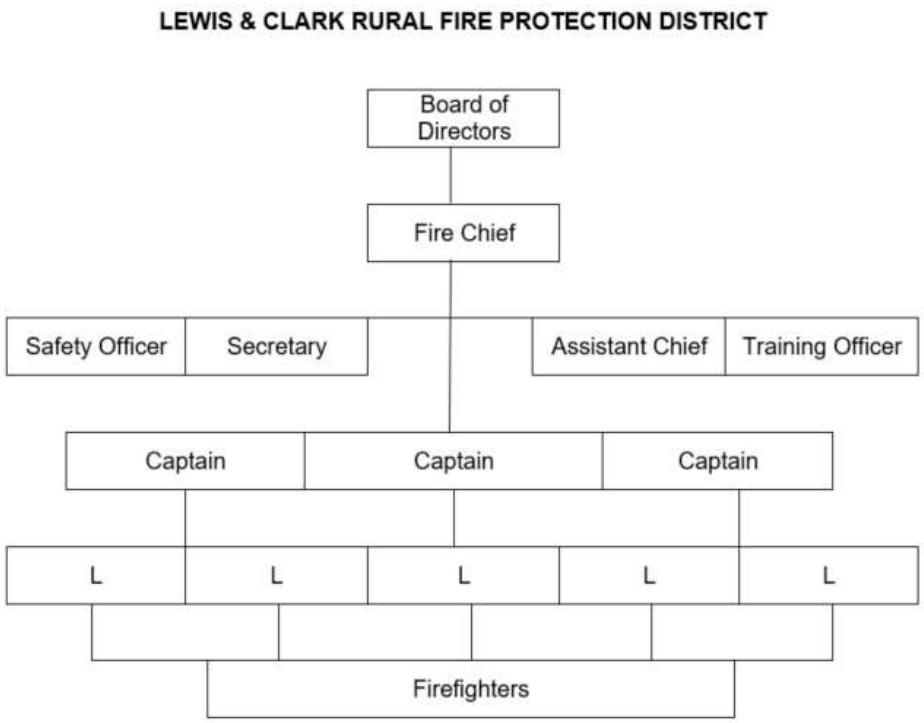
Cannon Beach Rural Fire Protection District

Cannon Beach Rural Fire Protection District (Cannon Beach Fire) is funded by taxes from the communities of Cannon Beach, Arch Cape, and Falcon Cove. The district is approximately 6 square miles, stretching approximately 24 miles along the coast and Hwy101, bit only about 1/4-mile-wide in most areas. The district covers from north of the Cannon Beach city limits, south into Tillamook County, ending at Oswald West State Park. The District provides services to approximately 2,200 permanent residents but is a tourist destination with multiple vacations rental homes, second homes, and large motels bringing tens of thousands of visitors a per day to Cannon Beach. Cannon Beach Fire District is managed by a Fire Chief with oversight by a five-member Fire Board. Cannon Beach Fire District, employees a Fire Chief, Operations Chief, Recruitment & Retention Lieutenant, part-time Admin assistant, and 15 community volunteers responding out of 2 stations.

Lewis and Clark Rural Fire Protection District

Lewis and Clark Rural Fire Protection District (Lewis and Clark Fire) is funded by taxes from the communities of Miles Crossing and Jeffers Gardens. Lewis and Clark Fire is managed by a Fire Chief with oversight by a five-member Fire Board.

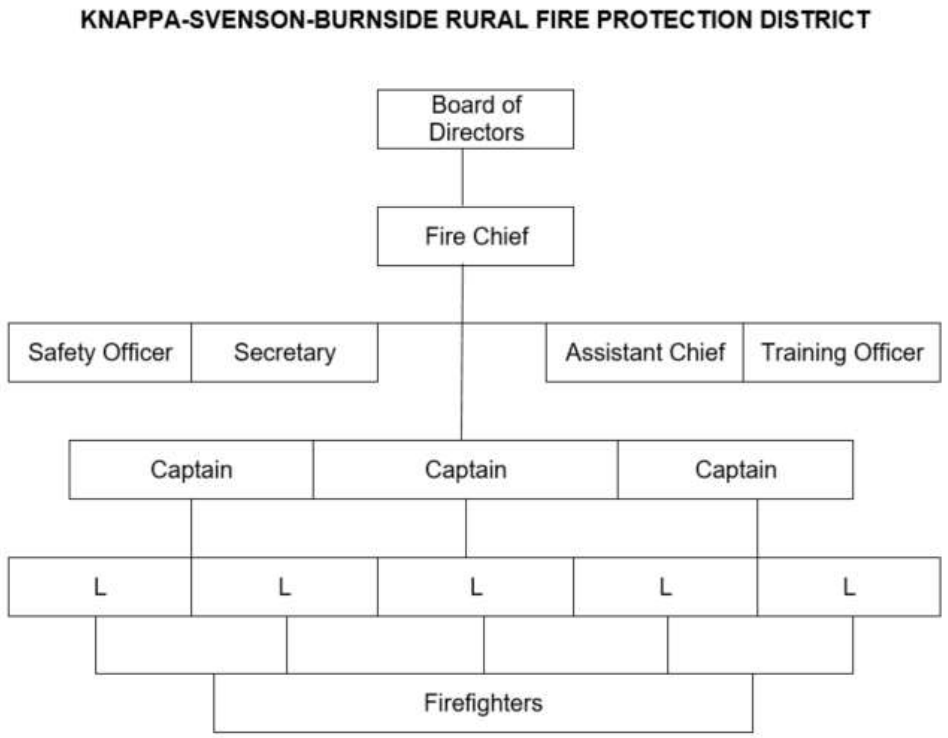
Figure II-5. Lewis and Clark Fire Organizational Chart



Knappa-Svensen-Burnside Rural Fire Protection District

Knappa-Svensen-Burnside Rural Fire Protection District (Knappa Fire) is funded in part by taxes from residents in the communities of Burnside, Knappa, Svensen, Brownsmead, and Bradwood. Knappa Fire is also the contract administrator for John Day-Fern Hill Fire District which includes fire chief leadership. Knappa Fire is managed by a Fire Chief with oversight by the Knappa Fire Board.

Figure II-6. Knappa Fire Organizational Chart



Arch Cape Domestic Water Supply District

The Arch Cape Domestic Water Supply District (ACDWSD) is funded by fees from the tax lots served—based in the Arch Cape unincorporated community of Clatsop County. ACDWSD is governed by the ACDWSD Board of Directors who are advised by the small staff led by the District Manager. The services of the small staff and District Manager are shared with Arch Cape Sanitary District.

Arch Cape Sanitary District

The Arch Cape Sanitary District (ACSD) is funded by fees from the tax lots served—based in the Arch Cape unincorporated community of Clatsop County. ACSD is governed by the ACSD Board of Directors who are advised by the small staff led by the District Manager. The services of the small staff and District Manager are shared with Arch Cape Domestic Water Supply District.

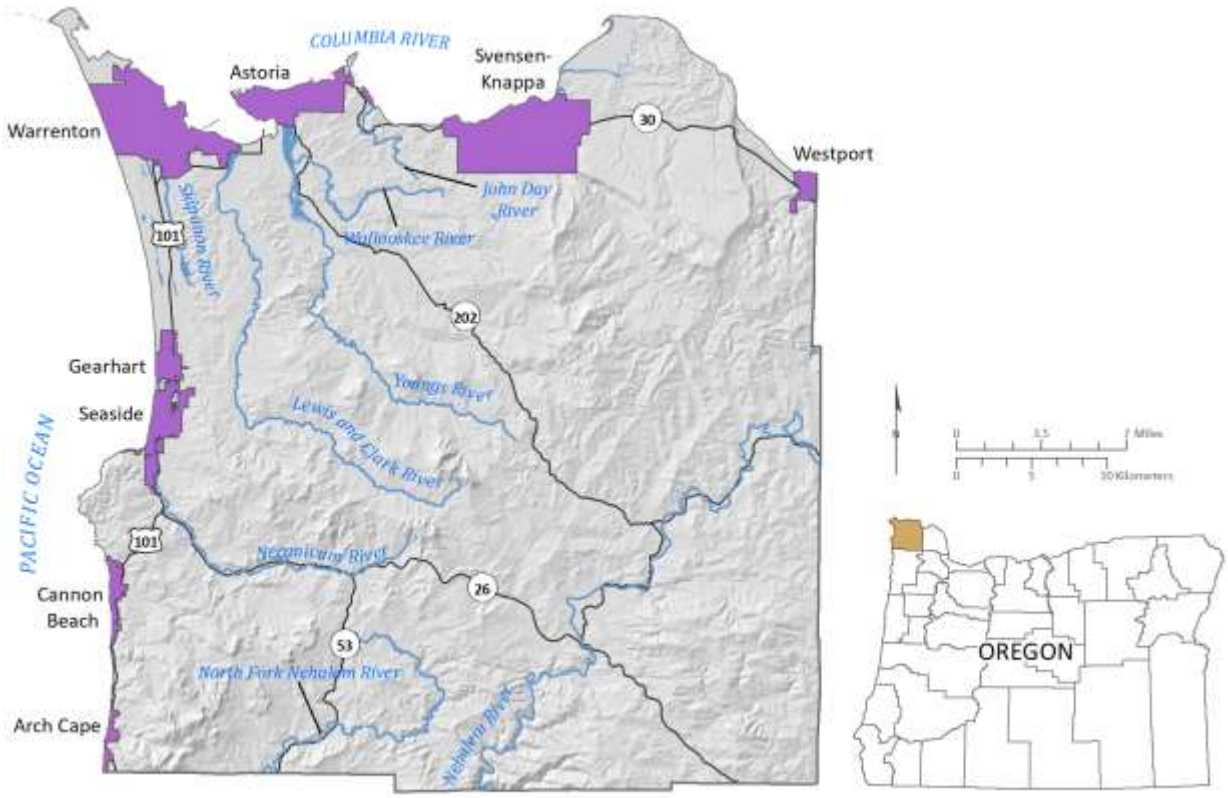
Falcon Cove Beach Domestic Water Supply District

Falcon Cove Beach Water District (FCBWD) is funded by fees from the tax lots served—based in the Falcon Cove Beach unincorporated community of Clatsop County. FCBWD is governed by the FCBWD Board of Directors who are advised by the primary operator of record, contractors, and the small community of customers they serve.

2. Geography

Clatsop County, Oregon is the contiguous project area for this natural hazard mitigation planning effort.

Figure II-7. Political Geography: Clatsop County Map



Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, p.4.

Clatsop County

The most northwest county in Oregon, Clatsop County 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 by Columbia and Washington counties. Much of Clatsop County is dominated by coastal terrain, and features include a coastal plain, 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 (Clatsop County, 2020).

Unincorporated Communities

Arch Cape & Falcon Cove Beach

The southern coastal boundary of Clatsop County occurs at Oswald West State Park which encompasses the headland known as Neahkahnie Mountain. The two small beach communities to the north, known as Arch Cape and Falcon Cove, are served by three of the special districts participating in the plan.

Jewell

The community of Jewell represents the center of Clatsop County and is connected to the rural communities of Mist-Birkenfeld near the rural eastern border. Surrounded by timberlands, it is home to an Oregon Department of Fish and Wildlife (ODFW) elk viewing area. The area is served by Clatsop County, with fire defense by the Mist-Birkenfeld and the Elsie-Vinemaple Rural Fire Protection Districts.

Miles Crossing and Jeffers Garden

Miles Crossing and Jeffers Garden are located in the unincorporated area east of Warrenton and south of Astoria at the confluence of the Lewis and Clark and Youngs Rivers. Historically an agricultural area, many lands here are protected by levees. The communities are served by Clatsop County, Youngs River Lewis and Clark (YRLC) Water District, Miles Crossing Sanitary Sewer District, and the Lewis and Clark Rural Fire Protection District.

Olney-Walluski

The communities of Olney and Walluski are located on the east side of Youngs River, southeast of Astoria. The communities are served by Clatsop County and the Olney-Walluski Rural Fire Protection District.

Knappa-Svensen

The community of Svensen-Knappa is located along the northern boundary of the County and includes forested bluffs above the Columbia River as well as islands of the Columbia River estuary. Clatsop County and Knappa Rural Fire Protection District serve the communities of Knappa, Svensen, Brownsmead, Bradwood, John Day, and Fern Hill. Water Districts that serve this area include Knappa Water Association, Wickiup Water District, and John Day Water District.

Westport-Wauna

The community of Westport is situated along the Columbia River on Highway 30, in the northeast corner of Clatsop County, at the boundary with Columbia County, OR, and Wahkiakum County, WA (across the Columbia). Georgia-Pacific's Wauna mill is located here. The area is served by Clatsop County, the Westport Water Association, and the Westport-Wauna Rural Fire Protection District.

Hamlet

The community of Hamlet is located on the North Fork Nehalem River south of Highway 26 east of Cannon Beach and the Necanicum Highway. It is served by Clatsop County and the Hamlet Rural Fire Protection District.

Elsie-Vinemaple

The communities of Elsie and Vinemaple occur on the Nehalem River in southeastern Clatsop County. This is a forested area occurs in a wide river valley with a history of flooding. The area is served by Clatsop County and the Elsie-Vinemaple Rural Fire Protection District.

City of Astoria

Located on the Columbia River, the City of Astoria features a unique river waterfront and historic homes perched on steep slopes providing vast views of the wide river estuary and shipping channel. The Astoria-Megler Bridge connects to Pacific County, Washington from Astoria. It is one of only two Columbia River crossings downstream of Portland. Youngs Bay Bridge connects Astoria to Warrenton, the regional airport, and points south. Astoria city services include police, fire, public administration, and public works including domestic water and sanitary service, and regulation of the local community. As the County Seat, Astoria is home to Clatsop County Administration and Sheriff's Office, Columbia Memorial Hospital, and other regional health services. Astoria is also home to the Port of Astoria's maritime operations, two campuses of Clatsop Community College, and the Sunset Empire Transportation District's Astoria Transit Center. The Astoria School District also serves portions of unincorporated areas of Clatsop County around the City.

City of Cannon Beach

Located just south of Tillamook Head on the Oregon Coast, the City of Cannon Beach features Haystack Rock, one of the most recognizable and popular attractions on the Oregon coast. This small resort community is located 80 miles west of Portland and 25 miles south of Astoria, and has an urban growth boundary of just 1.4 square miles (890 acres). Ecola Creek runs through the northern part of the town where it flows into the Pacific Ocean. The City of Cannon Beach provides police service, public works including water and sanitary service, and regulation of the local community. Fire service is provided to Cannon Beach and communities south by the Cannon Beach Rural Fire Protection District. Cannon Beach is served by the Seaside School District.

City of Gearhart

Located on the Necanicum estuary to the south, the City of Gearhart is a quiet coastal community that rests along the south end of the Clatsop Spit. Gearhart features a quaint downtown and destination golf resorts surrounded by the dunes of the Clatsop Plains. Gearhart provides police and fire service, and regulation of the local community. The City provides water service and their water supply system is connected to the cities of Seaside and Warrenton to allow for supply sharing. The City does not provide sanitary service. All structures are on sanitary or septic drainfield systems. Gearhart is served by the Seaside School District.

City of Seaside

The City of Seaside is a popular beach destination with a large expanse of sand, a boardwalk of shops and hotels, and a famous surf break. Located just north of Tillamook Head and the intersection of highways 26 and 101, the City is situated perfectly to be one of the major places where tourists flock from Portland and beyond when summer temperatures spike. The Necanicum River flows through Seaside then out to the ocean after being joined by Neawanna and Neacoxie creeks, forming the tidally-influenced Necanicum estuary. The City of Seaside is home to Seaside-Providence Hospital, the Seaside

School District, the Seaside Transit Center, and the Seaside Campus of Clatsop Community College. Seaside provides police and fire service, public works including water and sanitary service, and regulation of the local community. Water service is connected to Gearhart to allow for supply sharing.

City of Warrenton

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. Warrenton provides boat access and mooring for a large recreational fishing and boating community. Fort Stevens State Park historical area and campground provides additional recreational opportunities within the City. The topography and location of Warrenton make it an appealing destination for shopping and residential development.

Port of Astoria

The primary purpose of the Port of Astoria (Port) is to foster commerce. Ports have the authority to own and lease property, provide services, and levy taxes within their District boundaries. The Port of Astoria has the same service area and tax boundary as Clatsop County. The Port of Astoria manages a combination of marine, marina, industrial, and aviation facilities. These facilities are primarily located in the City of Astoria (Port waterfront properties and infrastructure) and the City of Warrenton (airport and industrial properties).

Sunset Empire Transportation District

Sunset Empire Transportation District (SETD) is a special district with the authority to provide transit services for and levy taxes from all of Clatsop County. The Astoria Transit Center is the bus depot and administrative offices. The Warrenton Operations Center provides bus operations, repair, and storage—it is where the majority of SETD employees report to work. Sunset Empire Transportation District has bus stops and transit routes along all the major transportation routes in Clatsop County.

Clatsop Community College

Clatsop Community College (CCC or the College) provides important post-secondary educational services to all of Clatsop County and is a special district with the authority to levy taxes from all of Clatsop County. CCC has three locations—two in Astoria and one in Seaside. While the college is relatively small in staff and population when compared to other community colleges around the State, its unique campus locations, targeted technical programs, and function in the community make it important.

Seaside School District

The Seaside School District (SSD) serves a large geographic area, from parts of Warrenton, then south down the coast through the towns of Gearhart, Seaside, Cannon Beach and Arch Cape. Inland to the east, the District continues past Saddle Mountain State Park Road—this service territory is also its taxing district. Seaside School District serves about 1,680 students in Clatsop County and is home to Pacific Ridge Elementary, Seaside Middle School, and Seaside High School. Cannon Beach Academy Charter School in Cannon Beach is also part of SSD.

Cannon Beach Rural Fire Protection District

Cannon Beach Rural Fire Protection District (Cannon Beach Fire) serves the communities of Cannon Beach, Arch Cape, and Falcon Cove with fire protection and emergency response—this area is also its tax district. Cannon Beach Fire has two stations—one in Cannon Beach and one in Arch Cape.

Lewis and Clark Rural Fire Protection District

Lewis and Clark Rural Fire Protection District (Lewis and Clark Fire) serves the communities of Miles Crossing, Jeffers Garden, Youngs River, and the Upper Lewis and Clark River area with fire protection and emergency services.

Knappa-Svensen-Burnside Rural Fire Protection District

Knappa-Svensen-Burnside Rural Fire Protection District (Knappa Fire) serves the Svensen, Knappa, Brownsmead, and Bradwood communities with fire protection and emergency response. This area is also their tax district. John Day-Fern Hill Fire District contracts administration and response from Knappa Fire—including sharing a Fire Chief, training, etc.

Arch Cape Domestic Water Supply District

Arch Cape Domestic Water Supply District (Arch Cape Water or ACDWSD) provides domestic water service to the community of Arch Cape. This area is also their tax district.

Arch Cape Sanitary District

Arch Cape Sanitary District (ACSD) provides sanitary sewer service to the community of Arch Cape. ACSD shared a taxing district and service territory with ACDWSD. These two service districts use a shared management approach to their operations. Each has a separate board, but they share staff and other joint-operation efficiencies as necessary. ACSD does not serve Falcon Cove Beach.

Falcon Cove Beach Domestic Water Supply District

The Falcon Cove Beach Water District (FCBWD) provides domestic water service to the community of Falcon Cove. This area is also their tax district. Falcon Cove Beach is south of Arch Cape, skirted by public lands in green on the north, east, and south sides and the area west of Highway 101 is the service territory for the domestic water supplier.

3. Climate

The climate of the project area is known to be damp, nearly year-round. This is particularly true along the Columbia River, and in the cool corridor along the Pacific Ocean. Where the forests are continuous with these areas, extensive cool and wet microclimates persist, historically creating cool weather all through the heat of the summer. The inland areas are subject to the annual drought that occurs in Oregon and the Pacific NW resulting in much warmer and drier conditions in peak summer.

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 and landslides. As is typical of western Oregon, the highest monthly precipitation values for the coast occur in the winter months of November, December, and January.

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, a few times 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%, dropping only to about 65% 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.

4. Demographics

Population demographics are a factor in a community's vulnerability to disaster because development patterns, economic characteristics, age, race, health, and wealth all may contribute to vulnerability and resilience. Understanding trends in these factors may foster a local government's ability to plan, regulate, and serve the population in need.

Population

The population of Clatsop County in 2018 was estimated to be 39,200. The largest incorporated city populations in Clatsop County were the City of Astoria with 9,695 people (25%), Seaside with 6,620 people (19%), Warrenton with 5,310 people (14%), Cannon Beach with 1,710 people (4%), and Gearhart with 1,505 people (4%). The unincorporated County population comprised 37% of the total with 14,360 people (Population Research Center (PRC), 2018). These population numbers may differ in the Clatsop County Housing Study by Johnson Economics, 2019

Table II-1. Population of Clatsop County and Cities

	Total Population			Share of County Population			Average Annual	
	2000	2010	2018	2000	2010	2018	2000-2010	2010-2018
Clatsop County	35,630	37,039	39,200	100%	100%	100%	0.4%	0.7%
Astoria	9,813	9,477	9,695	28%	26%	25%	-0.6%	0.3%
Cannon Beach	1,600	1,690	1,710	4%	5%	4%	0.5%	0.1%
Gearhart	1,234	1,459	1,505	3%	4%	4%	1.4%	0.4%
Seaside	5,902	6,457	6,620	17%	17%	17%	0.9%	0.3%
Warrenton	4,105	5,022	5,310	12%	14%	14%	2.0%	0.7%
Unincorporated	12,976	12,934	14,360	36%	35%	37%	0.0%	1.3%

Source: PSU Population Research Center & Forecast Program. Clatsop County Housing Study, p.3. https://www.co.clatsop.or.us/sites/default/files/fileattachments/county_government/page/11631/appendix_a-_housing_trends_and_needs_report_v2.pdf

Table II-2. Population and Households (2000, 2010, 2018 projected)

	Population				Households		
	2000 (Census)	2010 (Census)	2018 (PSU)	2018 Minus Group Pop. (PSU)	2000	2010	2018
Clatsop County	35,630	37,039	39,200	38,188	14,703	15,742	16,460
Astoria	9,813	9,477	9,918	9,651	4,235	4,288	4,553
Cannon Beach	1,588	1,680	1,707	1,585	710	759	796
Gearhart	995	1,462	1,483	1,483	450	649	645
Seaside	2,656	2,969	6,644	6,595	1,510	1,565	3,053
Warrenton	4,096	4,989	5,329	5,098	1,621	1,948	2,081
Unincorporated	16,482	16,462	14,120	13,776	6,177	6,533	5,332

Source: PSU, Population Research Center. U.S. Census. Johnson Economics: Clatsop County Housing Trends & Needs Report. Jan. 2019. Housing Profiles. 2018 data are projected estimates by PRC. https://www.co.clatsop.or.us/sites/default/files/fileattachments/county_government/page/11631/appendix_a-_housing_trends_and_needs_report_v2.pdf

Table II-3. Clatsop County Population by UGB and AAGR and Sub-areas (2000 and 2010)

	Total Population (by UGB)		Average Annual Growth Rate (AAGR)	Share of County	
	2000	2010	2000-2010	2000	2010
Clatsop County	35,630	37,039	0.4%	100%	100%
Astoria UGB	10,345	9,782	-0.6%	29.0%	26.4%
Cannon Beach UGB	1,603	1,693	0.5%	4.5%	4.6%
Gearhart UGB	1,318	1,508	1.4%	3.7%	4.1%
Seaside UGB	6,095	6,657	0.9%	17.1%	18.0%
Warrenton UGB	4,105	5,022	2.0%	11.5%	13.6%
Outside UGBs	12,164	12,377	0.9%	34.1%	33.4%

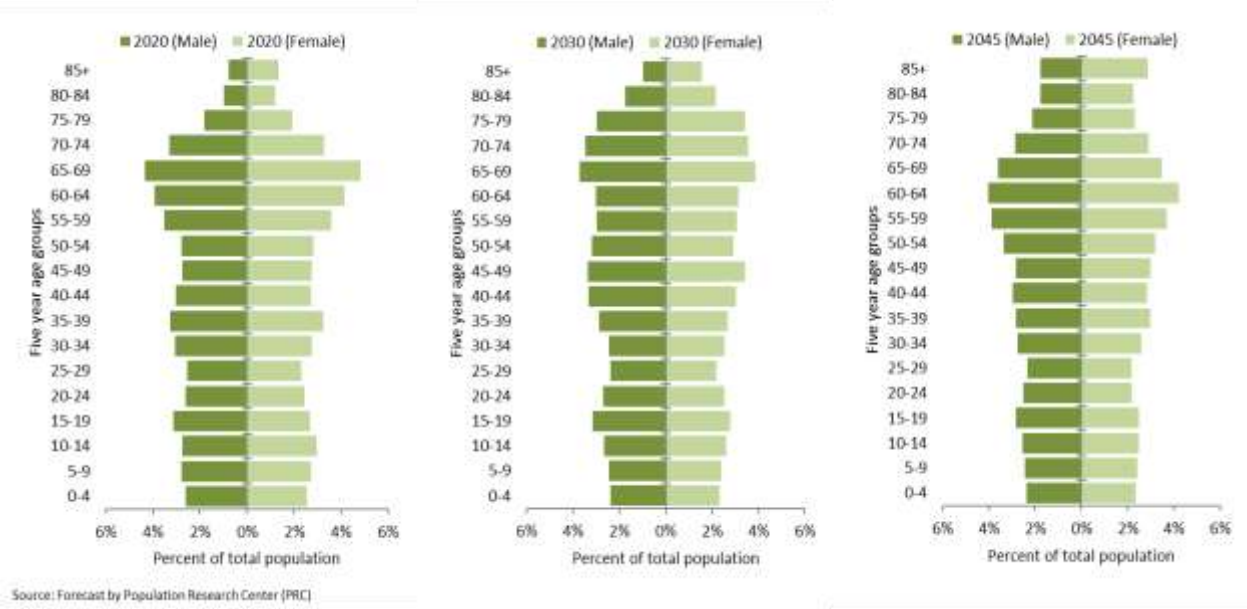
Note: Total Population by Urban Growth Boundary (UGB) and Average Annual Growth Rate (AAGR). Source: PSU, Population Research Center. Coordinated Population Forecast for Clatsop County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2017-2067. http://archives.pdx.edu/ds/psu/23476 U.S. Census Bureau, 2000 and 2010 Censuses.

By Age

According to the US Census American Survey, persons 65 years of age and older made up 20.8% of the total Clatsop County population in 2018, increasing 0.7% in one year. Persons 18 years and younger comprised 19.5% of the population, a level that was nearly stable from the previous year. Nationwide, the US has a higher percentage of the population occurring in age cohorts between the ages of 55 and 74 than other age groups due to the "baby boom" which occurred after World War II (from 1946 to 1964) as is evident in the pyramid for 2020 below in Figure II-8. Senior populations are typically more vulnerable to temperature extremes than other residents. The very young and very old share a proclivity for a wide range of conditions that require the support of family or community and generally are more likely to thrive under consistent, accessible, comfortable conditions.

The population pyramids below show how the demographics of age and sex vary over time.

Figure II-8. Population Pyramids for 2020, 2030, 2045



Source: Population Research Center (March, 2020).

By Race and Language

Race is a social construct that can be used to understand a community's history and guide policies. According to the 2018 Census, 3,129 people in Clatsop County, or 8.6% speak a language other than English at home. Of this non-English speaking population, 2,255 people speak Spanish at home (margin of error for both is +/- ~390 people).

Table II-4. Population by Race in 2000 and 2010

Clatsop County Population by Race	**2000**		**2010**	
	Pop.	%	Pop.	%
Total Population	35,630	100.0%	37,039	100.0%
Hispanic or Latino	1,597	4.5%	2,838	7.7%
Not Hispanic or Latino	34,033	95.5%	34,201	92.3%
White alone	32,364	90.8%	32,295	87.2%
Black or African American alone	156	0.4%	163	0.4%
Native American and Alaska Native alone	342	1.0%	308	0.8%
Asian Alone	423	1.2%	445	1.2%
Native Hawaiian and Other Pacific Islander alone	50	0.1%	84	0.2%
Some other race alone	14	0.0%	48	0.1%
Two or more races	684	1.9%	858	2.3%

Source: U.S. Census Bureau, 2000 and 2010 Censuses; PSU Population Forecast (2017).
https://www.pdx.edu/prc/sites/www.pdx.edu.prc/files/Clatsop_Report_201703_2017_Proposed.pdf

By Disability

According to 2018 Census, 10.4% of the population of Clatsop County has a mobility (ambulatory) difficulty, and this expands to 25% of the population for people over 65. The population with a cognitive difficulty averages 6.7-7.4%, except people over 75 suffer cognitive difficulties at a rate of 16%. These patterns are similar for independent living—the average of 8.3% with a difficulty increases to 24.1% at 75 years or older (US Census, 2018).

Table II-5. Persons with a Disability in Clatsop County

	Total Population	%
Clatsop County	37,746*	100%
With a Disability	7,309	19.4%
With a Hearing difficulty	2,614	6.9%
With a Vision difficulty	1,427	3.8%
With a Cognitive difficulty	2,783	7.8%
With an Ambulatory difficulty	3,703	10.4%
With a Self-Care difficulty	1,351	3.8%
With an Independent-Living difficulty	2,497	8.3%

Source: US Census, 2018. Note: *Total civilian non-institutionalized population.

There is a wide variation of the disabled population. Some individuals may have strong support structures and a high level of care provided to them by friends, neighbors, and care providers. Others may lack sufficient support. Some individuals may be largely self-reliant. In some cases, multiple risk factors, access limitations, or special needs can increase personal vulnerability.

Table II-6. Disabled Population, City of Astoria, 2013

Age	%
Under 18 years	7.5%
18 to 64 years	13.6%
65 years and over	36.2%

Source: 2009-2013 American Community Survey 5-Year Estimates

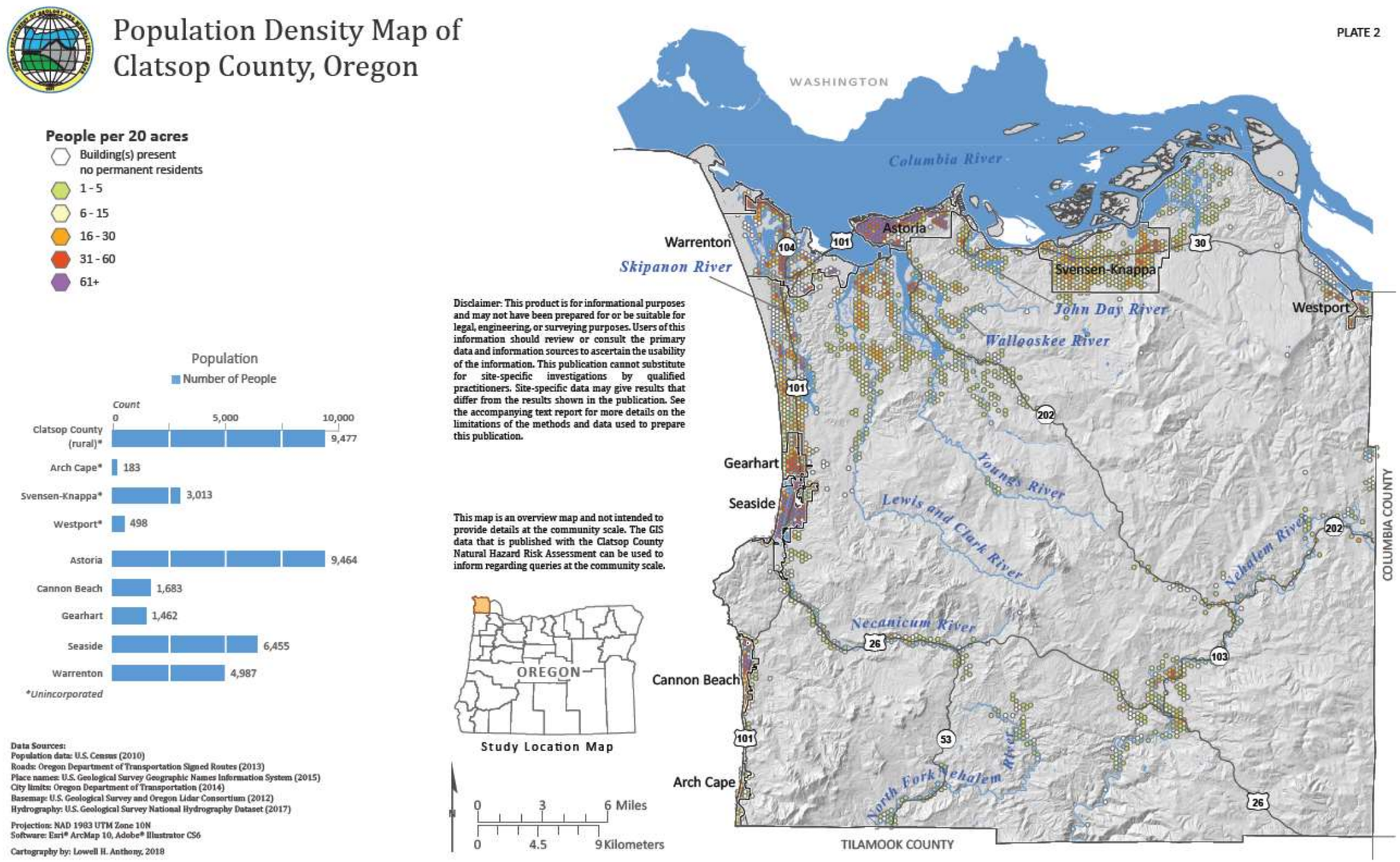
Tourist Population

Tourists are not measured in Census data so it can be difficult to document the number of visitors. Between 2016 and 2018, Clatsop County averaged approximately 3,900 visitor person-nights per year. Hotel/motel stays were 61% of these, or approximately 2,400 person-nights per year. Private home transient lodging visits accounted for about 13% or 500 person-nights per year, and 26% or 1,020 person-nights per year were in 'other' accommodations (Runyan, 2019).

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 identifying or using evacuation routes, or finding shelters in the event of an earthquake and/or tsunami. A typical tourist is less likely to have a 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.

The transient tourist population is highest during the summer, when most visitors come into the County. For some communities, the streets are literally full of visitors at peak season. The community operates under adverse conditions of traffic jams, a lack of parking, and competition for recreational and other resources in the summer. The visitor population of Clatsop County has a strong effect on the services demanded by the community such as utilities and public safety. If a major disaster occurred during the summer tourist season, every jurisdiction would require support at 2-10 times the level at which they are funded to operate by their existing tax base.

Figure II-9. Population Density Map



Source: Williams et al, 2020.

Population Forecast

In Oregon, population change affects regulations relating to buildable land, primarily Urban Growth Boundaries (UGBs). Land use planning goals guide communities to focus development to protect farm and forestland, and to create compact communities that are more affordable to serve.

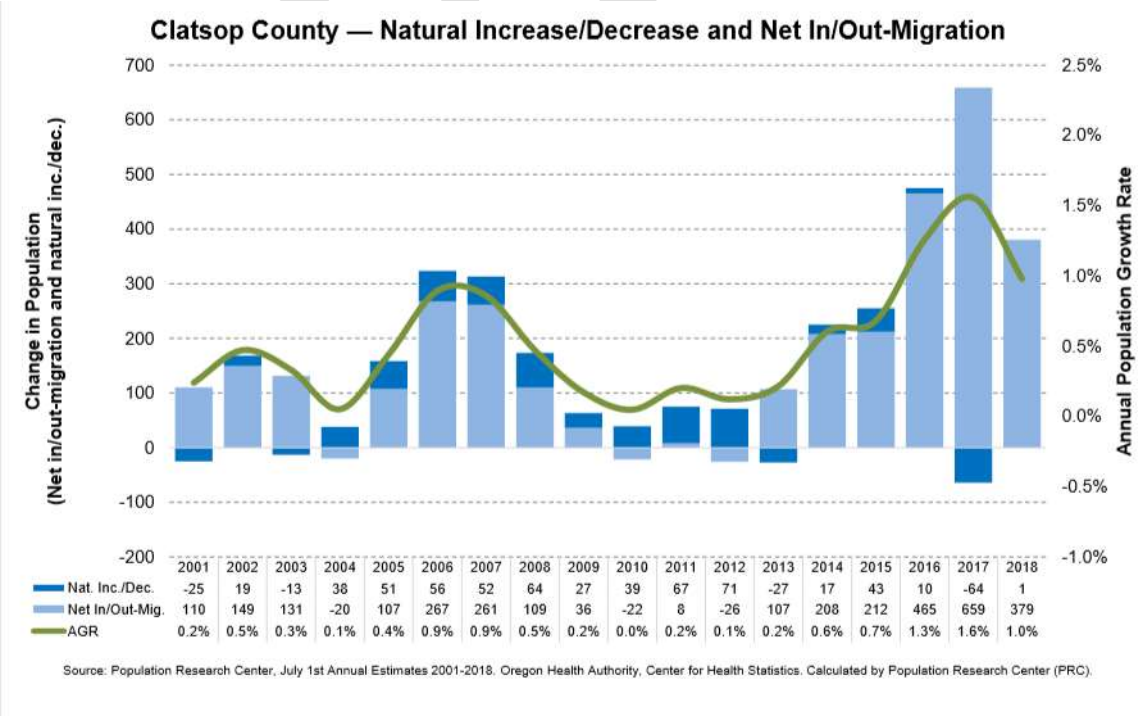
Table II-7. Forecasts for Total Population

Area/ Year	2025	2030	2035	2040	2045	2050	2055	2060
Clatsop County	38,254	38,807	39,261	39,632	40,010	40,419	40,832	41,249
Astoria	9,815	9,889	9,901	9,910	9,900	9,852	9,840	9,799
Cannon Beach	1,652	1,664	1,698	1,715	1,714	1,715	1,728	1,740
Gearhart	1,516	1,545	1,573	1,601	1,618	1,634	1,659	1,687
Seaside	6,716	6,874	7,050	7,177	7,283	7,435	7,587	7,761
Warrenton	5,586	5,924	6,322	6,689	7,011	7,325	7,727	8,222
Outside UGB	12,969	12,911	12,716	12,539	12,484	12,459	12,291	12,039

Source: Population Research Center, Portland State University, March 31, 2020. Proposed forecasts represent populations as of July 1 of each year.

In Clatsop County, the past decade has seen a trend of the rate of natural increase decline and net migration increase. This change is driven by a declining birth rate and the comparatively high number of individuals in the baby-boomer age cohorts of 55-59, 60-64, 65-69, and 70-74. The net in/out-migration increase is cyclical and correlated to economic strength due to the recreation and tourism orientation of the coastal economy—resulting in a significant upswing during the past five years.

Figure II-10. Population Change: Natural vs. Migration



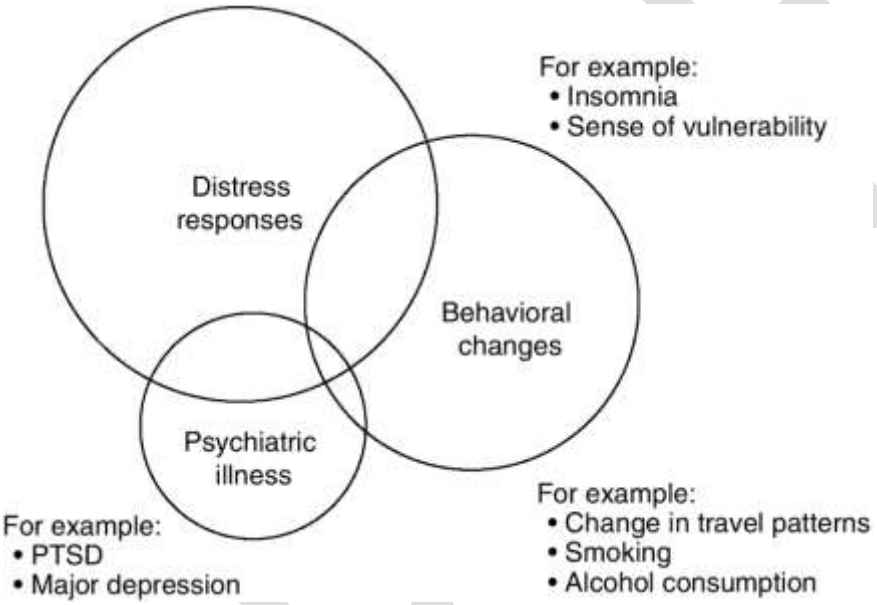
Source: PSU, 2017.

Mental Health and Trauma

Disaster conditions can aggravate anyone affected. For those who suffer from trauma or other mental illness, new stressors can be debilitating or have unpredictable result. Evidence of this is shown by a case study done following the Mt. St. Helens eruption disaster showing there was a marked increase in the caseload for mental health crisis services in the weeks following the eruption. 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.

Traumatic events have been studied for many years to understand their impact on the human brain (war, sexual assault, natural disasters, car crashes, terrorism, etc.) The effect of exposure to trauma is specific to the individual, and both psychological and physiological symptoms may result. In general, those exposed to a traumatic event show increased rates of acute stress disorder, post-traumatic stress disorder (PTSD), major depression, panic disorder, generalized anxiety disorder, and substance use disorder (Kessler et al., 1995). Although psychiatric illnesses such as PTSD are the more severe outcomes of traumatic events, they are also the best studied (US Institute of Medicine, 2003).

Figure II-11. Psychological consequences of disaster and terrorism



Note: Indicative only; not to scale. Source: US Institute of Medicine, 2003; Ursano, 2002.

Experience of a traumatic event does not dictate a psychological problem, but understanding the range of symptoms can help in understanding what type of support is needed.

Because disasters often result in the activation of mass care centers, sponsors of these centers may be particularly interested in addressing or understanding the effect of trauma on the populace. Providing compassion to the community by offering support services could be construed as a mental health intervention with positive benefits. This is sometimes called trauma-informed service or care when trauma is taken into consideration as something that may need to be addressed as a root cause of an individual or group problem.

For many, receiving community support to meet basic needs may resolve any observable impacts of a disaster on mental health. This is the definition of disaster "relief"—there are tangible physical and psychological benefits.

Management of congregate settings could include some form of monitoring to identify the level of stress or distress by common signs. For example, some people may be inclined to use coping mechanisms like smoking or alcohol. Others may be predisposed to a mental health crisis due to drug withdrawal. Unfortunately, psychiatric emergencies are a possible result of a disaster or its secondary impacts. Preparation for mass care should include training so that the causes and differences in psychiatric emergencies can potentially be identified, treated, or de-escalated before harm occurs.

Social Vulnerability and Underserved Communities

Disasters are terrible because of the loss they bring. Nearly anyone can experience a loss in their personal capabilities during or as a result of a disaster. This is particularly true for people already underserved or disadvantaged by one or more risk factors. Vulnerable populations present a special challenge to emergency managers and response agencies as they are more likely to have unique needs, and combinations of needs, that put them at risk of being victims of a disaster.

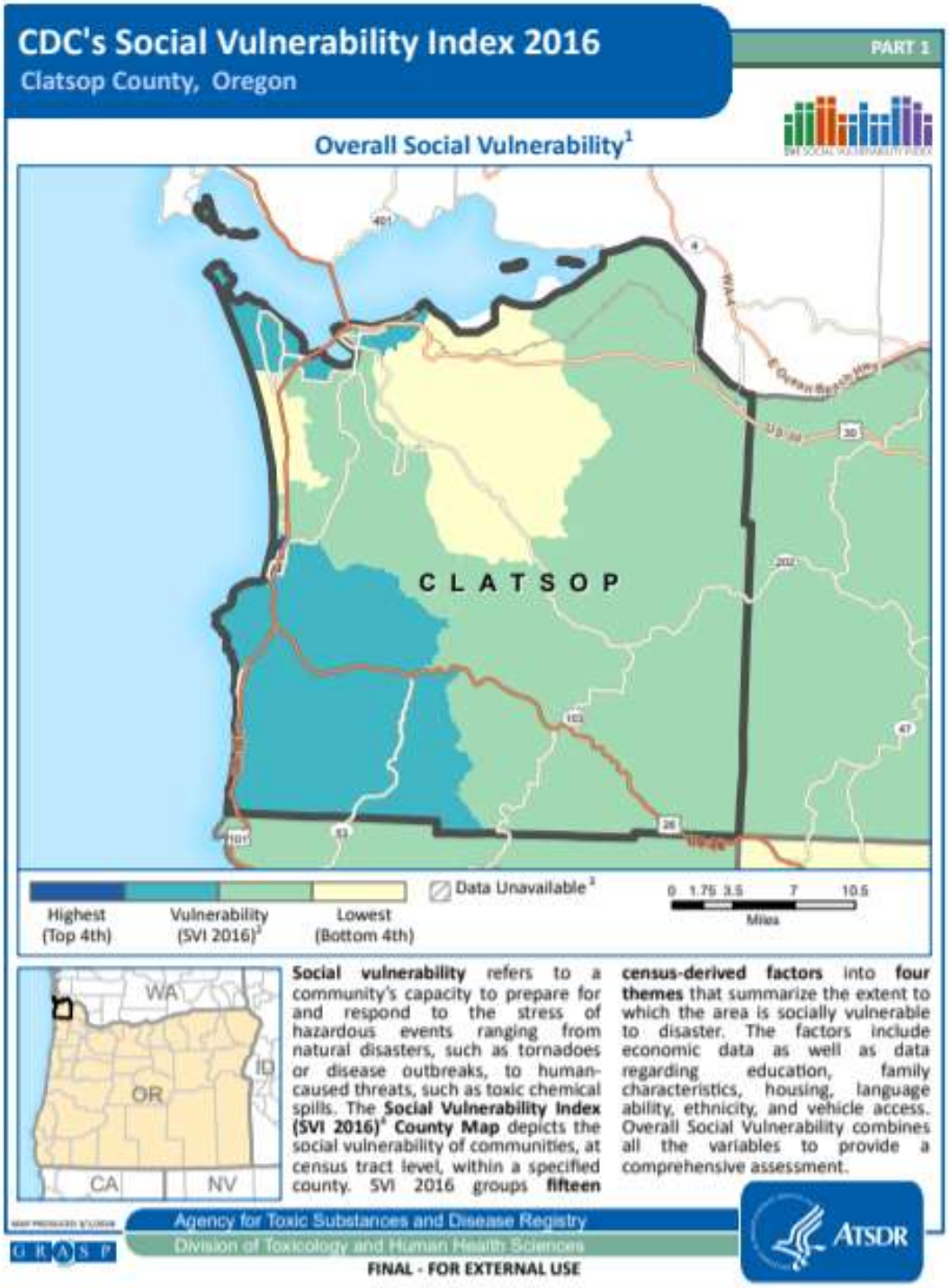
Vulnerable populations are those groups that possess specific characteristics that inhibit their ability to prepare for, respond to, or recover from a disaster. In addition, people from non-white or non-able bodied populations may be considered "underserved".

The State of Oregon Equity Framework defines historically and currently underserved communities as Oregonians who are:

- Native Americans, members of Oregon's nine federally recognized tribes, American Indians, Alaska Natives
- Black, Africans, African Americans
- Latinx, Hispanic
- Asian, Pacific Islanders
- Immigrants, refugees, asylum seekers
- Undocumented, 'Development, Relief, and Education for Alien Minors' Act Recipients (DREAMers)
- Linguistically diverse
- People with disabilities
- LGBTQ+
- Aging/older adults
- Economically disadvantaged
- Farmworkers, migrant workers
- Living in rural parts of the state

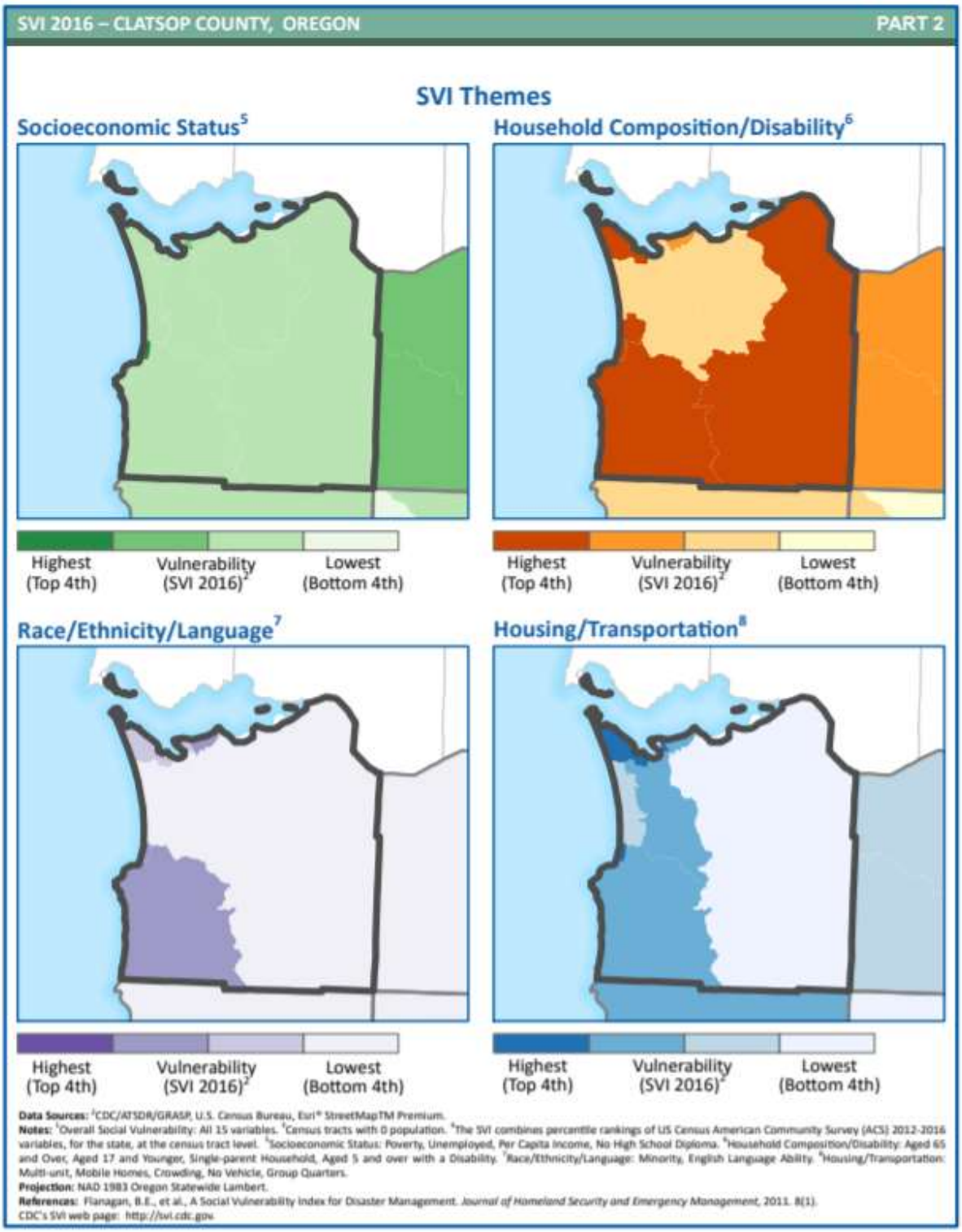
Individuals often identify with multiple communities and are impacted by compounding systems of oppression, also known as intersectionality. Identity and experience impacts racial, health, and economic equity and should be considered in applying core elements that help decision makers center equity in their planning and response efforts (Office of Governor Brown, 2020, p.2, 5.)

Figure II-12. Clatsop County Overall Social Vulnerability Index 2016



Source: ATSDR, 2016.

Figure II-13. Social Vulnerability Index Themes



Source: ATSDR, 2016.

5. Economics

Like other coastal resource-based communities in the Pacific Northwest, the economy of Clatsop County was historically based on forestry and fishing. The economy is slowly diversifying as these sectors evolve. According to Business Oregon in 2017, "natural resources such as forestry, farming, and fishing drive this region's large and competitive manufacturing sector."

Both Clatsop Community College (CCC) and Seaside School District (SSD) are working to support this diversification of the local economy with their robust programming, including the MERTS Technical Programs for CCC and a large-scale tsunami relocation project by SSD supported by a $250 million bond under construction 2019-2020.

Due to its proximity to the Oregon Coast and the Columbia River, Clatsop County is considered a major Northwest tourist destination. Points of Interest include: Astoria Column, Astoria waterfront, Flavel House Museum, Liberty Theatre, Lewis and Clark National Park (Fort Clatsop), 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, and the Twilight Eagle Sanctuary.

In Clatsop County, each jurisdiction is diversified in terms of how tourism and recreation contribute to the economy. The community of Gearhart developed as a quiet retreat between Astoria and Seaside after the railroad was built in 1889. Warrenton thrives in part as a retail destination for residents and cruise ship guests alike in addition to being a hub of the recreational and commercial fishing industry. Cannon Beach and Seaside each have a unique beach destination business angle, while Astoria is a center of culture and history which fosters year-round tourism.

The Port of Astoria supports shipping by hosting the ships and helicopters of bar pilots, US Coast Guard, and ocean-going vessels, providing deep water docks, and welcoming cruise ships to Astoria. The City of Astoria provides deep water dock at 17th Street Dock. The Sunset Empire Transportation District maintains a system of transit allowing visitors and residents alike to freely move between population centers across Clatsop County and beyond. The water and sanitary districts of Arch Cape support local residents as well as the increased water demand of summer visitors, as does Falcon Cove Beach Water and the public works providers within each municipality. Cannon Beach Fire District, Knappa Fire, Lewis & Clark Fire, and the other fire districts are on standby at all hours to protect residents and businesses alike.

Employment

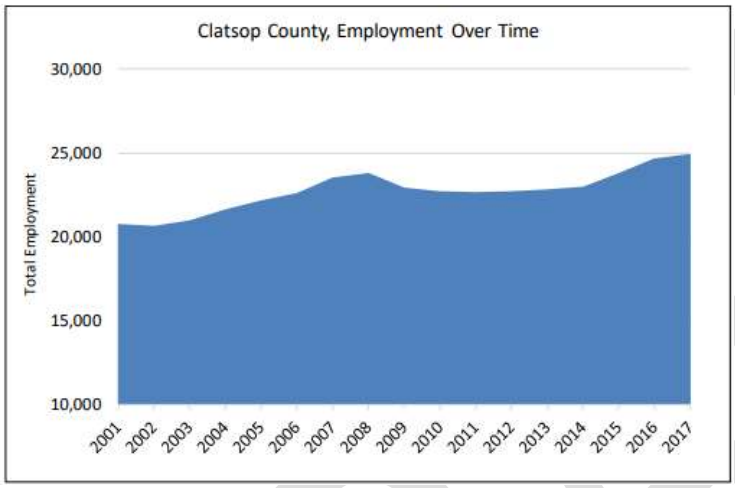
The Clatsop County Housing Trends and Needs Report (Jan. 2019) cites US Census Employment Dynamics (2017) in estimating a total of 24,975 jobs in Clatsop County, nearly 1,200 more than the prior peak in 2008. The industries representing the greatest share of employment are tourism related, health and social services, and manufacturing (which includes wood and fish processing facilities).

According to the 2017 *Regional Competitive Industry Analysis: Clatsop, Columbia, and Tillamook Counties* report by Business Oregon, Northwest Oregon was the 5th fastest growing region in the state between 2005 and 2015, but trailed the statewide growth rate by one percentage point. Clatsop County accounted for nearly half of total private sector employment in the region. In 2015, Clatsop County had

14,874 private sector jobs with $508,450,433 in total wages representing 48.4% of the region's employment. The annual average wage was just $34,184 which was low for the region and state.

Beverage manufacturing, basic chemical manufacturing, architectural and structural metals manufacturing, and other general purpose machinery manufacturing were the traded sector industries in the region that experienced the highest competitive advantage percent gains between 2005 and 2015. In 2015, Clatsop County had a total of 58 manufacturing establishments with 83.7% having less than 20 employees, 10.2% having between 20-99 employees, 4.1% having 100-249, and 2.0% having 250 or more (Business Oregon, 2017).

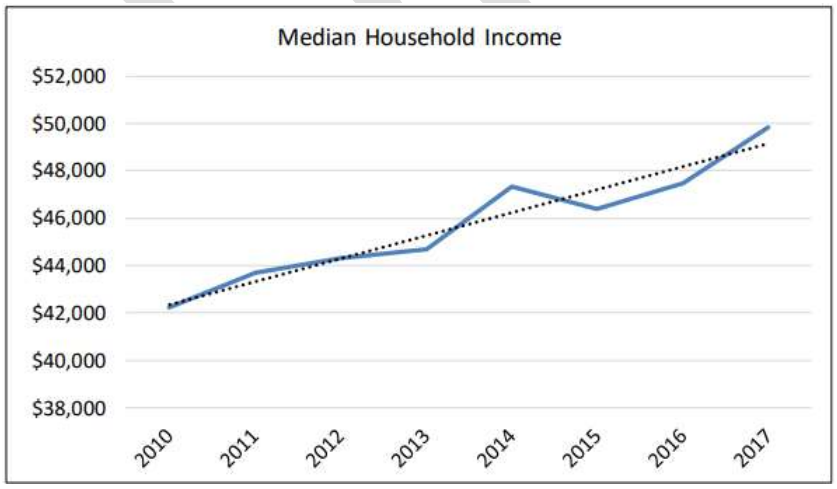
Figure II-14. Total Employment 2001-2017 (Clatsop County)



Source: US Bureau of Economic Analysis; Clatsop County Housing Trends & Needs Report, Jan. 2019.

Median household income continues to trend upwards according to Johnson Economics and the US Census.

Figure II-15. Median Household Income 2010-2017



Source: American Community Survey, 2017 5-year, B19013; Clatsop County Housing Trends & Needs Report, Jan. 2019.

Employment by Location

Some of the major employers in the project area include (Clatsop County, 2019):

- Georgia Pacific, Wauna Mill, in the unincorporated community of Wauna (Clatsop County)
- Warrenton Fiber Company in Warrenton
- Columbia Memorial Hospital in Astoria
- Providence Seaside Hospital
- Astoria School District
- Seaside School District
- County, State, and Federal Government, including the US Coast Guard
- Tongue Point Job Corps in Astoria
- LEKTRO in Warrenton

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 Astoria's economy, tourism, regional medical, education, and government are the main economic activities.

The top four employers in Cannon Beach are Martin Hospitality, Cannon Beach Conference Center, Hallmark Resort, and the City of Cannon Beach.

Employment in Gearhart centers on health care and social assistance, retail trade, construction, accommodation and food services, and educational services (https://datausa.io/profile/geo/gearhart-or).

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, Providence Seaside Hospital, Safeway, and the City of Seaside. 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."

Education, health, and social services and retail are the largest employers in Warrenton. 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). Warrenton is also home to three marinas including the City-run Hammond Marina and Warrenton Mooring Basin, and Skipanon Marina, a privately run marina.

Median income can be used as an indicator of the strength of the region's economic stability. In 2017, the median household income in Clatsop County and Cities ranged from $38,680 to $51,264, according to the US Census. Although income can be used to compare areas as a whole, these numbers do not reflect how income is stratified among residents.

Table II-8. Economic Demographics of Clatsop County and Cities

	Clatsop County	City of Astoria	City of Cannon Beach	City of Gearhart	City of Seaside	City of Warrenton
Number of Employees	17,121	4,634	779	700	2,893	2,400
Median Age	44.1	46.1	49.1	41.2	43.6	34.5
Median Household Income	$49,828	$44,747	$48,833	$50,982	$38,680	$51,264
Median Home Sale Price, 2018	$310,500	$309,000	$486,000	$402,000	$298,000	$275,000
% Property Value Change (1-yr)	3.46%	4.75%	-4.92%	-3.37%	2.83%	0.40%
Poverty Rate	12.2%	15.3%	16.4%	17.8%	12.4%	12.2%

Source: US Census, 2017 from Deloitte, 2020. 2018 Median Home Sale Price from App.A CC Housing Trends and Needs Report.
*East Clatsop Median Home Sale Price was $269,000.

These graphics that indicate where residents work and which local jobs are held by in-commuters or residents. This information could be relevant for evacuation planning in addition to addressing economic development.

Figure II-16 Local Residents Employment Location

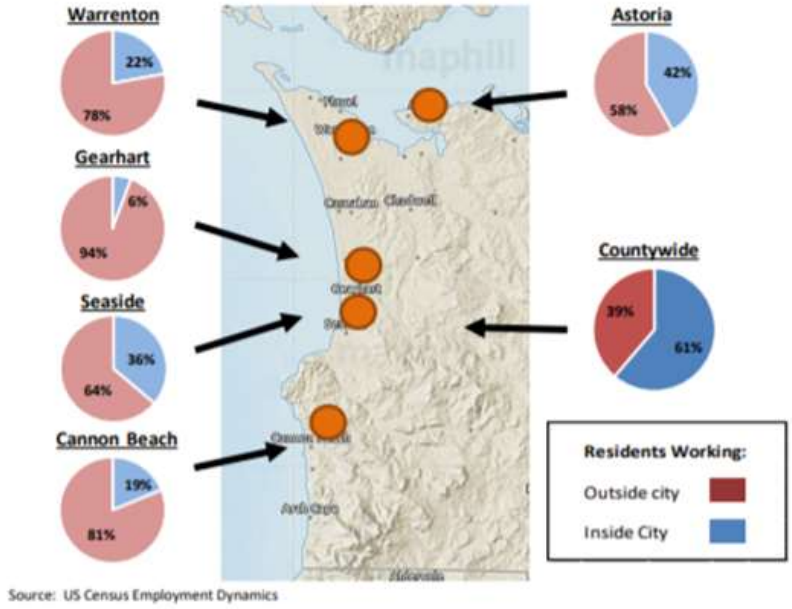
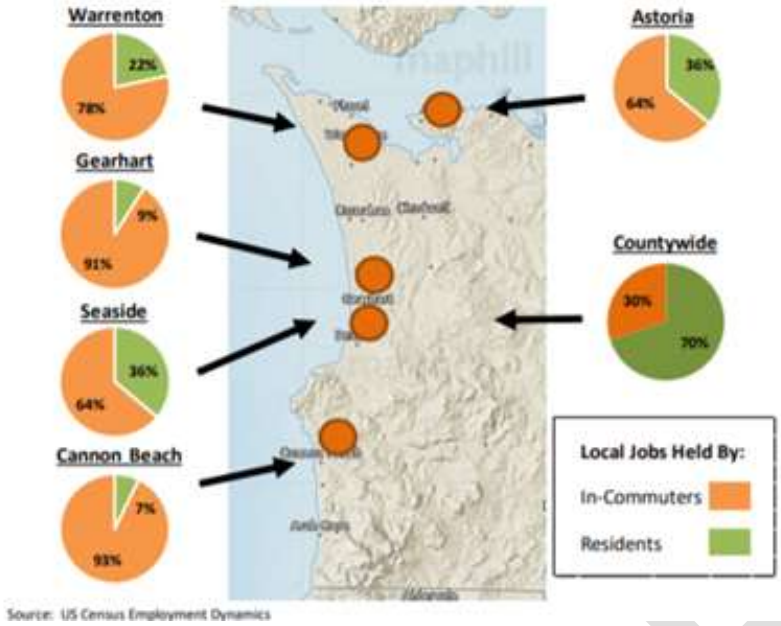


Figure II-17 Local Jobs Held (in-commuters vs. residents)

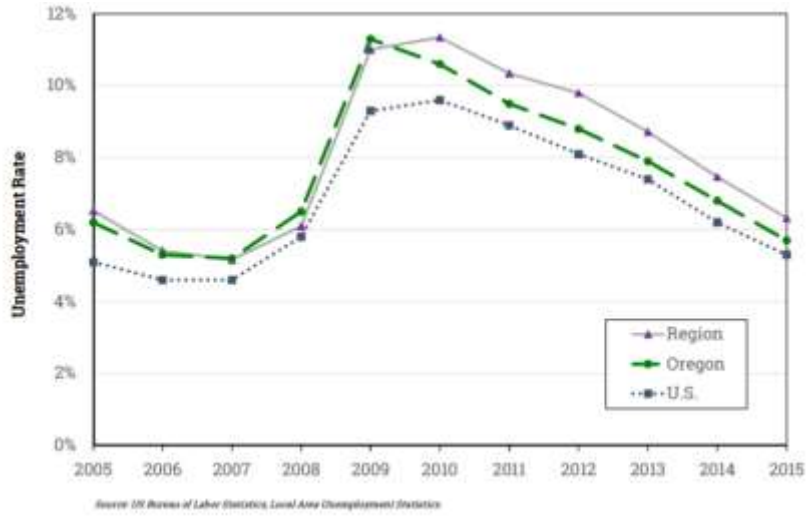


Approximately 70% of working Clatsop County residents work in the county, but the majority commute to a neighboring city. Astoria and Seaside have the highest rates of residents working where they live, ~40%.

Unemployment

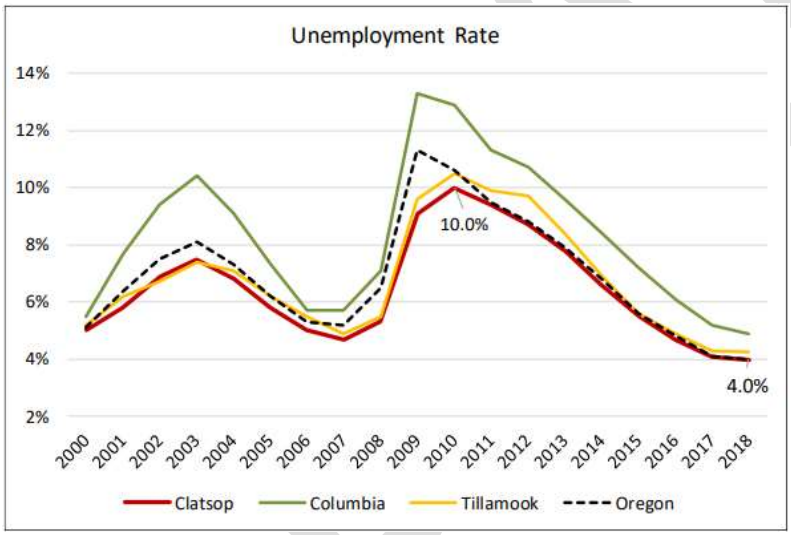
The region reached its highest unemployment rate over the 10 year period, 11.3%, in 2010 and has since declined, but has been noticeably higher than the state (and nation) rate since 2010. The lowest unemployment rate over the 10 year period, 5.2%, occurred in 2007 (Business Oregon, 2017, p.9). The COVID-19 crisis occurred during the preparation of this plan and statistics available for Oregon showed statewide unemployment rates moving from 3.5% in March 2020 to 14.2% in April 2020 (Bureau of Labor and Industries, 2020). It is likely that unemployment remained high or increased through June 2020 and it is also likely that unemployment rates for northwest Oregon will be higher than the statewide rate due to the impact of the pandemic on tourism and historical unemployment trends on the Oregon coast.

Figure II-18. Unemployment Rate: NW Oregon vs. State and US



Source: Business Oregon, 2017. Note: This graph shows the average annual unemployment rate for Northwest Oregon, Oregon, and the US from 2005-2015.

Figure II-19. Unemployment Rate 2000-2018 (Clatsop County and Comparisons)



Source: US Bureau of Economic Analysis; Clatsop County Housing Trends & Needs Report, Jan. 2019.

Poverty

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. The Census Bureau uses a set of income thresholds that vary by family size and composition to determine who classifies as impoverished. If a family's total income is less than the family's threshold than that family and every individual in it is considered to be living in poverty. For 2017, 12.2 % of Clatsop County (4,550 out of 37,300 people) and 13.1% of the total population of the US were living below this income level.

In Astoria, 15.3% of the population for whom poverty status is determined (1,450 out of 9,460 people) live below the poverty line. The largest demographic living in poverty were Females 45-54, followed by Males 55-64 and then Males 25-34. In Cannon Beach, 16.4% of the population (240 out of 1,470 people) for whom poverty status is determined to live below the poverty line. The largest demographic living in poverty are Females 55-64, followed by Males 55-64 and then Females 75+. In Gearhart, 7.8% of the population for whom poverty status is determined (275 out of 1,550 people) live below the poverty line. The largest demographic living in poverty are Females 35-44, followed by Females 55-64 and then Males 16-17. In Seaside, 12.4% of the population for whom poverty status is determined (800 out of 6,460 people) live below the poverty line. The largest demographic living in poverty are Females 18-24, followed by Females 35-44 and then Males 25-34. In Warrenton, 12.2% of the population (645 out of 5.28k people) lives below the poverty line. The largest demographic living in poverty are Females 25-34, followed by Females <5 and then Females 6-11 (US Census, 2017 from Deloitte, 2020.)

Educational Facilities

Clatsop County has one community college, five school districts, an education service district, two charter schools (1 public, 1 private), a job corps, and a variety of pre-school and after-school programs. Clatsop Community College (CCC) and Seaside School District (CCC) are participating in this mitigation planning effort.

The five school districts in Clatsop County include:

- Astoria School District
- Warrenton-Hammond School District
- Jewell School District
- Knappa School District
- Seaside School District

Figure II-20. Five School Districts of Clatsop County

Source: ESRI et al.

Clatsop Community College

Clatsop Community College (CCC) provides important post-secondary educational services to all of Clatsop County. CCC has three locations—two in Astoria and one in Seaside.

Figure II-21. Clatsop Community College Campus Locations

Lexington Campus

MERTS Campus

South County Campus

Source: CCC, 2019.

Lexington Campus, the College's campus in Astoria, on a hillside overlooking the Columbia River, provides state-of-the-art laboratories and classrooms, full-accessibility, and inviting, student-centered learning spaces. The campus offers a true college vibe with the campus bookstore, cafe, library, coffee shop, modern science labs, student clubs, and fitness center all available to our students. The Lexington Campus' nine buildings contain administrative offices and instruction in college transfer, Art, Business, Health Occupations, and Adult Basic Skills, including the GED®. Buildings located on Lexington Avenue, east of 16th Street, include Towler Hall, Patriot Hall, the Dora Badollet Library, Columbia Hall, Student Services Center, Fine Arts Center, Alder Hall, and the Facilities building.

Figure II-22. Clatsop Community College Lexington Campus Map

Source: CCC, 2019.

The Marine and Environmental Research and Training Station (MERTS) Campus is located about four miles east of Astoria off US Highway 30, on the waterfront. MERTS houses instruction in Maritime, Fire Science, CADD, Historic Preservation, Automotive, and Welding. MERTS programs emphasize hands-on learning. This proven delivery method allows students real world application of their studies that transfer immediately into the workforce and allow graduates quick access to well-paid local jobs.

The South County Campus is located in Seaside, Oregon, about 17 miles south of the Lexington Campus. This location is for small business and economic development services as well as various classes convenient to South County residents. Services include the Small Business Development Center, customized training to business and public, and community safety training. This campus is also home for Clatsop Economic Development Resources (CEDR), a full service resource center for business and industry.

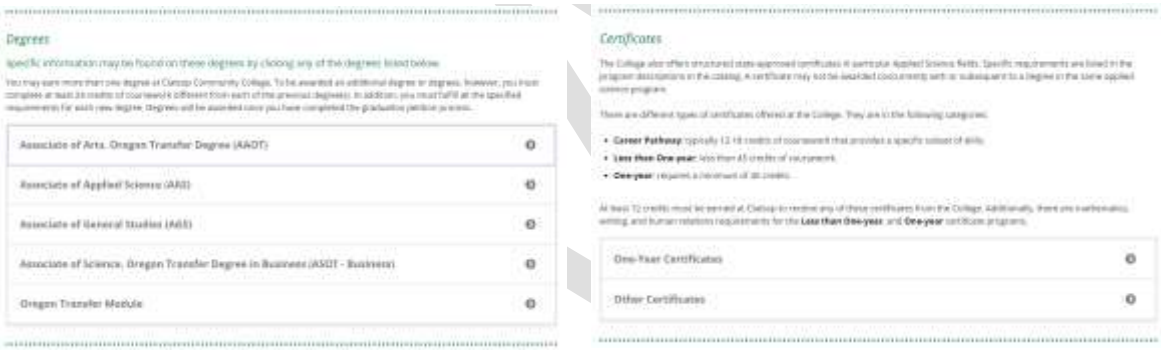
Clatsop Community College (CCC) is the fourth-smallest community college in Oregon and is by all accounts a coastal community college. Featuring strikingly beautiful views of the Columbia River from both campuses, the CCC college experience spans the gamut of basic adult education, to university preparation, to in-depth career technical programs in nursing, maritime science, and historic preservation. Striving to provide affordable access to higher education, Clatsop offers numerous professional and technical programs targeted at meeting the needs of the local economy. Programs range in length from three months certificates to two-year associate degrees (CCC, 2018-2019).

Programs

Clatsop's One-Year Certificates (at least 45 credits) include the following:

Automotive Technician
Business: General Office
Computer Aided Design and Drafting
Historic Preservation and Restoration
Maritime Science: Seamanship
Medical Assistant
Welding (American Welding Society Entry Level)

Figure II-23. Clatsop Community College Degree and Certificate Programs



Source: CCC, 2018-2019.

Seaside School District

The Seaside School District (SSD or District) is located on the North Coast of Oregon between the Pacific Ocean and the Oregon Coast Range in Clatsop County. The District currently serves approximately 1,680 students from the communities of Seaside, Gearhart, Warrenton, Cannon Beach, and Arch Cape. The District is an educational leader in Oregon. Many teachers and administrators have received state awards from organizations such as the Oregon School Boards Association and the Oregon Business Council's Employers for Educational Excellence. Numerous District teachers and administrators continue to serve on a variety of state committees (SSD, 2020). The 2016-2017 General Fund Operating Budget was $19,526,010 and supported approximately 202 employees and the following school facilities (Winterbrook Planning, 2017). The District is served by the Seaside Schools Bus Barn located at: 1985 N. Roosevelt Drive, Seaside, OR 97138. The District website is here: http://www.seaside.k12.or.us/.

Pacific Ridge Elementary School: https://pre.seaside.k12.or.us/

Pacific Ridge Elementary School serves approximately 700 students in kindergarten through fifth grade in Seaside, Oregon.

Seaside Middle School: https://sms.seaside.k12.or.us/

Seaside Middle School is located in the coastal community of Seaside, Oregon and serves about 350 students in 6th, 7th and 8th grades who reside in Cannon Beach, Gearhart, Seaside, and the surrounding rural areas.

Seaside High School: https://shs.seaside.k12.or.us/

Seaside High School serves nearly 500 students from the North Oregon Coast communities of Cannon Beach, Gearhart, and Seaside. The academic program has a strong emphasis on the core academic areas of English, math, science, social sciences, and foreign language, while also maintaining robust programs in the visual and performing arts, health and physical education, and career and technical education in business, construction and culinary arts. In addition, SHS has a multitude of clubs ranging from community service and costume design to robotics and fishing. A requirement that all seniors contribute a minimum of fifty hours serving others has created a legacy of service via the Pacifica Projects program.

Cannon Beach Academy: https://www.thecannonbeachacademy.org/

Cannon Beach Academy is a charter school founded in 2017 that is part of the Seaside School District, but has its own administration. The Academy is located in Cannon Beach and serves fewer than 50 students between Kindergarten and Fifth grade. The three-year charter was renewed in March 2020 (SSD, 2020).

6. Infrastructure

The subject of infrastructure is vast and detailed. For the 2021 Clatsop County NHMP update, this plan section attempts to achieve two efforts: 1) Identify and describe assets that are under consideration for mitigation under this plan; and 2) Present an integrated view of the structures, systems, and services that make Clatsop County function, with an emphasis on the participating jurisdictions.

In the rapidly evolving field of Infrastructure Security, it is important to consider the sixteen infrastructure sectors as defined by the Cybersecurity and Infrastructure Security Agency. This plan update considers eight sectors in varying degree of depth. Mitigation planning in the 2015 plan update and the DOGAMI Natural Hazard Risk Report focused on the *Emergency Services* and the *Government Facilities Sectors*. The 2021 plan update includes *Communications, Dams, Energy, Healthcare and Public Health sectors*, along with new mitigation partners in the *Transportation Systems, and Water and Wastewater Systems Sectors.*

Critical Facilities

Critical facilities are those that support government services or first responders' ability to take action in an emergency such as: fire and police stations, hospitals, city halls and other public administration buildings, public works shops, water/ waste water treatment facilities, schools, or any other facility that is regularly used or easily allocated for public service in a disaster. Critical facilities include locally designated shelters and mass care facilities. These are all considered to be a part of the Emergency Services or Government Facilities sectors. Critical facilities are a top priority in any comprehensive hazard mitigation planning effort. For the 2021 plan update, DOGAMI conducted an analysis of potential impacts to buildings by natural hazards. The following sections identify the status of these critical facilities by jurisdiction, as reported in the 2018 DOGAMI Natural Hazard Risk Report.

Clatsop County

The 2018 DOGAMI Natural Hazard Risk Report analyzed three Clatsop County critical facilities for losses and exposure to six hazards. The results in the table below indicate that two facilities have a greater than 50% risk of moderate to complete damage from an M 9.0 Cascadia Subduction Zone earthquake event.

Table II-9. Clatsop County-owned critical facilities

Critical Facilities (owned by Clatsop County across all communities)	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Clatsop County Public Works*	-	X	-	-	-	-
Clatsop County Sheriff*	-	X	-	-	-	-
Clatsop County Sheriff Department**	-	-	-	-	-	-

Source: Table adapted by DLCD and Clatsop County from Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020. *Svensen-Knappa critical facility table (p.55) **Astoria critical facility table (p.59).

Unincorporated Clatsop County

The results in the table below indicate a high probability that most rural Clatsop County critical facilities would suffer moderate to complete damage in a large earthquake event (16 of 20). Three are at risk from a medium tsunami event and are located in the 100-year flood zone, while Brownsmead Fire Station is likely beyond the tsunami zone, but at risk of flood. Eleven facilities are at risk of landslide, but only Olney-Walluski Fire Station has low earthquake, but high landslide risk. Six facilities could potentially face wildfire based on DOGAMI's methodology as guided by Oregon Department of Forestry.

Table II-10. Critical facilities in Unincorporated Clatsop County

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Brownsmead Fire Station	X	X	-	-	-	-
Camp Rilea - National Guard Training Center	-	X	-	X	-	-
Elsie/Vinemaple RFPD	-	X	-	X	-	-
Gearhart Rural Fire District	-	-	-	-	-	-
Hamlet Rural Fire District	-	X	-	-	-	-
Jewell School	-	X	-	X	-	-
John Day-Fern Hill Fire Station	-	X	-	X	-	-
Lewis & Clark Elementary	-	X	-	X	X	-
Lewis & Clark RFPD	X	X	X	-	X	-
Miles Crossing Sanitary Sewer District	X	-	X	-	X	-
Mist-Birkenfeld RFPD	-	-	-	-	-	-
Mist-Birkenfeld RFPD - Fishhawk Lake	-	X	-	X	-	-
Olney-Walluski Volunteer Fire & Rescue	-	-	-	X	-	-
Olney-Walluski Water Association	-	X	-	X	-	-
Oregon Military Department	-	X	-	-	X	-
Shoreline Sanitary District	-	X	-	-	-	-
Sundown Sanitation District	-	X	-	-	X	-
Wauna Water District	-	X	-	X	-	-
Wickiup Water District	-	X	-	X	X	-
Youngs River-Lewis & Clark Water District	X	X	X	X	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, p.51. Note: Brownsmead Fire Station is operated by Knappa Fire.

Arch Cape

Critical facilities in the Arch Cape area were evaluated as a discrete group in the 2018 DOGAMI *Natural hazard risk report for Clatsop County*, unpublished.

Table II-11. Unincorporated community of Arch Cape critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Arch Cape Dom Water Supply	-	X	-	X	-	-
Arch Cape Fire Station	-	-	-	-	-	-
Arch Cape Sanitary District	-	X	-	-	-	-
Cannon Beach Fire and Rescue Arch Cape	-	X	X	-	-	-

Source: Williams et al, 2020, p.53.

Knappa-Svensen

Critical facilities in the Knappa-Svensen area were evaluated as a discrete group in the DOGAMI Natural Hazard Risk Report. All six facilities are susceptible to moderate to complete earthquake damage in a CSZ earthquake event and Knappa Water Association is vulnerable to landslides. Brownsmead Fire Station is listed in the unincorporated Clatsop County critical facilities table.

Table II-12. Knappa-Svensen critical facilities

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Clatsop County Public Works	-	X	-	-	-	-
Clatsop County Sheriff	-	X	-	-	-	-
Hilda Lahti Elementary School	-	X	-	-	-	-
Knappa High School	-	X	-	-	-	-
Knappa Svensen RFPD	-	X	-	-	-	-
Knappa Water Association	-	X	-	X	-	-

Source: Williams et al, 2020, p.55.

Westport

Critical facilities in the Westport area were evaluated as a discrete group in the DOGAMI Natural Hazard Risk Report.

Table II-13. Unincorporated community of Westport critical facilities

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Westport Heights Water System	-	X	-	X	-	-
Westport Water Association	-	X	-	X	-	-
Westport Wauna RFPD	-	-	-	-	-	-

Source: Williams et al, 2020, p.57.

City of Astoria

The 2018 DOGAMI Natural Hazard Risk Report analyzed 18 critical facilities in Astoria, six of these City of Astoria-managed facilities, for losses and exposure to six hazards. The results in the table below indicate that seven are at risk of high to very high landslide risk, six have tsunami risk, and nearly all are at seismic risk.

Table II-14. City of Astoria critical facilities

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Astoria City Hall	-	X	-	-	-	-
Astoria Fire Department	-	X	X	-	-	-
Astoria Fire Station #2	-	X	-	-	-	-
Astoria Head Start	-	X	-	X	-	-
Astoria Middle School	-	X	-	-	-	-
Astoria Police Department	-	-	X	-	-	-
Astoria Public Works	-	X	X	-	-	-
Astoria Senior High School	-	X	-	X	-	-
Astoria Wastewater Treatment	-	X	-	-	-	-
City of Astoria Reservoir #2	-	-	-	-	-	-
Clatsop Community College	-	X	X	X	-	-
Clatsop County Sheriff Department	-	-	-	-	-	-
Columbia Memorial Hospital	-	X	-	-	-	-
John Jacob Astor Elementary	-	X	-	X	-	-
Oregon State Police	-	X	X	-	-	-
Parks Medical Limited LLC	-	X	-	X	-	-
Providence Heart Clinic North Coast - Astoria	-	X	-	X	-	-
Tongue Point Naval Air Station	X	X	X	X	-	-

Source: Williams et al, 2020, p.59.

Astoria has 2 fire stations, 1 police station, 1 hospital, 3 large medical facilities, 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 (in UGB area with joint fire response but law enforcement is handled by County).

City of Cannon Beach

The 2018 DOGAMI Natural Hazard Risk Report analyzed four Cannon Beach critical facilities for losses and exposure to six hazards. The results in the table below indicate that three of the four have considerable earthquake and tsunami risk.

Table II-15. City of Cannon Beach critical facilities

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Cannon Beach Elementary	-	X	X	-	-	-
Cannon Beach Fire and Rescue	-	-	-	-	-	-
Cannon Beach Police Dept.	-	X	X	-	-	-
Providence Health System - Oregon	-	X	X	-	-	-

Source: Williams et al, 2020, p.61. *DLCD Note: Cannon Beach Elementary was relocated out of the tsunami zone in 2019.*

Critical facilities in Cannon Beach include the police station, city hall, and one public charter school (Cannon Beach Academy at 3781 S. Hemlock Street, Cannon Beach, OR 97110). Public Works maintains drinking water and waste management facilities.

The Cannon Beach Fire Protection District has two main stations, the Cannon Beach Station and the Arch Cape Station.

City of Gearhart

The 2018 DOGAMI Natural Hazard Risk Report analyzed three Gearhart critical facilities for losses and exposure to six hazards. The results in the table below indicate that all three have a >50% probability of suffering moderate to severe damage in a CSZ earthquake and a subsequent medium tsunami.

Table II-16. City of Gearhart critical facilities

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Gearhart Elementary School*	-	X	X	-	-	-
Gearhart Police Dept.	-	X	X	-	-	-
Gearhart Volunteer Fire	-	X	X	-	-	-
Pacific Medical and Surgical Group**	-	-	-	-	-	-

Source: Williams et al, 2020, p.63. **DLCD Note: The Gearhart Elementary School is now closed and students attend Pacific Ridge Elementary School outside of the tsunami zone in Seaside. The City of Gearhart and the Seaside School District consider these facilities to be removed from the list of "at risk critical facilities", however, to be consistent, this table is presented as published in the 2020 Natural Hazard Risk Report for Clatsop County. **City of Gearhart proposes revisions to this table described in the paragraph below.*

Gearhart partners with DOGAMI on the geohazard research and analysis that informs risks to the City. Gearhart would suggest that its understanding of critical facilities includes additional information beyond the table above. For example, the Pacific Medical and Surgical Group is within the Earthquake and Tsunami areas and should have an X in the table above. In addition, the Gearhart Water Treatment Plant and reservoir would also be subject to moderate to complete damage in a CSZ earthquake and tsunami. Finally, the Gearhart 1M gallon water reservoir would have all boxes, except flood, checked as City staff understand risk from earthquake, tsunami, landslide, wildfire, and coastal erosion all to pose a risk to the 1M gallon water reservoir.

Critical facilities in Gearhart include the fire station, city hall, police station, and water treatment facility and reservoirs. Gearhart Elementary School property was sold in 2020. Students remain in the Seaside School District and were relocated to the Pacific Ridge Elementary School facility in Seaside. Critical facilities can serve as temporary shelters until locally designated shelters are developed.

City of Seaside

The 2018 DOGAMI Natural Hazard Risk Report analyzed nine Seaside critical facilities for losses and exposure to six hazards. The results in the table below indicate that eight are exposed to considerable earthquake risk and tsunami risk

Table II-17. City of Seaside critical facilities

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Broadway Middle School*	X	X	X	-	-	-
Seaside Fire and Rescue	-	X	X	-	-	-
Seaside Head Start	-	-	X	-	-	-
Seaside Heights Elementary School*	-	X	X	X	-	-
Seaside High School*	-	X	X	-	-	-
Seaside Police Dept.	-	X	X	-	-	-
Seaside Providence Hospital	-	X	-	-	-	-
Seaside Public Works	-	X	X	-	-	-
Seaside Water Treatment	-	X	X	-	-	-

Source: Williams et al, 2020, p.65. **DLCD Note: All three Seaside School District schools listed above have been relocated to outside of the tsunami zone. The City of Seaside and Seaside School District consider these facilities to be removed from the list of "at risk critical facilities", however, to be consistent, this table is presented as published in the 2020 Natural Hazard Risk Report for Clatsop County.*

The following facilities are critical systems and services for 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, Seaside Middle School, and Pacific Ridge Elementary School
- 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

City of Warrenton

There is one public elementary school, one public high school in the Warrenton-Hammond School District 30 school system, and one private school, Coryell's Crossing on SE Marlin Ave. Warrenton has two fire stations with two paid staff and approximately 30 volunteers located in Hammond and Warrenton. The water treatment plant is located at 88650 Lewis and Clark Road in Astoria. The waste water treatment plant is located at 105 NE 5th Street in Warrenton. Medix Ambulance, located on SE Dolphin Avenue, serves the North Coast.

The 2018 DOGAMI Natural Hazard Risk Report analyzed ten Warrenton critical facilities for losses and exposure to six hazards. The results in the table below indicate that eight face flood risk in a 100-year event, three contend with wildfire risk, and seven have considerable earthquake and/or tsunami risk in a CSZ event.

Table II-18. City of Warrenton critical facilities

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
CMH Medical Group Urgent Care	-	-	-	-	-	-
Port of Astoria	X	X	X	-	-	-
Providence Medical Clinic - Warrenton	X	-	X	-	X	-
South Jetty High School	-	X	-	-	-	-
U.S. Coast Guard - Air Station Astoria	X	X	X	-	-	-
Warrenton Fire Dept.	X	-	X	-	-	-
Warrenton Grade School	X	X	-	-	X	-
Warrenton High School	X	X	X	-	X	-
Warrenton Police Dept.	X	X	X	-	-	-
Warrenton Public Works	X	X	X	-	-	-

Source: Williams et al, 2020, p.67.

Fire Defense in Clatsop County

Within the county boundary there are (5) incorporated cities with fire departments: Astoria, Cannon Beach, Seaside, Gearhart and Warrenton. In addition to the city fire departments there are 7 rural departments. 93% of Clatsop Counties Firefighters are volunteers. The remaining 7% are paid officials ranging from Fire Chiefs to Training Officers. The City of Astoria is the only fire department that staffs 9 firefighters.

There are fourteen (14) organizations that provide wildland fire protection in Clatsop County, comprised of 7 Rural Fire Districts, 5 city fire departments, the National Park Service, and Oregon Department of Forestry (ODF). During elevated levels of Fire Danger the Northwest Oregon Fire Protection Association (NWOFPA) contracts with local companies to provide air patrol, and through special appropriations a helicopter is pre-positioned within the boundaries of the NWOFPA.

Oregon Department of Forestry and the Clatsop County Fire Defense Board are in a partnership to suppress wildland fires, and operate under a closest forces concept. ODF is responsible for protection of private lands, National Park Service lands, United States Fish and Wildlife Service and county and State of Oregon lands within the Forest Protection District. ODF has a mutual aid agreement with the rural and city fire districts/departments within Clatsop County that allows for assistance to be provided regardless of jurisdiction.

Astoria Fire Department

Figure II-24. Astoria Fire Department

In 2020, the City of Astoria Fire Department celebrated its 150th year in operation. The Department was formed in 1870 to protect the citizens of Astoria from the threat of fire. As the area continued to grow so did the risk of fire and on December 8, 1922 a historic fire broke out near 11th and Commercial Street. It began just after 2 a.m. and by 6 a.m. most of the downtown district was destroyed. The City of Astoria rebuilt and the fire department eventually grew into a fully career department. As times have changed so has the Astoria Fire Department and the department is currently a combination fire department comprised of eleven career members, three intern firefighters, and ten volunteer firefighters.

Astoria Fire Department personnel provide emergency services to the City of Astoria and our surrounding communities through our mutual aid agreement. With a population of just under 10,000 and heavy tourism including cruise ships that dock at the Port of Astoria and river boats that dock at 17th Street Dock, Astoria Fire Department is committed to providing trained and knowledgeable personnel prepared to respond to the needs of our community. The mission of the Astoria Fire Department is to provide emergency response, customer service and public education in partnership with our community.

We do this through our core values:

> INTEGRITY- the quality of possessing and steadfastly adhering to high moral principles and professional standards.

PRIDE- the correct level of respect for the importance and value of your personal character, life, efforts, or achievements.
COMPASSION- sympathy for the suffering of others, including a desire to help.
PROFESSIONALISM- the skill, competence, or character expected of a member in a highly trained profession.

Astoria Fire Department responds to fires, medical emergencies, motor vehicle accidents, and hazardous materials incidents within the city limits of Astoria and at Tongue Point. To better serve the community, the City of Astoria has two fire stations. One fire station is located in Uniontown at 301 W Marine Drive and the Public Safety Building which houses Fire, Police, and the Astoria 911 Center is located at 555 30th Street. The majority of the calls received, approximately 62%, are medical emergencies. In 2017, Astoria firefighters responded to 1,420 emergencies. In 2018 there were 1,444 emergencies, and in 2019 there were 1,399 emergencies.

Cannon Beach Fire

Figure II-25. Cannon Beach Fire District

Source: Cannon Beach Fire

The Cannon Beach Rural Fire Protection District was formed in 1947 to protect the citizens of the Cannon Beach area from the threat of fire. As the area grew, so did the need for more space and equipment. A second station was built in Arch Cape and in 1996, the original station (located downtown) was replaced with the current station at 188 East Sunset. The original mission of the volunteers was to extinguish fires; however, it soon became apparent that there were other demands for service. In the 1950's search and rescue was formed, and in the 1970's Emergency Medical Services. Soon after high angle rescue and surf rescue joined the list of provided services.

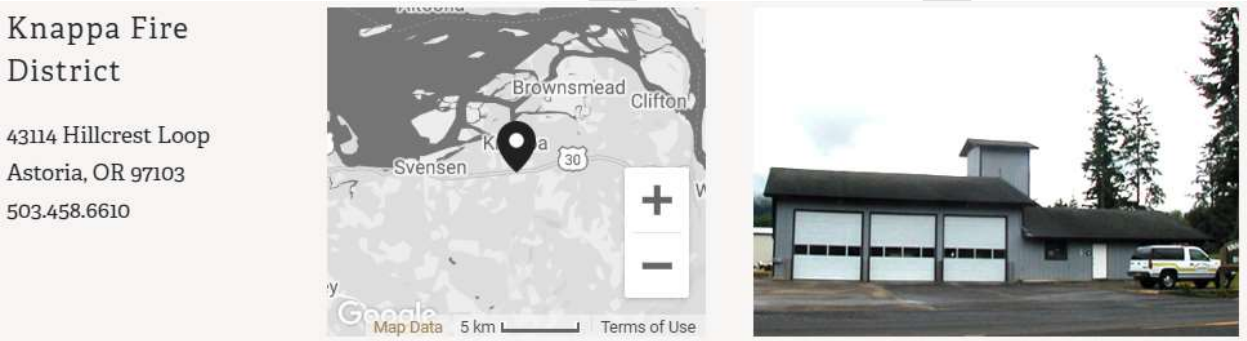
Today Cannon Beach Fire District personnel provide firefighting and EMS services to the Northwest Oregon coastal communities of Cannon Beach, Arch Cape, and Falcon Cove. With a population of 2,500 and 750,000 to 1,000,000 tourist visiting annually, Cannon Beach is committed to providing trained and knowledgeable personnel prepared to respond to the growing community and tourism needs. We strive to continually improve our organization through the use of innovation, allowing us to provide the highest level of service possible to those in need.

Cannon Beach Rural Fire Protection District (CBRFPD) responds to fire, medical, search and rescue, and water rescue emergencies from Hwy 26 & 101 junction south into Tillamook County into Oswald West State Park. Not to mention mutual aid to neighboring agencies. To better serve the community, volunteers living south of Cannon Beach can respond to our sub-station located in Arch Cape.

The majority of the calls received are medical emergencies. In 2016, CBRFPD responded to 421 calls and that included fires, search and rescue, and general assistance to the public and neighboring towns. In 2017, there were 428 emergencies, in 2018 there were 410 emergencies, and in 2019 there were 438 emergencies in total. On September 1, 2018, the Insurance Services Office Public Protection Classification (ISO_PPC) for the Cannon Beach, Arch Cape, and Cove Beach/Falcon Cove communities will be changing from a Class 4 to a Class 3. There are 3,456 fire agencies in Oregon and only 84 that have the Class 3 rating.

Knappa Fire District

Figure II-26. Knappa Fire District



Source: http://www.clatsopfirefighters.org/locations

The Knappa Fire District was founded in 1955. In the early years, the Fire District was comprised of approximately 12 square miles, one station, and 11 Volunteers. The District responded to an average of 12 calls for service a year. In 1957, the Fire District embarked into Emergency Medical Services (EMS). The Fire District implemented the Svensen Highway First-Aid Station. This consisted of 7 members attaining basic first-aid certification through the American Red Cross. In 1965, after the completion of the new Highway 30, the first-aid care was available in home. The firefighters made house calls. Mostly, it consisted of basic splinting and bandaging. In the early 1970's, when EMS was in its early stages following the implementation by Congress of the "Emergency Medical Services Act," the Fire District received an ambulance donation from the Astoria Fire Department.

Today "Knappa Rescue" as it is most commonly called, operates three Rescue Vehicles and is capable of not only providing a very high level of basic life support, but has extensive extrication equipment, capability of automatic defibrillation, and EMT Intermediate and Paramedic skills.

The Fire District purchased its first new fire engine in 1967, a Western States Front Mount 1,000 gpm/1,000 gallon tank. This vehicle served the Fire District very well for 30 years. Prior to the purchase of this vehicle the district relied on vehicles that were either donated or purchased for very small amounts. The Fire District has undergone changes within its management structure also. In May of 1990

the District increased its tax base to fund its first career Fire Chief and in April of 1991 that person was hired. This ended a 36 year tenure of Volunteer Fire Chiefs for the district. The Fire District has continued to grow over the years. The largest annexations occurred in 1978 with the addition of the upper Brownsmead and Fertile Valley area, in 2000 with the merger of Brownsmead, and in 2003 with the annexation of the Clifton, Bradwood, and Gnat Creek areas.

Today, the Fire District provides services with an average of 28 Volunteers and a career Fire Chief. Knappa Fire typically responds to about 400 calls for service annually. The District comprises of a geographic area of approximately 80 square miles with a population of roughly 3500. Geographically it is the largest Fire District in Clatsop County. This is in part because of its history of annexation. A merger with Brownsmead occurred in 2000 and a Clifton-Bradwood merger occurred in two stages, first in 2002, then was finalized by the County in 2005. These changes allocate state timber revenues to the District, but not private dollars.

Three Knappa Fire Station Addresses:

- 94141 Barendse Road, Astoria, OR
- 92768 Keller Road, Astoria, OR
- 43114 Hillcrest Loop, Astoria, OR

John Day Fire District is a separate district that contracts administration and response from Knappa Fire. This service territory includes John Day Slough and houseboats/float houses on Svensen and Blind Slough.

Lewis and Clark Fire District

Figure II-27. Lewis and Clark Fire District

Source: http://www.clatsopfirefighters.org/locations

The Lewis and Clark Fire District provides fire protection service to the Miles Crossing and Jeffers Garden areas of Clatsop County. The main station is in Jeffers Garden at 34571 U.S. Highway 101 Business—is located less than a mile away from the Lewis and Clark River. The second station is at 90216 Logan Road,

Astoria, OR. The department's main fire station and well within the tsunami inundation zone at very low elevation and the Logan Road site is at approximately 30'.

The District is operated by a Fire Chief, a part time training officer, and a department of 26 volunteers operating out of two stations. An experienced Fire Board consists of five members and is responsible for hiring and supervising the Fire Chief. Lewis and Clark Fire volunteers have trainings twice a month and completes between 2,000-4,000 hours of training per year.

The majority of the calls received are medical and motor vehicle accidents, comprising about 70%. Other calls include structural fires, wildfires, and special rescues. Fort Clatsop is managed by National Park Service and covered by Lewis & Clark for fire protection currently.

The department is embedded in this unincorporated area of Clatsop County so there is a lot of engagement that happens. From Safe kids (helmets, car seats) to water safety for Youngs River (Youngs River Falls, City of Astoria) to Firewise education about defensible space treatment techniques, to medical transports, Lewis and Clark RFPD have their pulse on their community. In fact, the Fire Chief and several Fire Board members assist with (or have in the past) the operation of the Water and Sewer Board. A lot of water system improvement has occurred in the last 10 years—many line replacements and leak reduction.

Two mitigation successes related to water—Lewis and Clark Fire increased the number of hydrants to 100 from 20-30; 90% of the District has fire hydrants. Changed ISO rating from 8-9 to 3-4.

Gearhart Fire Department

Figure II-28. Gearhart Fire Department

Source: https://www.gearhartfire.com/stations

Gearhart Fire Department was built by volunteers in 1958. The building is beyond its useful life and its replacement is a top priority of the City Council. The Gearhart Volunteer Fire Department (Gearhart Fire)

responds to approximately 500 incidents yearly, and has the capacity for 35 volunteers to serve on the roster. The Gearhart Fire covers 28 square miles ranging from Cullaby Lake in the North, extending to Gearhart City limits to the South. From milepost 8.5 on Lewis & Clark Road to the East and to the Pacific Ocean on the West. The department responds from 2 stations, Station "2900" located at 670 Pacific Way in Downtown Gearhart and from the Hertig Station at Hwy 101 & Westlake Lane.

Gearhart Fire responds to all emergencies including but not limited to; all fires, emergency medical calls, vehicle accidents, natural disasters, hazardous materials incidents, requests for public assist, search & rescue, and automatic/mutual support to departments throughout the county and statewide when needed. The community evidenced their support for fire station mitigation from a Cascadia subduction zone earthquake and tsunami event by endorsing a relocation site located outside of the large tsunami scenario in 2019.

Seaside Fire & Rescue Department

Figure II-29. Seaside Fire Department

Source: http://www.clatsopfirefighters.org/locations

The Seaside Fire & Rescue Department (SF&R) responds to approximately 1,500 calls per year with 35 volunteers and 4 career staff. SF&R has a full complement of resident volunteers who attend college and live at the fire station to learn work experience.

The Seaside Fire & Rescue Department continues to be very active with prevention, inspections, investigations, trainings, meetings, and the lifeguard program. The lack of rain and snow for the last few years once again made for extreme fire conditions last summer that ended up sending firefighters on numerous wildland conflagration events in the states of Oregon and California. More information is available in the SF&R Annual Report 2018:
http://www.cityofseaside.us/sites/default/files/docs/fire_department_annual_report_2018_.pdf

SF&R Equipment

- Ladder “Truck” (tiller) carries more than 200 feet of ground ladders and has one 100-foot aerial device along with extra heavy tools and equipment used at fires for rescue, removing smoke and

gases from buildings during a fire and controlling the utilities to a building. Crews consist of one captain, one driver/engineer, and two firefighters (two ladder trucks also have a driver on the rear part of the truck).

- A new Tractor Drawn Aerial (TDA) Ladder Truck arrived in 2019.
- Lucas device: Automatic strap-on CPR machine. Benefits: With the LUCAS device, fatigue, individual variations or psychological factors are removed from CPR and there is no longer a need for switching CPR providers every two minutes. LUCAS helps provide high-quality and safer chest compressions in situations such as patient movement and transportation, during prolonged CPR.
- 2 Type 1 Engines both engine equipped with airbags, struts, intermediate life support (ILS) medical equipment, 1 Lucas Device.
- 1 Type 1 Tender equipped with BLS medical equipment and an AED.
- I Tractor Drawn Aerial Quint fully loaded with, rope rescue, confined space rescue, trench rescue, and ILS Medical Equipment and 12 lead heart monitor.
- 3 Jet Ski's
- Tech Rescue Pickup fully loaded with water and rope rescue equipment, also has a 25 gallon gas tank with pump to fill ATV's and Jet Ski's, also has BLS Medical Equipment and AED.
- 2 Side by Side ATV's fully loaded with water rescue equipment, BLS Medical Equipment and AED's
- SF&R is equipped with a full water rescue team (with wetsuits, dry suits), as well as a full rope rescue team (with all the harnesses, Arizona Vortex, and rope) to respond to high angle rescues from ocean cliffs.
- In 2018, SF&R put into service a new MSA Self Contained Breathing (SCBA) Apparatus, Rapid Intervention Kits, confined space units, and new SCBA air fill station.

Warrenton Fire Department

Figure II-30. Warrenton Fire Department

Source: City of Warrenton

The City of Warrenton Fire Department provides service to the City of Warrenton and contract services to the Warrenton Rural Fire Protection District. The city also provides fire protection service to Fort Stevens State Park, Camp Rilea Military Training Site, the Astoria/Warrenton Regional Airport and USCG Air Station. The department has a career staff of two, including a Training Officer and Firefighter. The department currently has two fire stations with two paid staff and approximately 25 dedicated volunteer firefighters located in Hammond and Warrenton.

Water Infrastructure

Arch Cape Domestic Water Supply District

Arch Cape is a remote rural community with minimal development other than residential use. The area is served with drinking water by the Arch Cape Domestic Water Supply District (ACDWSD or Arch Cape Water District) and by the Arch Cape Sanitary District (ACSD) for sewer.

Arch Cape Domestic Water Supply District (ACDWSD) was formed in 1977 under ORS 264 and included two previously incorporated water districts (Price and Dichter systems). The piping systems were connected and served 167 connections and provided domestic water supply to the southern coastal fringe of Clatsop County, specifically the Arch Cape community.

ACDWSD serves 335 households with 3 District employees: a part-time administrative staff person and two operations staff: Phil Chick, Matt an operator of both the water and sanitary facilities.

Arch Cape Sanitary District

The water and sanitary districts serving Arch Cape are operated together. The customer, staff, and general hazard risk is fully described in the ACDWSD section above. However, there are some important differences in terms of operating plans, etc. that are listed below. Staff and Board members from both organizations participated equally in the process and this integration should be seen as a strength of efficiency rather than a deficit.

Falcon Cove Beach Domestic Water Supply District

Falcon Cove is a small, remote unincorporated area where the sole development use is residential. It is surrounded by Oswald State Park forest lands to the south and east that are used for recreation and provide water supply and watershed protection to the Falcon Cove Beach Domestic Water Supply District, known as the Falcon Cove Beach Water District (FCBWD). There are private timber lands east of the State Park that influence water production.

Falcon Cove Beach Water District (FCBWD) is a community water system designed to serve 95 connections and a population of 200 (C.Dice, 2018). Of the 92 homes, less than 15 are occupied by full time residents and 30 are used as short-term rentals. The community and water system is entirely located on the west side of Highway 101.

Hospitals

Clatsop County has two hospitals. While every critical facility is important in the event of a natural disaster, the places that care for people who are sick or injured is extremely essential. It is also extremely important that these facilities maintain an uninterrupted supply of power and water.

Columbia Memorial Hospital is an accredited 49-bed hospital, which serves all of Clatsop County, Oregon and the lower Columbia River region of western Washington. Operating from income from services provided, the Hospital is not tax supported. Learn more about our hospital and its services at Columbia Memorial Hospital's website http://www.columbiamemorial.org/. Physical location: 2111 Exchange St., Astoria, OR 97103.

Providence Seaside Hospital is part of the not-for-profit Providence Health & Services, Oregon's largest health system and largest private employer. Providence Seaside serves people living in or visiting the North Coast area through our hospital and clinics located in Warrenton, Seaside, Cannon Beach, Wheeler and Astoria. For more information, please visit www.providence.org/northcoast. Physical location at: 725 S. Wahanna Rd, Seaside, OR 97138.

At the January 28, 2020 Clatsop NHMP Steering Committee meeting, Maria Ross, Public Health Emergency Preparedness liaison with Oregon Health Authority, gave a presentation entitled "Building Coastal Hospital Resiliency". Her talk explained the Coastal Hospital Resilience project and the role of Oregon Health Authority its service regions and organizational structure.

Most hospital buildings in Oregon were constructed prior to any knowledge of the risk of a magnitude 9 Cascadia earthquake and tsunami and before significant seismic building code provisions were enacted in the mid-1990s. Oregon's coastal hospitals are especially vulnerable due to their proximity to the Cascadia subduction zone. Seismic vulnerability is increased by poor construction as a result of inadequate building codes and by long-term disruptions of emergency fuel and water supplies likely to

follow a major earthquake. Given current conditions, post-earthquake operations are expected to be severely impacted, which will limit the ability of hospitals to provide healthcare services to their communities.

As part of the Coastal Hospital Resilience Project, the Oregon Health Authority (OHA) Healthcare Preparedness Program (HPP) regional liaisons and the Oregon Department of Geology and Mineral Industries (DOGAMI) are partnering with the 11 hospitals along the Oregon coast to engage in disaster preparedness planning. Leadership at all 11 coastal hospitals are committed to preparing to be able to provide healthcare services immediately after a Cascadia earthquake and tsunami. Preparing for Cascadia earthquakes will also help with preparing for other types of disasters, such as winter storms and human-caused disasters.

Hospital decision makers, including leadership, facility managers, emergency planners and other personnel, require practical scientific information and technical guidance on Cascadia disaster preparedness. This report, which is part of the Coastal Hospital Resilience Project, includes three guidance documents designed to assist hospitals personnel in their preparedness efforts.

See Appendix A5 for Hospital Resilience Guidance.

Communications Infrastructure

Emergency Communications

In Clatsop County there are two primary emergency (9-1-1) call centers, or public-safety access points (PSAPs)—one operated by the City of Astoria (Astoria 9-1-1) and other one operated by the City of Seaside (South Clatsop County Dispatch /o Seaside Police Dept.). The Oregon State Police operate a secondary PSAP at the Northern Command Center in Salem (OEM, n.d.)

In the early 1970's most agencies handled their own dispatching services. As the demand started to grow for all residents to have access to 9-1-1, dispatching functions became consolidated under central answering points. In 1994 Oregon required all emergency dispatchers to be certified the same as a police officer or fire fighter. Today, the occupation of emergency dispatching has become highly specialized. Oregon requires all dispatchers to attend a two-week state academy. After this training is complete trainees then move into a 4-6 month intensive local training program under the direct supervision of an experienced Field Training Officer (FTO). Once completed, they are able to operate the radio, take 9-1-1 and non-emergency phone calls, operate the Computer Aided Dispatch system, operate the Law Enforcement Data terminal, and are also Emergency Medical Dispatch certified (Astoria Dispatch, 2020).

The State of Oregon has enhanced 9-1-1 (E911) which allows the location of the caller to be automatically transmitted along with the call. The technology displays both the locations of hard wired land-line 9-1-1 calls (the phone address and call back number) and the GPS coordinates for Phase-2 cellular 9-1-1 calls (Seaside Dispatch, 2020) as regulated by the Federal Communications Commission (FCC).

Astoria Dispatch

Astoria 9-1-1 operates twenty-four hours a day year round and has a staff of nine Dispatchers and one Manager. Astoria 9-1-1 began in 1977 and operates under the governance of the City of Astoria.

Subscriber Agreements are established with more than fifteen agencies. Astoria 9-1-1 answers calls from all citizens in Astoria, Warrenton, and the County except for the cities of Seaside, Gearhart, and Cannon Beach. Astoria 9-1-1 dispatches for the following:

FIRE DEPARTMENTS:

- Westport Fire & Rescue
- Knappa, Svensen, Burnside RFPD
- John Day – Fernhill RFPD
- Astoria Fire Department
- Warrenton Fire Department
- Warrenton RFPD
- Lewis & Clark RFPD
- Olney Walluski Fire & Rescue
- Elsie Vinemaple RFPD
- Oregon Department of Forestry
- USCG Air Station Astoria Fire Department
- Camp Rilea Fire Department

LAW ENFORCEMENT AGENCIES:

- Astoria Police Department
- Clatsop County Sheriff
- Warrenton Police Department
- Port of Astoria Security

Seaside Dispatch

Seaside's Communications Center began radio dispatching for Seaside and Gearhart Fire Departments in the 1950's. In 1972, Seaside was the second city in the state to acquire 9-1-1. Staffing consists of a Communications Manager and 6.5 dispatchers. Seaside also utilizes support staff, who are cross-trained and certified to augment communications as necessary. This staffing level allows for primarily two dispatchers on duty, other than early morning hours. Our dispatchers and support staff also serve as receptionists for our agency.

Seaside 9-1-1 serves all of south Clatsop County and east up Highway 26 to Saddle Mountain, including Hamlet, Arch Cape, Cannon Beach, Seaside, Gearhart and the south end of Warrenton. This is dispatch for calls for police and fire, and transfer of medical calls to Medix Ambulance Service. Seaside Dispatch acquired the current transmission site atop Tillamook Head in 1988. The site provided better radio communications to outlying areas (Seaside Dispatch, 2020).

The City is in the process of updating its communication system. The equipment at the repeater sites has become dated and has since prohibited clear reception between radio users. A new transmitter has been erected at the new East Hills reservoir site adjacent to the new High School/Middle School. This site will soon become the City's EOC location. Other repeaters throughout the county have also been updated to improve City communication among other agencies. They are:

- Tolovana (just south of Cannon Beach)—This is an existing site. Old equipment is being upgraded from voter to repeater type radio equipment. It is outside of the tsunami inundation zone.
- Tillamook Head—Replaced old aging equipment. Outside inundation zone.
- Humbug—Completely new site. Repeater type radio equipment. Outside inundation zone.
- Seaside Police Department—Update to switch apparatus, which is part of interoperability to Astoria dispatch.

Private Telecom

Other utilities include telephone services, provided by Qwest, and data lines, provided by Charter Communications. 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 was completed shortly thereafter.

Electricity and Gas

Pacific Power Company supplies electricity to the western and northern parts of Clatsop County. West Oregon Electric Cooperative, Inc. < https://www.westoregon.org/> electric service to much of the southeastern County, and a small area in northeast Clatsop including Westport is served by Clatskanie Peoples' Utility District (PUD) <https://www.clatskaniepud.com/>. Pacific Power has been an active partner in improving wind and winter storm resilience. They are burying power lines where feasible to reduce the impacts of wind and winter storm events.

Northwest Natural Gas provides the natural gas service. At the January 28, 2020 Clatsop NHMP Steering Committee meeting in Astoria, Tiffany Brown gave a presentation entitled, "Emergency Fuel Planning: A Local and Regional Overview". She provided background and information on the vulnerabilities of the Critical Energy Infrastructure (CEI) Hub in Portland in the event of a Cascadia Earthquake and challenges that will be faced at the local level, both direct and indirect hazard impacts. A dataset on local fuel storage locations is being compiled.

Transportation

Transportation infrastructure is an important consideration when planning for emergency service provisions. It is also critical to essential functions. A detailed understanding of the local jurisdictional transportation and commuting patterns requires review of the local comprehensive plans, the zoning ordinances, US Census data, the coordinated population forecast, and descriptions of transportation facilities on ODOT and Clatsop County transportation maps.

The principal roads, bridges, and highways of the County are susceptible to landslides due to topography, bedrock geology and local soil profiles. Clatsop County is especially vulnerable to earthquake hazards from regional seismicity, earthquake-induced landslides, and especially the Cascadia Subduction Zone (CSZ). These transportation corridors form the backbone of the lifelines that support function, response, and recovery of Clatsop County communities.

Transportation and Evacuation Planning: Tsunami Mitigation

Evacuation from the risk of a tsunami caused by a local earthquake is a high priority mitigation action shared by all participating jurisdictions. Evacuation planning involves a strong education and outreach component coupled with an evacuation plan based upon the community transportation infrastructure.

There are two key policy mechanisms used to implement these evacuation plans: tsunami evacuation routes defined in the Gearhart Transportation System Plan and a tsunami overlay zone (THO zone). These documents have been integrated into the city comprehensive plan and zoning ordinance to assure future development will be aligned with the tsunami plans. As evacuation routes and resiliency measures such as reducing dwelling density in high risk areas must be woven into the design of the community, updates to transportation and comprehensive plans provide the opportunity to make improvements and should be considered a best practice approach to tsunami evacuation planning. The following jurisdictions are taking steps to improve their community's tsunami resilience through transportation and evacuation planning:

Table II-19. Tsunami Evacuation Planning by Jurisdiction

	Clatsop County	Astoria	Cannon Beach	Gearhart	Seaside	Warrenton
Tsunami Education and Outreach*	X	X	X	X	X	X
2013 Tsunami Evacuation Route Map (DOGAMI)	X	X	X	X	X	X
Transportation Plans/ Update			X	X		
Tsunami Evacuation (Facility) Plan	X			X		
Tsunami Overlay Zone				X		
Comprehensive Plan Integration				X		
Other Plans (Park, etc.)				Pending Park Plan 2022		

Note: X is used to indicate tsunami mitigation efforts that are underway or complete. *All plan jurisdictions contribute to tsunami awareness. Astoria has a TSP and Comp Plan, but neither address tsunami evacuation. Clatsop County is in the process of completing a TEFIP with a TGM grant from DLCD (Jan. 2021). Gearhart included key components of a Tsunami Evacuation Facility Plan (tsunami evacuation routes and improvements) into their existing Transportation System Plan.

Roads

Three major highways converge in Clatsop County: Highway 101 (Pacific Coast Scenic Byway), Highway 26, and Highway 30. Interstate I-5, the only four-lane, north-south freeway is at Longview, Washington, about 50 minutes east of Astoria. US-101 is the only continuous passage for automobiles and trucks traveling north-south along the Oregon Coast.

Two major transportation routes run through Astoria, Federal Highways 30 and 101. Highway 30 runs east to west from Westport to Astoria and Highway 101 comes into Astoria over the Columbia River on the Astoria-Megler Bridge to the north and into Warrenton via Young's Bay to the south. State Highway 202 runs along the southern edge of Astoria and continues into the center of the County to Jewell. Continuing south, Highway 101 links all the major population centers of the county—Gearhart at the south end of the Clatsop Spit, then into Seaside at the mouth of the Necanicum River, and further onto Cannon Beach, Arch Cape, and Falcon Cove Beach, south of the intersection with Highway 26. Warrenton is connected to US 101 by secondary roads: East Harbor Drive which runs east west and South Main Avenue which runs north and south. The major arterial going through Cannon Beach, Hemlock St, connects to Highway 101 on its northern and southern ends. Clatsop County's transportation system currently consists of approximately 250 miles of roads, 68 bridges and three ocean beach approaches (Clatsop County, 2013).

Bridges

Bridges and tunnels need to be retrofitted to withstand ground shaking. The figures below 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 in the event of a major earthquake.

Table II-20. Bridge Inventory for 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 http://www.oregon.gov/ODOT/HWY/BRIDGE/docs/brlog.pdf

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. 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.

Highways

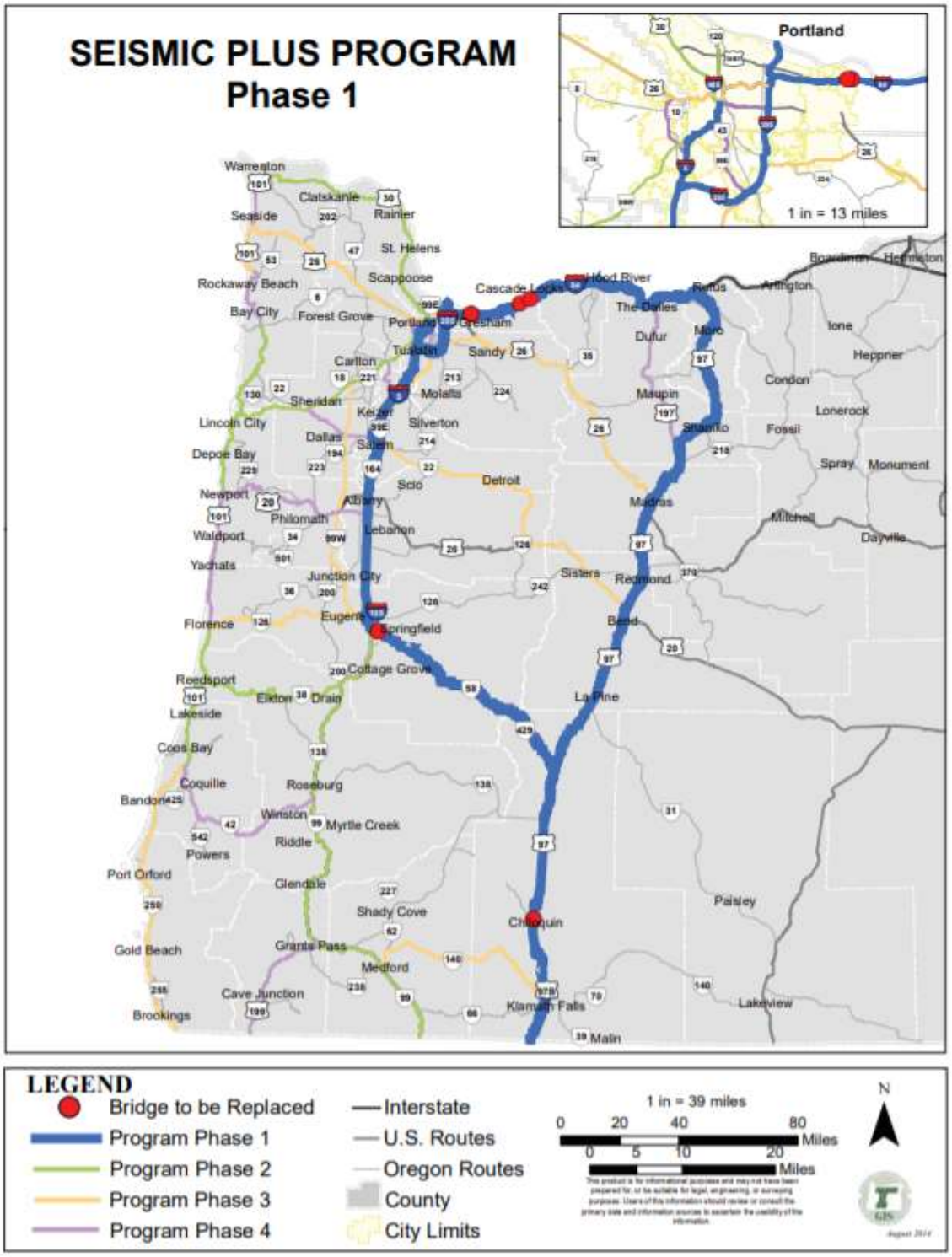
The Oregon Department of Transportation manages the major highways in the State of Oregon. These corridors have expensive transportation infrastructure designed to carry heavy traffic or traverse areas that require significant engineering to construct such as the following bridges or along the highly erosive Oregon Coast.

Figure II-31. Highway 101 Bridges of Clatsop County

Source: ODOT __

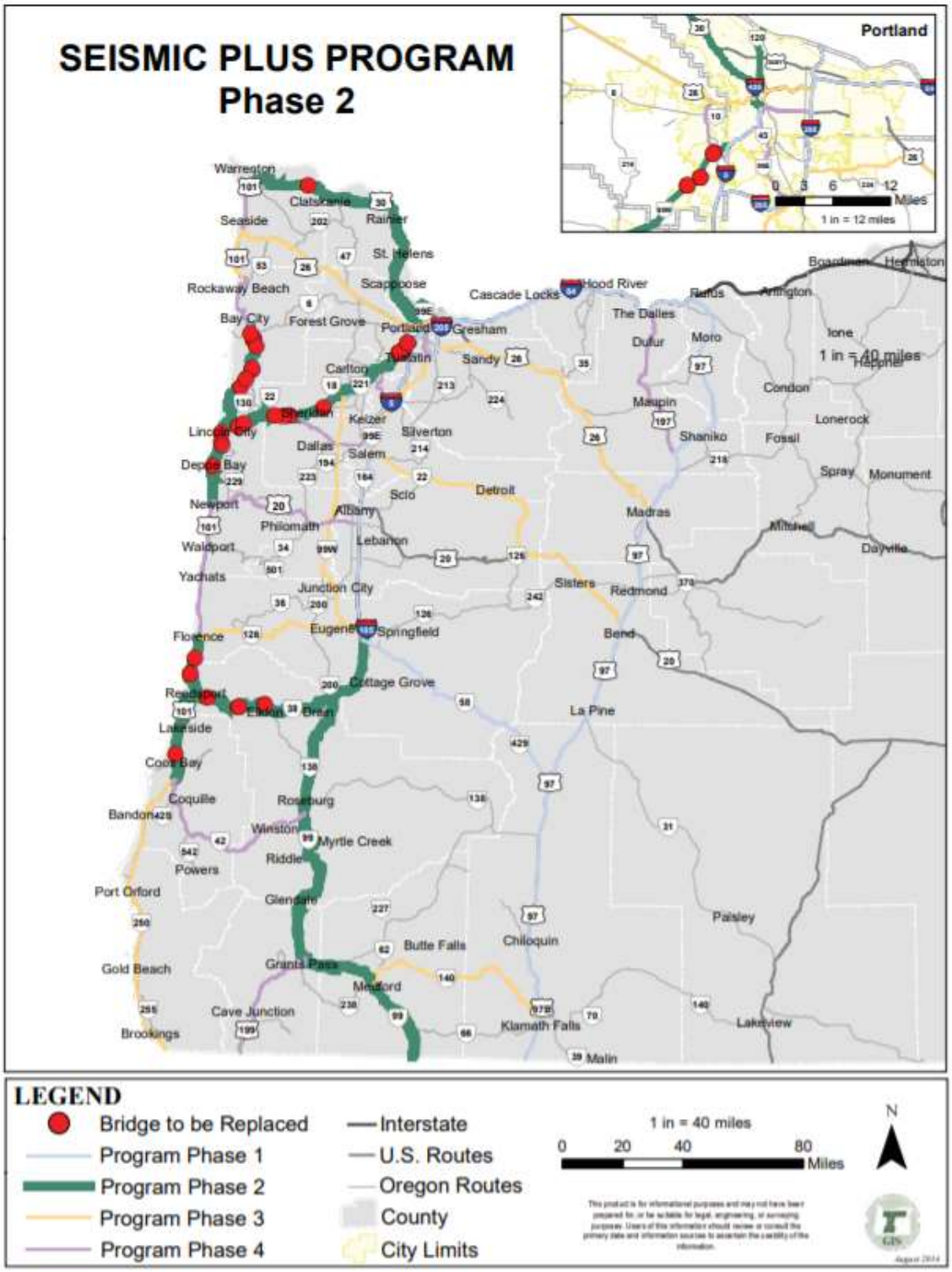
ODOT is systematically improving the seismic resilience of their bridges and road system via the Seismic Plus Program. This work is being done in stages to address the high cost of retrofitting bridges. Phase 1 will be done first. It addresses Interstate 5 and two ways of accessing the airports in Eastern Oregon (Bend and Redmond) that are anticipated to have much less serious damage in a severe earthquake event than the Oregon Coast. These corridors are being reinforced so that they may serve as lifelines for response and recovery in a major Cascadia earthquake event. Phase 2 will address some of the Oregon Coast. For Clatsop County, it will provide reinforcement along Highway 30 in the Columbia Gorge and then access to counties south (ODOT, 2014).

Figure II-32. ODOT Map Seismic Plus Phase 1



Source: ODOT, 2014.

Figure II-33. ODOT Map Seismic Plus Phase 2



Source: ODOT, 2014.

Transit: Sunset Empire Transportation District (SETD)

The Sunset Empire Transportation District (SETD) was formed in 1993 and provides transit service to Clatsop County and beyond. SETD serves over 37,000 citizens in Clatsop County with 41 District employees: administrative staff, mechanics, and 23 bus drivers and 6 others with commercial driver's licenses (NW Transit, 2019). The Clatsop County boundary is the SETD tax district boundary. The District operational area consists of three facilities, bus shelters, stops along transit routes, roads, and anywhere there are residences as certain programs offer curb-to-curb service (Lewicki, May 2019).

Changes recommended in the SETD Long Range Comprehensive Transit Plan (Sept. 2016) were funded in the 2017 State of Oregon Transportation funding bill by allowing a new tax (1/10 of 1% of payroll). These include: route re-alignment, adding weekend service, adding routes, adding vehicles, and adding a significant number of employees.

Sunset Empire Transportation District (SETD) has a variety of programs to improve accessibility of transit services:

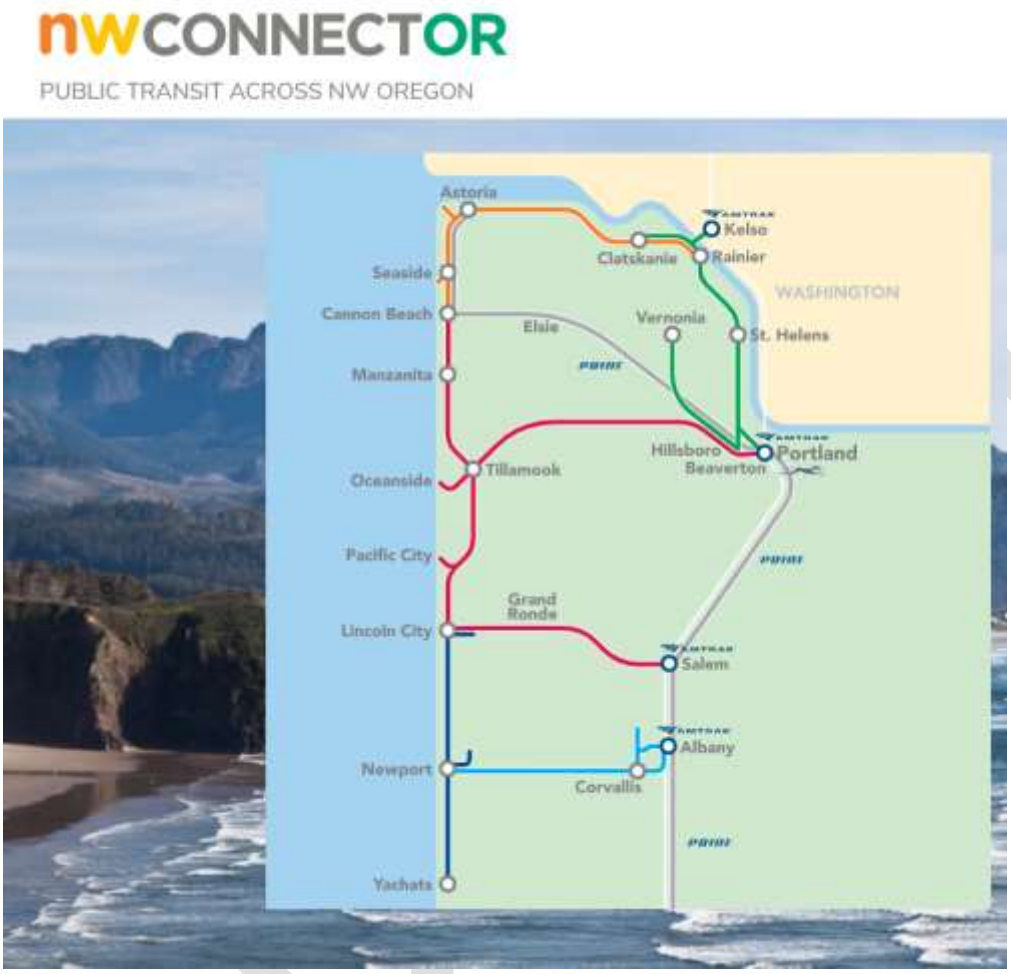
- RidePal: This service provides travel training which includes all the tools that a person needs to ride the bus with confidence. RIDEPAL staff are trained to provide easy step by step instructions and make sure that transit questions are answered.
- Bus Orientation: One on one instructions on the basics of riding a bus.
- RidePals: Individual Travel Training
- Group Travel Training: Bring your friends and learn how to plan a bus adventure down the coast or to Portland.
- Paratransit Services: These are curb to curb and vehicles are wheelchair accessible and comparable to the existing SETD bus services being operated within the designated service area. Individuals certified with conditional eligibility are encouraged to use regular fixed route bus service whenever possible.
- Dial-a-Ride: Dial-a-Ride is curb to curb transportation that travels beyond the scope of our regular Fixed Route Bus and Paratransit Services and is available only through advance reservations.

Transit Partnerships:

- NW Connector: The focus of SETD's transit partnerships is regional mobility. A member of the Northwest Oregon Transit Alliance, SETD is one of five counties that do a joint marketing (signage, strategies) and ticket sales to bring people to the coast from the valley. Transit agencies usually do not necessarily coordinate their schedules with neighbors, and tell our story at national conferences, but NWOTA is a model for how to do such coordination.

Figure II-34. NW Connector Transit Agencies

Figure II-35. NW Connector Route Map



Source: NW Connector, 2019. Note: SETD partners with four other transit districts to provide regional bus service.

Rail Service

Rail service is not available in Clatsop County.-The line from Tongue Point east was determined to be too costly to repair in recent years. The City of Astoria owns the line west of Tongue Point to the Port of Astoria. There is no freight or passenger service to Astoria. The 2003 passenger service was a specialty train for the Lewis & Clark Bicentennial only (R. Johnson, 2020, personal communication).

Maritime: Port of Astoria

The Port of Astoria connects Clatsop County to the sea. Located on the Astoria waterfront 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 has been a center of maritime activity for more than 100 years. The Port's vision is to be a significant contributor to the community's and state's economic development and a catalyst for job and business creation in Clatsop County (Port of Astoria, 2019).

The Port's facilities are the first on the Columbia River and include three piers with deep-water ship berths and a barge ramp. The Port of Astoria has been a port of call for cruise ships since 1982 and serves as a docking site for cruise ships with 19 dockings in 2008 and 17 dockings with 28,915 passengers in 2015; 23 dockings with 42,962 passengers in 2016; 19 dockings with 42,688 passengers in 2017; 23 dockings with 43,942 passengers in 2018; 18 dockings in 2019 with 33,758 passengers. Tentative 35 dockings with 69,517 passengers in 2020 (number of dockings was reduced due to the COVID 19 virus quarantines); and tentative 13 dockings with 28,890 passengers in 2021 (City of Astoria, 2020).

Maritime Assets:

- Central Waterfront includes Piers 1, 2, 3.
- East Mooring Basin: Fishing and private vessels
- Fishing pier, boat ramp, boat mooring, accessed by a causeway. (Causeway is closed)
- West Mooring Basin: Marina with many long-term private owners as well as a fueling station and day-use marina.
- Marine terminal: Pier 1
- Cruise ships, river boats, research vessels and other large vessels
- Port Industrial Area
- Local Businesses
- Rental Properties
- Skipanon estuary land
- POA owned land

Figure II-36. Port of Astoria Maritime Operations Aerial Photo

Source: USDA, ESRI.

Air: Port of Astoria Regional Airport

Port of Astoria Regional Airport (AST) is a public airport located in Warrenton and is home to the Coast Guard Sector Columbia River.

Airport Industrial Park

The Port of Astoria Regional Airport, operated by the Port of Astoria, is located on 870 acres in Warrenton, four miles south of downtown Astoria. The facility is located at 1110 SE Flightline Drive, Warrenton, Oregon 97146. It 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.

The Port of Astoria Regional Airport Industrial Park is a 45-acre site adjacent to AST that is available for industrial development or logistics warehouse capacity (Port of Astoria, 2019).

Figure II-37. Port of Astoria Regional Airport Drone Photo

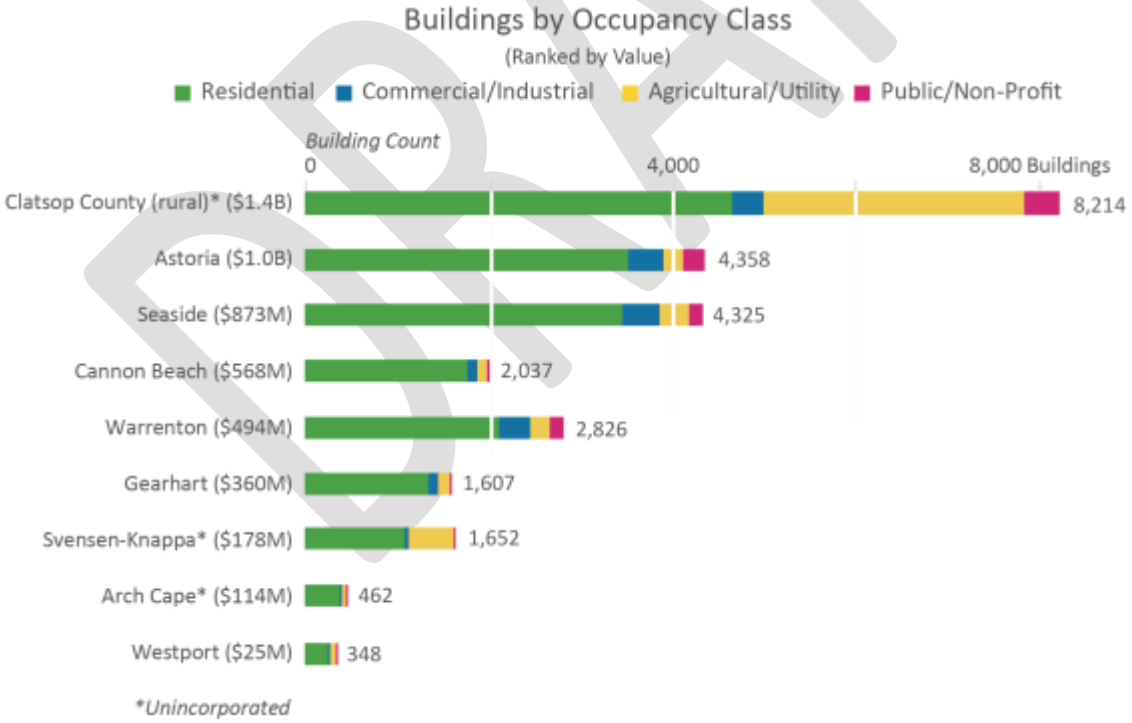
Source: WireLizard, Creative Commons. https://commons.wikimedia.org/wiki/File:Astoria_Regional_Airport.jpg

7. Built Environment

One way to look at the potential risk from natural hazards is from a community building value perspective. The current value or replacement cost of a structure is an indication of what could be lost in a large event. Information about the population size, land use types, and economic capacity of a particular area can also be conveyed.

The risk analysis conducted by DOGAMI in Open-File Report O-20-16 *Natural hazard risk report for Clatsop County* (Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020) uses the ArcGIS mapping tool to overlay flood and geohazard information across the database of buildings to conduct analyses of which buildings will be impacted. The building inventory was developed from several data sources and was refined for use in loss estimation and exposure analyses. Clatsop County supplied assessor data that was formatted for use in the risk assessment. Tax lot data, which contains property boundaries and other information regarding the property, was obtained from the county assessor and was used to link the buildings with assessor data. The linkage between the two datasets resulted in a database of User Defined Facilities (UDF) points that contain attributes for each building. These points are used in the risk assessments for both loss estimation and exposure analysis. The table below illustrates the variation of building value and occupancy across the communities of Clatsop County (Williams et al, 2020)

Figure II-38. Community building value in Clatsop County by occupancy class



Note that "Clatsop Co. (rural)" excludes incorporated communities, Arch Cape, Svensen-Knappa, and Westport. Source: Williams et al, 2020, p.12.

Table II-21. Clatsop County building inventory (detail by type).

(all dollar amounts in thousands)

	Residential			Commercial and Industrial			Agricultural			Public and Non-Profit			All Buildings*			
Community	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Building Value ($)	Building Value per Community Total	Number of Buildings	Number of Buildings per County Total	Building Value ($)	Building Value per County Total
Unincorp. County (rural)	4,657	646,370	47%	348	439,782	31.9%	2,820	139,226	10%	389	153,585	11.1%	8,214	32%	1,378,964	27%
Arch Cape	399	103,630	91%	3	1,343	1.2%	48	4,424	4%	12	4,287	3.8%	462	1.8%	113,684	2.3%
Svensen-Knappa	1,103	140,552	79%	30	5,813	3.3%	491	23,228	13%	28	8,456	4.7%	1,652	6.4%	178,049	3.5%
Westport	262	17,450	70%	12	1,997	8.0%	63	2,602	10%	11	2,879	11.5%	348	1.3%	24,928	0.5%
Total Unincorp. County	6,421	908,003	54%	393	448,934	26%	3,422	169,480	10.0%	440	169,207	10.0%	10,676	41.3%	1,695,624	33.7%
Astoria	3,524	539,468	52%	394	200,656	19.3%	214	8,422	1%	226	288,513	27.8%	4,358	17%	1,037,058	21%
Cannon Beach	1,765	485,477	85%	110	50,941	9.0%	116	8,560	2%	46	22,897	4%	2,037	7.9%	567,876	11.3%
Gearhart	1,349	312,942	87%	111	31,379	9%	130	7,470	2%	17	8,180	2%	1,607	6.2%	359,970	7.2%
Seaside	3,467	659,457	76%	394	111,039	13%	327	24,375	2.8%	137	77,633	9%	4,325	16.7%	872,504	17.4%
Warrenton	2,124	273,264	55%	333	133,509	27%	215	12,361	3%	154	74,546	15%	2,826	10.9%	493,680	9.8%
Total Clatsop County	18,650	3,178,611	63%	1,735	976,458	19%	4,424	230,667	5%	1,020	640,975	12.8%	25,829	100.0%	5,026,711	100.0%

Source: Williams et al, 2020, p.69. ** DLCD note: DOGAMI uses building footprint data which results in a higher number than permitted structures.*

Housing

Of all resident-occupied housing stock across the county, 67% is single family homes, 6% are mobile homes, and the remaining 27% is some type of attached structure. Most detached structures (single family homes and mobile homes) are owner occupied, while the majority of attached structures are renter-occupied. The vacancy rate of ownership housing is low in rural Clatsop County (7%), Warrenton (8%), and Astoria (14%), but relatively high in the more tourism-dependent areas of Cannon Beach (63%), Gearhart (57%), and Seaside (34%) (Johnson Economics, 2019).

Single-Family Dwellings

Single-family dwellings can be detached like a stand-alone residential structure or attached, like a duplex or townhome. They are distinct from multi-family housing by their discrete entrance to the outside and to the street via an exterior access like a yard.

Multi-Family Dwellings

Multi-family units are those with two or more attached living spaces that do not have separate entrances, yard space, and other characteristics that distinguish them from some duplexes, townhomes, and condos.

Apartment buildings constructed with unreinforced masonry are of particular concern for earthquake risk. At nearly a quarter of all housing across the county, there are 3,622 multi-family units. An analysis of the age of these structures could provide insight into the location and type of risks facing local communities.

Mobile Home or Other

This category of housing could be considered a measure of vulnerability from a natural hazard standpoint. “Other” housing could be unpermitted structures or vehicles. Mobile home housing is often less insulated, lacking a full foundation, or may not be compliant with requirements to elevate or strap the unit down to the foundation. Consider the location and type of mobile home housing to prepare for and mitigate natural hazards.

Table II-22. Mobile Home Housing Units

			Units in Manufactured Home Parks			
	Total	**Other**	**Total in Parks**	**Astoria-Knappa-Westport**	**Seaside**	**Warrenton**
Mobile Home or Other	1,117	363	754	233	250	271
55+ Park	-	-	275	32	86	157
Family	-	-	479	201	164	114

Source: US Census Bureau (2014-2018). American Community Survey, Housing Characteristics for Occupied Housing Units. https://data.census.gov/; Bolton, Megan (2019, Jan. 16.) OHCS Mobile Home Parks with OR Districts.

Figure II-39. Map of Manufactured Home Parks

Source: Bolton, Megan (2019, Jan. 16.) OHCS Mobile Home Parks with OR Districts. State of Oregon

Mitigation Considerations

Certain housing types tend to be less disaster resistant and warrant special attention. Manufactured or mobile homes, for example, are an important component of affordable housing and the designs are improving, but are generally more prone to wind and water damage than standard stick-built homes. Older structures can present a challenge due to the cost and complexity of upgrades. Unreinforced masonry structures (URMs) or brick buildings, often carry an historic designation but require extensive work or demolition in order to become seismically stable. Unfortunately, the 150 years of construction that occurred prior to our geologic understanding of the extreme earthquake risk in the Pacific Northwest means that many older structures would be dangerous in a high magnitude seismic event.

Table II-23. Housing Age by Year-Built – Occupied Units, Clatsop County

	Clatsop County	
Housing Age	**Total Occupied**	**% Occupied**
	15,910	**100%**
2014 or Later	323	2.0%
2000-2013	2,057	12.9%
1960-1999	7,054	44.3%
Before 1960	6,475	40.7%

Source: US Census Bureau (2014-2018). American Community Survey, Housing Characteristics for Occupied Housing Units. https://data.census.gov/

Building Codes

Construction practices improve over time and new buildings are built to higher standards. This is because building codes have been improved as scientific understanding of natural hazards has grown.

In Oregon, the state legislature established a "uniform" building code in 1973. The Building Codes Division provides uniform standards that ensure newly constructed residential and commercial buildings are safe for citizens to occupy. Oregon's Statewide Building Code is available online at:

https://www.oregon.gov/bcd/codes-stand/Pages/adopted-codes.aspx

Building codes are updated as the science and technology for best practices emerges and industry demands. Each building, electrical, and plumbing code update uses resources that are more fire-retardant, more flood-proof, and with greater structural integrity to endure loads from snow, wind, earthquakes, and daily use. Building code updates occur at the state level. As they are approved, changes can be found online: https://www.oregon.gov/bcd/codes-stand/Pages/codebook-history.aspx

Land Use and Development

Land use planning in Oregon consists of a system of laws and government collaboration that is rare in the United States. Voters approved the framework for the system in 1973. The system now preserves vast areas of land for farm and forest production, protects habitat, conserves natural and historic resources, and protects air and water, all while continuing to allow development of land for homes and businesses. The comprehensive land use planning system in Oregon begins with a set of 19 Statewide Land Use Planning Goals. These goals address the local process of land use planning, direct the state's resource preservation, give guidance for urban development, and offer direction to cities and counties who need to plan for coastal assets.

Local governments are responsible for meeting these land use goals via the implementation of their local rules and permit systems. The outcome of the goals is as unique as each city and county of Oregon – each local government develops a comprehensive plan that addresses the resources, constraints, and opportunities specific to the place. Zoning ordinances and zoning maps implement the comprehensive plans, along with master plans for infrastructure and overlay zones to implement particular land use goals, etc. The comprehensive plans for each city and county identifies land use needs within the planning area as well as the urban growth boundary (UGB), an evidence-based approach is used to change these foundational documents as required by statute. For example, community-specific housing studies that include a Buildable Lands Inventory (BLI) as a part of a Housing Needs Analysis (HNA), document population, the projected population change, the lands available and their constraints, in addition to a suite of other development considerations. From a hazards perspective, the Buildable Lands Inventory process will identify the majority of severe hazard risks that a community faces—such as those occurring in the 100-year flood zone, in wetlands, at severe slopes, etc. The lands that face hazards that are included in the inventory may be regulated by a zoning code in order to ensure that the structure placement and construction type fit the location and community needs.

Changes in Development

The change in total housing units and building permits are two metrics for change in development used in this report. The total number of housing units in Clatsop County increased rapidly last decade, but slowed with the onset of the recession of 2008. The growth consisted of nearly 1,900 new housing units

(over 9%). Seaside and Warrenton had the largest share of this growth in total housing units, with other areas seeing modest gains in total housing units. Seaside, Warrenton, and Gearhart all grew their share of the county totals of housing units, while Cannon Beach remained flat and Astoria and the area outside UGBs saw small declines. In terms of relative housing growth, Seaside saw the largest increase during the 2000s, as its total housing stock increased 22% (by 406 housing units) by 2010 (PSU, 2017).

Table II-24. Total Housing Units and Average Annual Growth Rate

	Total Housing Units		AAGR	Share of County	Share of County
	2000	2010	2000-2010	2000	2010
Clatsop County	19,685	21,546	0.9%	100.0%	100.0%
Astoria	4,862	4,982	0.2%	24.7%	23.1%
Cannon Beach	1,651	1,814	0.9%	8.4%	8.4%
Gearhart	1,346	1,574	1.6%	6.8%	7.3%
Seaside	4,171	4,732	1.3%	21.2%	22.0%
Warrenton	1,802	2,208	2.1%	9.2%	10.2%
Unincorporated	5,853	6,236	0.6%	29.7%	28.9%

Source: U.S. Census Bureau, 2000 and 2010 Censuses; PSU 2017.

Building permits are another metric for changes in development. See the tables below for the numbers of building permits issued..

Table II-25. Building Permits Issued in Clatsop County and Municipalities

Year	2018	2015	2010	2005	2000	1999	1996
Clatsop County	**200**	**52**	**--**	**232**	**145**	**151**	**199**
Astoria	**235**	**534**	**535**	**449**	**347**	**360**	**444**
Cannon Beach	**#**	**#**	**#**	**#**	**#**	**-**	**-**
Gearhart	**37**	**26**	**14**	**29**	**-**	**-**	**-**
Seaside	**12**	**22**	**17**	**46**	**21**	**-**	**-**
Warrenton	**129**	**138**	**127**	**-**	**-**	**-**	**-**

Source: City of Astoria, City of Seaside, City of Warrenton, Clatsop County
https://www.co.clatsop.or.us/buildingcodes/page/permits-issued-archive

The purpose of housing studies in Oregon is to project the need for land and homes based on population projections. Portland State University conducts consistent population data which is then analyzed for use by jurisdictions in reports like the Clatsop County Housing Trends and Needs Report (Jan. 2019).

Figure II-40. Projected Growth & New Housing Need, Clatsop County Cities

Geography	Population			Households			Housing Units		
	2018	2038	Growth	2018	2038	Growth	2018	2038	Growth
Astoria	9,918	10578	660	4,553	4,855	302	5,187	5,532	345
Cannon Beach	1,707	1878	171	796	876	80	1,847	2,032	185
Gearhart	1,483	1699	216	645	739	94	1,606	1,840	234
Seaside	6,644	7739	1,095	3,053	3,557	504	4,772	5,559	787
Warrenton	5,329	7616	2,287	2,081	2,974	893	2,456	3,510	1,054
Unincorp. County	14,120	12,296	-1,824	5,332	4,554	-778	6,805	5,707	-1,098
Clatsop County Total:	39,200	41,806	2,606	16,460	17,555	1,095	22,673	24,180	1,507
Assuming No Loss in Unincorporated County:									
Unincorp. County	14,120	*14,120*	*0*	5,332	*5,332*	*0*	6,805	*6,805*	*0*
Clatsop County Total:	39,200	*43,630*	*4,430*	16,460	*18,333*	*1,873*	22,673	*25,278*	*2,605*

Source: PSU Population Research Center, US Census, Johnson Economics.

Plan Jurisdictions

Clatsop County

Housing

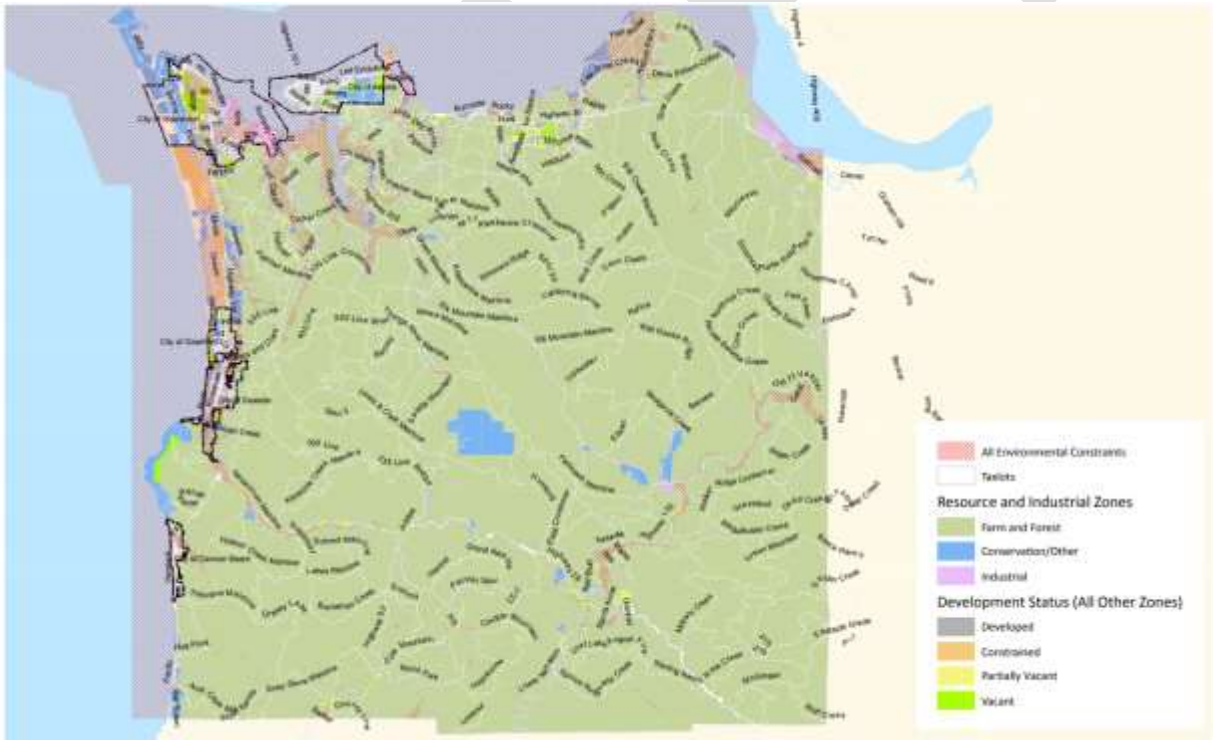
In 2018, Clatsop County had a total of 22,673 housing units according to the PSU Population Research Center and the US Census, as summarized by Johnson Economics. Unincorporated Clatsop County had a total of 6,805 housing units and 5,332 households, supporting a population of 14,120 persons.

Land Use and Development

Clatsop County's Land Use Planning Division provides zoning information for properties outside of urban growth boundaries and city limits including rural service areas, such as Arch Cape, Jeffers Gardens, Knappa-Svensen and Miles Crossing. Development is guided by zoning and land use regulations. Zoning information is available via web map. Find the link and instructions at:
https://www.co.clatsop.or.us/landuse/page/zoning-land-use-regulations

The Clatsop County Land and Water Development and Use Code (LAWDUC) adopted 2018 guides development and land use in the flood and geohazard overlay zones.

Figure II-41. Clatsop County Buildable Lands Inventory Map



Source: Clatsop County Housing Study, Jan. 2019. https://www.co.clatsop.or.us/county/page/clatsop-county-housing-study

City of Astoria

Housing

In 2018, the City of Astoria had a total of 5,187 housing units and 4,553 households, supporting a population of 9,918 persons according to the PSU Population Research Center and the US Census, as summarized by Johnson Economics.

Land Use and Development

Commercial 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 reconstruction in recent years. Residential development is located south of downtown and the east-west commercial corridor, with some residential development along the Columbia River on the east end of the City. Additional growth is limited by water bodies on three sides of the City and a designated 'land reserve.' Much of the city's surplus R-3 buildable residential land is in large single-ownership parcels and/or owned by the Federal government limiting development. Due to the concern with steep slopes and landslides, the City did a more detailed lot by lot inventory to eliminate potentially hazardous lots from the identified buildable areas. The City of Astoria completed a buildable lands inventory in 2011 with the following results.

RESIDENTIAL LAND SUPPLY

Table II-26. Estimated Net Land Surplus/(Deficit) by Zoning, Astoria UGB, 2027

Type of Use	R1	R2	R3	AH-MP	Total
Land Need	115.4	51.2	67.0	2.7	236.3*
Land Supply	25.20	74.99	119.18	1.49	220.86
Surplus/(Deficit)	(90.20)	23.79	52.18	(1.21)	(15.44)*

Source: Wingard Planning & Development Services
** Note: Scrivener's Error in actual figure. BLI shows 236.4 and (15.54) but should be 236.3 and (15.44).*

EMPLOYMENT LAND SUPPLY

Table II-27. Estimated Net Land Surplus/(Deficit) by Zoning, Astoria UGB, 2027

Growth Scenario	Type of Use	Commercial (Office/Retail)	Industrial/Other	Total
Medium	Land Need	38.2	11.5	49.7
	Land Supply	17.1	39.3	56.4
Surplus/(Deficit)	Surplus/(Deficit)	(21.1)	27.8	6.7

Source: Cogan Owens Cogan

City of Cannon Beach

Housing

In 2018, the City of Cannon Beach had 1,814 housing units according to the US Census and the PSU Population Research Center. Of the vacant housing, 75.7% (1,264) are for seasonal, recreational, or occasional use. Around 65% of the city's housing stock was built prior to 1980, before stronger seismic building codes were put into place.

Land Use and 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. 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 (2006), there were 288 undeveloped single-family lots within the city limits. Within the UGB there were an additional 127 lots available, resulting in 415 potential lots available for construction.

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 ocean front is a mixture of dwellings.

City of Gearhart

Housing

In 2018, the City of Gearhart had a total of 1,606 housing units and 645 households, supporting a population of 1,483 persons according to the PSU Population Research Center and the US Census, as summarized by Johnson Economics.

Land Use and Development

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.

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. Issuance of every building permit notifies landowners of the tsunami risk in Gearhart and requires a signature of such notice.

City of Seaside

Housing

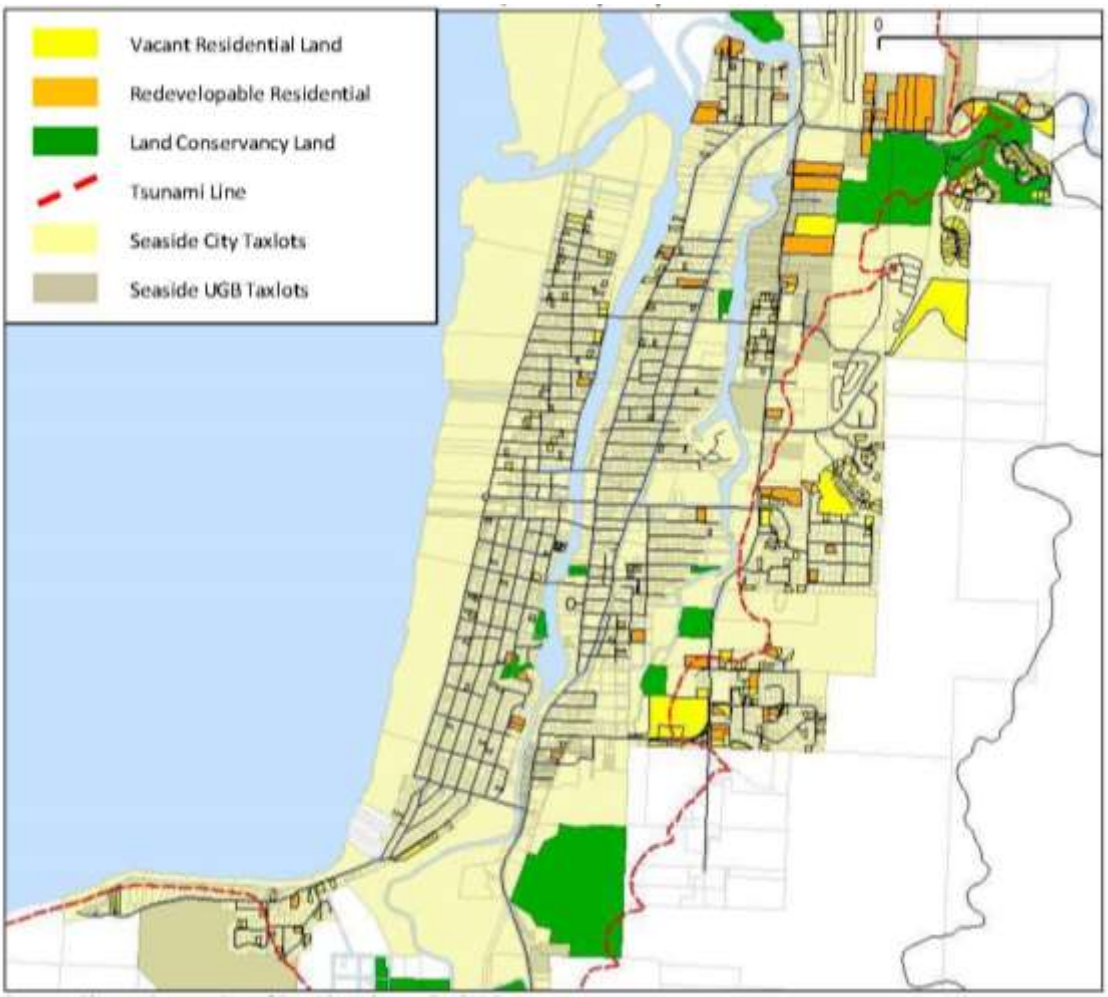
In 2018, the City of Seaside had a total of 4,772 housing units and 3,053 households, supporting a population of 6,644 persons according to the PSU Population Research Center and the US Census, as summarized by Johnson Economics.

Land Use and Development

Development in Seaside is mostly on a two-mile strip between the Pacific Ocean and Neawanna Creek. 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. The number of units built exceeded the number of buildings permits, indicating that some multi-family residential structures were built. 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 below.

Figure II-42. Seaside Residential Buildable Lands



Source: Source: Clatsop County, City of Seaside, Johnson Reid LLC

City of Warrenton

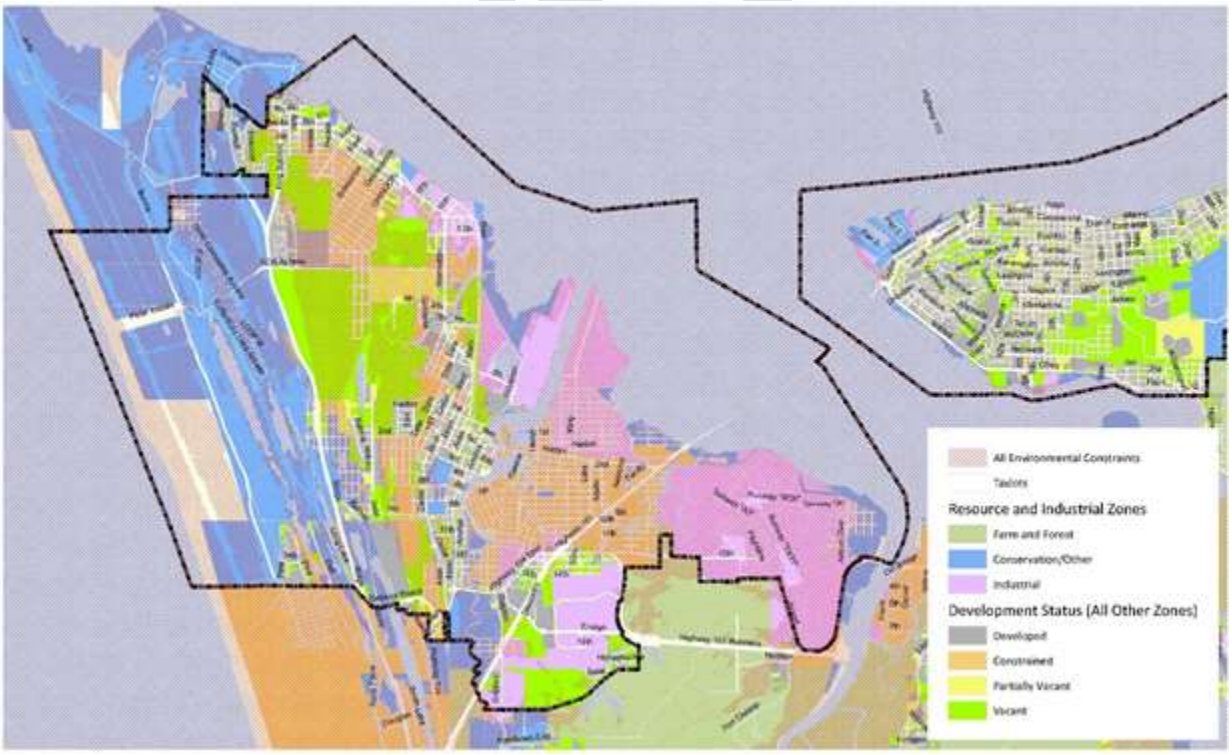
Housing

In 2018, the City of Warrenton had a total of 2,456 housing units and 2,081 households, supporting a population of 5,329 persons according to the PSU Population Research Center and the US Census, as summarized by Johnson Economics.

Land Use and Development

Commercial development in Warrenton is located on East Harbor Drive, Highway 101 and the downtown on Main Avenue. Industrial areas are located in the North Industrial Park where the Astoria-Warrenton Regional Airport is located within the eastern border of the City of Warrenton; the southern portion on the easterly side of Highway 101; portions of Warrenton; and Weyerhaeuser plant located along the Skipanon River. The City has an urban renewal district for future development which extends approximately from Skipanon Drive to the north and the City's limits to the south, Alder Avenue to the west and Heron Avenue to the east. It encompasses 928 acres including existing public right-of-ways and waterways. In 2007 a buildable lands inventory was conducted by Cogan Owens Cogan. This report stated that there are approximately 949 acres of buildable land. More than 467 acres of this land is zoned for employment, 288 acres of which is industrial; and approximately 157 acres of commercial land. Approximately 481 acres are for various residential densities (Buildable Lands Inventory, pp.8-9).

Figure II-43. City of Warrenton Buildable Lands Inventory Map



Source: Clatsop County Housing Study, Jan. 2019. https://www.co.clatsop.or.us/county/page/clatsop-county-housing-study

Figure II-44. City of Warrenton Zoning Map

Source: City of Warrenton webpage, 2020. https://www.ci.warrenton.or.us/gis/page/warrenton-map-gallery-0

8. Cultural and Historic Resources

Cultural and historic resources provide information about our past, insight into our present, and frame our local character and identity. Historic and cultural resources such as historic structures, sites, and landmarks can frame the identity of a community or support a local economy with tourism dollars. Because of their importance to the community, protecting these resources from the impact of disasters is important.

This plan section outlines historic resources and context for the six local government jurisdictions. The Oregon State Historic Preservation Office (SHPO) has staff archaeologists can provide education on cultural heritage issues, explain current state cultural resource laws and regulations, and help resolve potential conflicts involving development, scientific research, and the respectful treatment of cultural resources. Contact SHPO at https://www.oregon.gov/oprd/OH/Pages/archaeology.aspx

SHPO also provides information on Disaster Preparedness, Recovery, and Resilience for heritage sites and museums. The web site includes models, guidebooks, tools, etc. to assist in the preparation of local plans and best practices for management of the cultural resources in a disaster. See SHPO at https://www.oregon.gov/oprd/OH/Pages/DisasterPrep.aspx.

Clatsop County

Before 1850 most of Clatsop County's government activity occurred in Lexington. As Astoria grew, activities gradually shifted to that city. Astoria was chosen by electors to be the county seat in 1854 and the first county government sat in Astoria in 1856.

The early sessions of the county court prior to 1855 were held in the homes of county officials and private citizens, first in Lexington and later in Astoria. In 1855 a two-story frame courthouse was completed. The second courthouse was completed in 1908 and is still in use.

The first county government was organized in the mid-1840s with the election of justices of the peace, clerk, sheriff, assessor, and treasurer, and the formation of district courts and the county board of commissioners. In 1964 the county court was replaced by a board of commissioners. The voters of Clatsop County approved a home rule charter in 1988 that called for a board of county commissioners as the policy-determining body of the county and a county administrator to oversee daily operations of the government. The county government currently consists of five commissioners, each elected from one of five geographic districts, and a county administrator and nine departments.

Today, Clatsop County voters elect five commissioners, a district attorney and the sheriff (Clatsop County, 2020).

City of Astoria

Situated along the Columbia River, Astoria is the oldest city in Oregon and the oldest American settlement west of the Rockies. Surrounded on three sides by the Columbia, Youngs, and Lewis & Clark rivers, the steep hillsides of Astoria exhibit beautiful Victorian and Craftsman homes. Astoria was originally established as a fur trading post in 1811 by a party commissioned by John Jacob Astor, a New

York financier. It developed as a fishing and timber producing community and by 1847, the first US post office was established here. Astoria was incorporated in 1856 with a population of 250. The City's highest population was in 1920 at the peak of the fishing industry with 14,027 residents reducing to 10,349 by 1930. During World War II, there was a US Naval Base located at Tongue Point which raised the population to 12,331 in the 1950 census. Art galleries, restaurants, microbreweries, eclectic shops and the restored 1920's Liberty Theater reflect a revitalized, vibrant downtown in this community of approximately 10,000 residents (City of Astoria, 2020).

The City's Historic Inventory, dated December 2019, includes the following historic resources:

- 5 Museums (Flavel House Museum, OR Film Museum, CCHS Heritage Museum, Fire Museum, Columbia River Maritime Museum)
- 3 Private Museums (Museum of Whimsy, Hanthorn Cannery Museum, Svensen Blacksmith Shop)
- 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)
- 7 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); White Star Cannery on 2nd Street (Local Landmark)
- 1 Historic Reconstruction (First US Customhouse West of the Rocky Mountains)
- Historic Register including 107 individual local designations plus 746 historic designated properties both local and National for a total of 851 designated historic properties in the City.

The two major museums, Clatsop County Historical Society (CCHS) and Columbia River Maritime Museum (CRMM), have worked toward establishing hazard mitigation planning for their facilities and historic collections. CRMM has a "Emergency Preparedness and Response Plan" dated February 2020, and a "Pocket Emergency Quick Reference Guide" dated January 2019. These deal primarily with staff and visitor safety in an event but do include some information on facility and collections management in an event. CCHS currently does not have a formalized disaster plan. Over the next five years, CCHS plans to develop an appropriate Disaster Plan for each of their facilities.

City of Cannon Beach

The City of Cannon Beach was first incorporated as a city in 1957. Cannon Beach is a major tourist destination of the Oregon Coast. Featuring "Haystack Rock" just south of Ecola State Park, this upscale beach town combines scenic quiet coastal retreats with walkable shopping and dining.

The National Register of Historic Places lists four historic sites within the City of Cannon Beach. These sites include three 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.

City of Gearhart

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.

The National Register of Historic Places lists two historic sites within the City of Gearhart – Sea Lyft and the Charles David Latourette House and Sea Lyft.

City of Seaside

In 1852, two entrepreneurs purchased 6,112 acres in the Necanicum River estuary 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.

The National Register of Historic Places lists these historic sites within the City of Seaside—Charles Preston House 141 Ave. I, Seaside (Clatsop), Oregon; Haller–Black House 841 S. Promenade, Seaside (Clatsop), Oregon; William and Nellie Fullam House 781 S. Promenade, Seaside (Clatsop), Oregon. 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.

City of Warrenton

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 incorporated the former community of Hammond into Warrenton in 1992.

The National Register of Historic Places lists the Daniel Knight Warren House as an historic site within the City of Warrenton. Fort Stevens Park draws approximately one million visitors a year. The wreck of the Peter Iredale is located in this park. In Hammond, Battery Russell Park is surrounded by historic residences including the Officers Bed and Breakfast. Other historic structures include the Munson House, the Peace House, the Coast Guard Lifesaving Station, and the Hammond Town Hall. The Goodwin–Wilkinson Farmhouse is outside of city limits on US-101 west of Cullaby Lake.

9. Natural Resources

The population centers of Clatsop County are located along the Pacific Coast and the Columbia River and its estuary. The interior of the county is sparsely populated by comparison and has no incorporated jurisdictions. Dispersed rural residences and businesses flank the edges of the five cities and extend into the forested interior of county along the main travel routes—through Oregon's Coast Range that creates a diverse topography across the central and eastern county with valleys shaped by the Nehalem River and various smaller rivers and streams.

In the southwest corner of Clatsop County, one could describe the landscape as where 'the forest meets the sea'. Here cliffs and small beaches align the ocean's shore. Headed north on Highway 101 in the south county, the cliffs become set back to the east as erosive forces first reveal iconic basalt "haystacks" as one approaches Cannon Beach and Ecola State Park. North of the Necanicum River estuary at Seaside, the mountains fall back from the ocean's edge and the dunes of the Clatsop Plains roll north until they meet the spits of land along the mouth of the Columbia River.

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.

- 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%)

Columbia River

Columbia River Estuary

Heading east along the Columbia River, the valley opens into a gorge with the steep slopes of the river terrace reaching high above the mighty river. The Astoria-Megler Bridge connects Oregon and Clatsop County with the State of Washington. Highway 30 provides access for the Columbia River communities before continuing into Columbia County and the City of Portland. This rural landscape is defined by the emerging Columbia River Gorge—with some lands on the lowest river terrace, such as the myriad river side channels, which form islands. These are usually inhabited by birds and fish, various fishing vessels, and feature boat docks, or homes and farms on the larger islands. The terrace of the river is high and consists of a forested landscape that continues across the Coast Range until reaching the adjacent counties.

Habitats such as estuaries are sometimes referred to as "natural infrastructure" due to the number of "ecosystem services" provided by these areas. These services are based upon the habitats retaining their innate functions and structure—and being left in an untouched, natural state. Ecosystem services can range from flood management and rearing of young fish that might occur in the estuary, to runoff management, water storage, and water purification provided by uplands. The State of Oregon has a program to support the protection, improvement, and conservation of habitats. There are a number of organizations in Clatsop County (see Table XX in Appendix XX) available to assist private homeowners, businesses, and municipalities in the design, funding, and implementation of "natural infrastructure"

projects such as culvert or tide gate replacement, tree planting, and wetland projects. The five cities, County, and Port of Astoria are all members of the Columbia River Estuary Study Taskforce (CREST). CREST's mission is to provide locally-based, high quality environmental planning, habitat restoration, and research services to the Columbia-Pacific Region.

Columbia Bar

The Columbia River enters the Pacific Ocean at the Clatsop Spit. The Columbia Bar is a system of bars and shoals at the mouth of the Columbia River between the Oregon and Washington state borders. The bar is about 3 miles wide and 6 miles long—it is bound by the north and south jetties which are 2 miles apart. The Columbia River Bar is the one of the busiest and most dangerous shipping channels in the world. The shifting sands of the bar require special boat captains called bar pilots be flown by helicopter or boated by a pilot boat onto incoming ships to steer them in with their local knowledge and skill. The U.S. Coast Guard is on stand by for rescues. Once past the initial channel, the bar pilot disembarks and the river pilot continues piloting the ship upriver.

The bar can be viewed in Fort Stevens State Park on the Clatsop Spit or from Cape Disappointment in Ilwaco, WA. The bar is where the river's current dissipates into the Pacific Ocean, often as large standing waves. The waves are partially caused by the deposition of sediment as the river slows, as well as mixing with ocean waves. The waves, wind, and current are hazardous for vessels of all sizes. The Columbia current varies from 4 to 7 knots (7.4 to 13.0 km/h) westward, and therefore into the predominantly westerly winds and ocean swells, creating significant surface conditions. Unlike other major rivers, the current is focused "like a fire hose" without the benefit of a river delta. Conditions can change from calm to life-threatening in as little as five minutes due to changes of direction of wind and ocean swell. Since 1792, approximately 2,000 large ships have sunk in and around the Columbia Bar, and because of the danger and the numerous shipwrecks the mouth of the Columbia River acquired a reputation worldwide as the graveyard of the Pacific. It is known as the most dangerous entrance to a major commercial waterway in the world.

The navigational channel is 2,640 feet wide at the west end and narrows to 600 feet within the jetties (though the jetties themselves are never closer than two miles apart). The channel is dredged to 55 feet (17 m) in the northern three-quarters and 48 feet (15 m) for the southern quarter. Inside the bar, the channel remains 600 feet (180 m) wide and reduces to 43 feet (13 m) deep (Columbia River Bar Pilots, 2014).

The nearby United States Coast Guard Station Cape Disappointment, Washington, is renowned for operating in some of the roughest sea conditions in the world and is home to the National Motor Lifeboat School. It is the only school for rough weather and surf rescue operation in the US and is respected internationally as a center of excellence for heavy boat operations.

Pacific Coast

Oregon's dramatic and beautiful coastline is the result of dynamic, powerful, natural forces of weather, climate, ocean waves and currents, and plate tectonics. These forces continually shape the coast, creating an environment that is at once attractive and dangerous. Most development on the Oregon coast has taken place in less hazardous areas. Due to lack of less hazardous buildable land, new development is increasingly proposed for hazardous areas, such as steep slopes, ocean bluffs, landslide-

prone sites, and low-lying areas subject to ocean flooding, coastal erosion, and tsunami inundation. People may purchase or occupy developments in hazard prone areas with no knowledge of the risk.

In addition, scientists are continually refining their understanding of the potentially catastrophic forces of earthquakes and tsunamis, as well as the more gradual effects of climate change. The vulnerability of coastal communities to chronic and catastrophic forces is a concern to those who live, work, and recreate in those communities, and to public officials responsible for community safety and well-being.

Forests and Timberlands

Western Oregon was historically dominated by vast conifer forests. These forests ranged in age and tree size due to natural disturbance from coastal erosion, drought, floods, landslides, wildfire, windstorms, and on longer timescales, volcanic events, earthquakes, and tsunamis.

Today, shifting conditions in the global climate, cyclical changes of El Nino/La Nina, development in urban-wildland interface areas, forest management practices, and changes in groundwater all affect the health of forests and how prone they may be to wildfire or other disasters in any given year.

Today, the majority of forestland in Clatsop County is under management as timberlands. Major forestland management in Clatsop County is conducted by:

- Lewis & Clark Timberlands managed by GreenWood Resources.
- Clatsop State Forest, managed by Oregon Department of Forestry
- Weyerhaeuser

Watersheds

A watershed is the area of land where all of the water that drains off of it goes into the same body of water. All of Oregon is divided into watersheds according to designated drainage basins. These watersheds include streams, rivers, lakes, wetlands, and groundwater in the same geographical region. Clatsop County is home to four watershed organizations, a soil and water conservation district, and a land trust that work to preserve the natural functions of local watersheds and ecosystems by helping landowners access grant funds to improve their lands.

Figure II-45. Clatsop County Watersheds

Source: Clatsop County GIS. 2006. https://www.co.clatsop.or.us/county/page/maps-geographic-information-systems

The North Coast Watershed Association http://www.clatsopwatersheds.org/watersheds/ incorporates two watershed areas.

1) *River Watershed Council* http://www.clatsopwatersheds.org/watersheds/river-council/ serving: Skipanon River, Youngs Bay, Big Creek, Nicolai-Wickiup Watershed and other Columbia River tributaries within Clatsop County.

2) *Coastal Watershed Council* serving: Ecola Creek, Arch Cape, Short Sands, Necarney and other coastal drainages of Clatsop County. http://www.clatsopwatersheds.org/coastal-council/

Necanicum Watershed Council https://www.necanicumwatershed.org/

The service territory includes the municipalities of Seaside and Gearhart and the sub-watersheds of: Neawanna Creek, Neacoxie Creek, Upper Necanicum River, and the Necanicum Estuary.

Upper Nehalem Watershed Council https://unwc.nehalem.org/

Lower Nehalem Watershed Council https://lnwc.nehalem.org/

The Nehalem River is the longest river in the Oregon Coast Range flowing 105 miles from its source, its headwaters located in Clatsop County. The Nehalem River and its tributaries form a watershed of 855 square miles.

Clatsop Soil and Water Conservation District http://clatsopswcd.org/

North Coast Land Conservancy https://nclctrust.org/

B. Natural Hazards

1. Coastal Erosion

Causes and Characteristics

Coastal erosion occurs through a complex interaction of many geologic, atmospheric, and oceanic factors. 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. Two 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. Erosion becomes a hazard when human development, life, and safety are threatened.

Coastal erosion occurs via the following mechanisms:

- Beach, dune and bluff erosion caused by wind, waves, runoff, and disturbance;
- Mass wasting of sea cliffs in the form of landslides and slumps due to gravity, constant wave and tidal effects, 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 current embayments; and
- Recession of coastal bluffs due to long-term changes in mean sea level and the magnitude and frequency of storm systems.

Erosion may be caused by large waves, storm surges, rip current embayments, high winds, rain, runoff, flooding, or increased water levels and ocean conditions caused by periodic ocean conditions such as an El Niño event. Oregon's coastal erosion is largely driven by major storm events that can produce waves 20 to 50 feet in height. The large waves coupled with high water levels from storm swash allow the waves to reach much higher elevations (Allan, 2017). Coastal bluffs comprised of uplifted marine terrace deposits and sand dunes are especially vulnerable to erosion. Beaches and dunes are highly susceptible to erosion, especially during large storms coupled with high ocean water levels (Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020). Vegetated dunes have eroded back as much as 50 meters in just one or two winters in some areas. Unlike bluff-backed shorelines, dunes can accrete back during cycles of decreased storm activity, which may erase signs of long-term erosion rates, and mask the potential for catastrophic erosion events (Allan, 2017). The following lessons were learned (and oftentimes forgotten between damaging events):

- Oregon coastal processes are complex and dynamic, sometimes eroding, sometimes aggrading;
- 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).

The subtle sensitivity and enduring resilience of the Oregon coast makes it a challenge to manage.

From *Coastal Erosion Hazard Zones along the Clatsop Plains, Oregon: Gearhart to Fort Stevens* (DOGAMI Open-File Report O-01-04):

> The response of coastal shorelines in the form of erosion or accretion is exceedingly sensitive to a multitude of complex factors that include the beach sediment budget, wave energy, variations in water level, nearshore morphology, shoreline orientation, and the geology of the region. Because many shorelines are composed of unconsolidated sediments, including significant stretches of the Oregon coast, they are able to respond rapidly and are among the most dynamic and changeable of all landforms. It is this dynamism at the coast that makes beaches such an integral and important landform as they moderate the effects of wave energy. (Allan, J. & Priest, G., 2001. p.1)

Historic Coastal Erosion Events

The following table provides information on the previous occurrences of severe coastal erosion.

Table II-28. Historic Coastal Erosion Events

Date	Location	Description	Notes
Jan. 2018 (01/18/2018)	N. Oregon Coast	Flood, Coastal Erosion	Severe beach erosion and damage to trails near the Peter Iredale Shipwreck, about 5 to 6 ft. of dune entirely eroded and swept out to sea. Logs and other debris washed up on roads.
1980-2018	Falcon Cove	High Waves, Coastal Erosion	Five homes lost to coastal erosion.
1997-1998	N. Oregon Coast	High Waves, Coastal Erosion	El Niño events
1982-1983	N. Oregon Coast	High Waves, Coastal Erosion	El Niño events
1978	Nestucca Spit	High Waves, Coastal Erosion	Winter storm caused beach and cliff erosion.
1972	Siletz Spit	High Waves, Coastal Erosion	Winter storm caused beach and cliff erosion.

Source: Dice, C., 2019; NOAA Storm Events Database, https://www.ncdc.noaa.gov/stormevents/ , accessed 12/2/2019.

Human-Influenced Coastal Erosion

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.

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.

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for coastal erosion was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the appendix and the considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

In 2015, the Clatsop County Steering Committee estimated a 'high' vulnerability for coastal erosion, likely due to the large amount of coastal land area and the number of dwellings in or near erosion zones such as those structures located on cliffs or in areas protected by dunes other natural structures. For the 2021 Plan Update, the scenario considered was one or more homes and associated infrastructure at risk of cliff erosion.

Coastal erosion is ranked has a high risk hazard by 5 of the 16 jurisdictions. As coastal erosion is a slow-moving (or chronic) hazard that affects just a few people, or in the case of some jurisdictions, it doesn't impact assets at all, there were rankings in the medium, low, and 'not applicable' rankings. Risk assessment participants generally appreciated the future risk of coastal erosion from sea level rise and king tides, but did not anticipate impacts to occur during the time period of this plan (2020-2025).

The following hazard rankings were provided by the participating jurisdictions for coastal erosion:

Table II-29. Hazard Vulnerability Analysis: Coastal Erosion

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	16	13	22	67	119	M
City of Astoria	16	20	80	56	172	H
City of Cannon Beach	10	40	50	70	170	H
City of Gearhart	2	25	50	7	84	M
City of Seaside	10	25	50	35	120	M
City of Warrenton	2	5	10	7	24	L
Arch Cape Water District	20	45	50	56	171	H
Arch Cape Sanitary District	20	45	50	56	171	H
Cannon Beach RFPD	20	5	10	35	70	L
Clatsop Community College	0	0	0	0	0	n/a
Falcon Cove Water District	20	50	50	70	190	H

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Knappa-Svensen-Burnside RFPD	0	0	0	0	0	n/a
Lewis and Clark RFPD	0	0	0	0	0	n/a
Port of Astoria	0	0	0	0	0	n/a
Seaside School District	0	0	0	0	0	n/a
Sunset Empire Transit District	0	0	0	0	0	n/a

Source: Clatsop County MJNHMP Update Steering Committee, Apr. 2019-Jan. 2021; Clatsop County EOP 2018, p. 18.

Vulnerability Assessment

According to the regional risk assessment for the Oregon Coast, the following assets and locations are generally the most vulnerable to coastal erosion (Oregon DLCD, 2015):

- Buildings, parks, and infrastructure along low-lying areas adjacent to bays or the ocean and at higher elevations where buildings and infrastructure have been located on readily erodible materials (e.g., consolidated sand, weakly cemented sandstone, siltstone, etc.).
- Areas subject to flooding with wave action—while 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 which fall under the regulatory purview of local jurisdictions compliant with the National Flood Insurance Program (NFIP).
- Coastal highways are strongly impacted by coastal erosion. In Clatsop County much of the problem is linked to the local geology. Bedrock conditions 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.

Coastal erosion is increasingly affecting people due to development near the beach or coastal bluffs. Structures and infrastructure that serve vacation homes are the primary vulnerability of this hazard. Uninformed people who purchase real estate in areas subject to coastal erosion are the primary individuals at personal risk of this hazard, although first responders and other emergency personnel are likely at greater hazard as they will be required to assist in coastal erosion-related rescues in recreational settings. Typically, shoreline stabilization efforts using riprap are not an effective long-term mitigation (Stimely and Allan, 2014). Whether it is a gradual process or in the form of landslides, coastal erosion can cause loss of property (Williams et al, 2020).

This summary and figure identify the coastal erosion risks only to the segment of Clatsop County analyzed in the study:

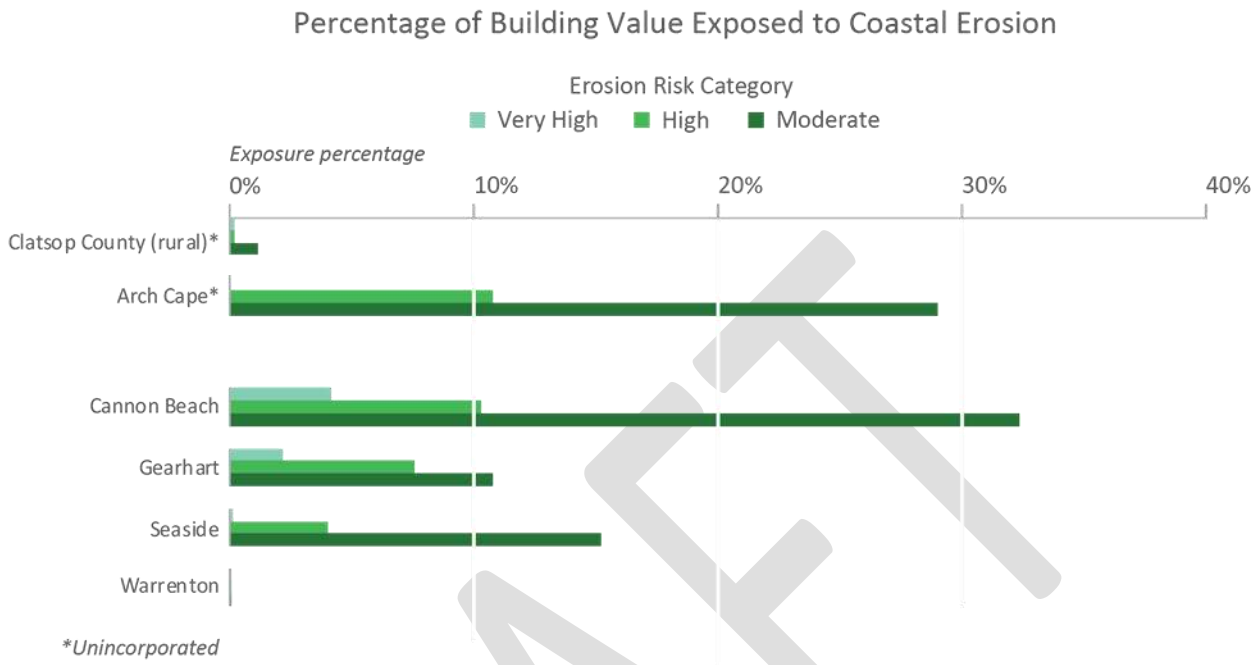
Clatsop countywide coastal erosion exposure (Moderate hazard):

- Number of buildings: 349
- Exposure value: $135,900,000
- Percentage of exposure value: 3.6%
- Critical facilities exposed: 0
- Potentially displaced population: 104

Source: Williams et al, 2020, p.34.

In the table below, coastal erosion risk for unincorporated communities is included in the "Clatsop County (rural)" category.

Figure II-46. Coastal erosion exposure by Clatsop County community.



Note: Beyond the designated communities, in unincorporated Clatsop County, building values total $2.5 million in areas of very high coastal erosion hazard, $2.6 million in areas of high hazard, and $16 million in areas of moderate hazard. Source: Williams et al, 2018. p.34.

Future Climate Conditions: Coastal Erosion

Sea level rise and changing wave dynamics are key climate change impacts expected to increase the risk of coastal erosion and flooding hazards on the Oregon Coast. Local sea level rise in Clatsop County is projected to reach 0.8 to 4.8 feet by 2100. These estimates include vertical land movement trend estimates and are based on two global sea level scenarios used in the 2018 US National Climate Assessment. The likelihood of a 4-foot flood event, that is, water reaching four feet above mean high tide, ranges from 4%-38% by the 2030s, 19%-100% by the 2050s, and 98-100% by 2100 (Dalton, M.M., 2020, p.38). Climate change is expected to exacerbate coastal erosion in Clatsop County. By 2100 or before, assets and people within the 4-foot inundation zone are highly likely to be impacted or displaced—including 3,407 people, $138 million in property value, and a half-mile of state, county, and local roads (Dalton, M.M., 2020, p.38). "The projected increase in local sea levels along the Oregon coast raises the starting point for storm surges and high tides making coastal hazards more severe and more frequent in the future (Climate Central, 2019; Dalton, M.M., 2020, p.35)."

Local citizens can observe and help document the impacts of climate change. Twice a year, high tides in Oregon are higher than usual. These extreme high tides, commonly called "King Tides," occur when the moon is closest to the Earth, and the Earth is closest to the sun. Because these events are associated with localized flooding and erosion, they are being used to measure and educate the community about the potential impacts of sea level rise and changing wave dynamics. A citizen science photo documentation project can be viewed or participated in online at www.oregonkingtides.net .

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential coastal erosion mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices.

- Monitor ground movement in high susceptibility areas, especially during or after large storms.
- Consider restricting development in coastal erosion zones.
- Maintain existing erosion control structures.
- Identify critical facilities and infrastructure near high susceptibility coastal erosion areas.
- Consider land value losses due to coastal erosion in future risk assessments.

Table II-30. Coastal Erosion Exposure

			(all dollar amounts in thousands)								
			High Hazard			Moderate Hazard			Low Hazard		
Community*	Total Number of Buildings	Total Estimated Building Value ($)	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed
Unincorp. County (rural)	8,214	1,378,964	17	2,505	0.2%	20	2,595	0.2%	54	15,544	1.1%
Arch Cape	462	113,684	0	0	0%	50	12,270	11%	121	33,051	29%
Total Unincorp. County	8,676	1,492,648	17	2,505	0.2%	70	14,865	1%	175	48,595	3.3%
Cannon Beach	2,037	567,876	82	23,499	4.1%	141	58,705	10%	412	183,977	32%
Gearhart	1,607	359,970	28	7,738	2.2%	81	27,241	7.6%	108	38,843	11%
Seaside	4,325	872,504	2	1,260	0.1%	56	35,067	4%	258	132,890	15%
Warrenton	2,826	493,680	1	23	0%	1	23	0%	1	23	0%
Total Clatsop County*	19,471	3,786,677	130	35,024	0.9%	349	135,900	3.6%	954	404,327	11%

*Does not include non-coastal communities (these communities do not factor into total amounts and percentages).

Source: Williams et al, 2020. p. 75. DLCD Note: Falcon Cove is included in the Arch Cape unincorporated area. For the purposes of the 2020 Natural Hazard Risk Report, DOGAMI designated Astoria, Knappa-Svensen, and Westport, as 'non-coastal communities', thus this table excludes building numbers for those communities. Astoria has some coastal erosion along Youngs Bay but is not included in DOGAMI report.

2. Drought

Causes and Characteristics

Drought is commonly defined as a deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage (NDMC, 2020). 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. Researchers have identified over 150 published definitions of drought (OEM, 2016). To simplify analysis, the National Drought Mitigation Center https://drought.unl.edu/ provides five different ways that drought can be defined:

- **Meteorological drought** is a measure of change in precipitation from normal. Associated conditions include reduced precipitation, high temperatures, high winds, low relative humidity, increased evaporation and transpiration, and reduced runoff, infiltration, and groundwater recharge. Due to climatic differences, what might be considered drought in one location of the state may not be the same elsewhere.
- **Agricultural drought** is a situation where the amount of moisture in the soil no longer meets the needs of a particular crop. Associated conditions include soil water deficiency, reduced water availability for crops, and reduced biomass/yield.
- **Hydrological drought** occurs when surface and sub-surface water supplies are below normal. Associated conditions include reduced streamflow and inflow to lakes, ponds, and wetlands.
- **Socioeconomic drought** occurs when a physical water shortage begins to affect people—individually and collectively, as reflected in the area's economy.
- **Ecological drought** is a prolonged and widespread deficit in naturally available water supplies that create multiple stresses across ecosystems.

Historic Drought Events

The following table provides information on the previous occurrences of droughts.

Table II-31. Historic Drought Events

Date	Location	Description
2015	25 counties in Oregon	Clatsop County did not have a drought declaration but did experience a dry and hot spring and summer following two years of lower moisture and higher temperatures (2013-2014).
2001-02	Statewide, except Portland metro area and Willamette Valley	The second most intense drought in Oregon's history; 18 counties with state drought declaration (2001); 23 counties state-declared drought (2002); some of the 2001 and 2002 drought declarations were in effect through June or December 2003; Coos and Curry Counties in Region 1 were not under a drought declaration until December of 2002
1985-1997	Oregon	Generally a dry period, capped by statewide droughts in 1992 and 1994.
1992	Statewide	1992 fell toward the end of a generally dry period, which caused problems throughout the state; the 1992 drought was most intense in eastern Oregon, with severe drought occurring in Region 1; the winter of 1991-1992 was a moderate El Niño event, which can manifest itself in warmer and drier winters in Oregon; Governor declared a drought for all 36 counties in September 1992
1976-1981	Western Oregon	Intense drought; 1976-1977 was the single driest water year of the century.
1939-1941	Oregon	A three-year intense drought; Water Year 1939 was one of the more significant drought years on the Oregon Coast during that period.
1917-1931	Oregon	A very dry period, punctuated by brief wet spells in 1920-21 and 1927. The 1920s and 1930s, known more commonly as the Dust Bowl, were a period of prolonged mostly drier than normal conditions across much of the state and country; moderate to severe drought affected much of the state except southeastern Oregon.
1924	Oregon	A prolonged statewide drought that caused major problems for agriculture
1904-1905	Oregon	A drought period of about 18 months.

Source: Taylor and Hatton, 1999; 2015 Clatsop NHMP; 2016 Tillamook NHMP.

Potential Impacts

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. 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. In addition, drought and water scarcity add another dimension of stress to species listed pursuant to the Endangered Species Act (ESA) of 1973.

Watersheds in Clatsop County are largely rain-dominated systems, meaning the drivers of drought and water scarcity are different than across much of the western US, where mountain snowpack contributes to streamflow (Dalton *et al.*, 2017; Mote *et al.*, 2019). As with the rest of the Pacific Northwest, Clatsop

County typically experiences wet winters and dry summers. This seasonal cycle of precipitation means that severe drought is rare during the rainy winters on the Oregon coast, but the region is prone to periods of summertime water scarcity, especially when precipitation is lower than average in the shoulder seasons (e.g., spring, fall). This is exacerbated by the lack of natural storage (e.g., snowpack) and built storage (e.g., reservoirs) (OCCRI, 2020, p.24).

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for drought was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the appendix and the considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

In ranking the drought hazard, the scenario considered most likely to be a threat were summer low-water conditions that necessitated water conservation efforts be implemented by drinking water providers. Coastal counties have historically been low risk for drought compared to the rest of the state, however in unincorporated areas served by special districts, water supply is sometimes limited by the size or management of the watershed area which results in a moratorium on constructions or localized water conservation measures.

In 2015, the Clatsop NHMP Steering Committee gave drought a 'low' ranking assuming that that no more than one incident was likely within a 75-100 year period and that less than 1% of the population or regional assets would be affected by a major drought event due to the extensive rainfall (100+ inches) received each year. Drought has historically been averted as a result of the County's high rainfall from moist air masses moving onto land from the Pacific Ocean and there are no records of a severe drought in Clatsop County. However, perceptible changes in rainfall, summer dryness, and wildfire risk are informing and changing the perceived hazard risk level.

For the 2021 Plan Update, drought is ranked higher than in previous plan updates by 10 of the 16 jurisdictions. Drought is considered a high-risk hazard by Clatsop County, Seaside, Arch Cape Water District, Arch Cape Sanitary District, and Falcon Cove Beach Water District. This ranking was established by drinking water providers reliant upon surface water and County officials who manage associated risks like fire danger and water supply. Drought is ranked as a medium risk hazard by three of the municipal water providers (Astoria, Cannon Beach, Warrenton) indicating concern about water supply if a drought occurred but an adequate water supply under most conditions. The balance of the low rankings largely reflect that water supply is outside of the scope or authority of the jurisdiction or department making the assessment. Variability in water availability was anticipated by the majority of risk assessment participants who noted an anecdotal change in local moisture trends towards dryness.

The following hazard rankings were provided by the participating jurisdictions for drought:

Table II-32. Hazard Vulnerability Analysis: Drought

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	2	36	72	57	168	H
City of Astoria	16	20	80	35	151	M
City of Cannon Beach	2	15	30	35	82	M
City of Gearhart	2	5	10	7	24	L
City of Seaside	2	25	100	35	162	H
City of Warrenton	2	15	80	14	111	M
Arch Cape Water District	12	50	100	56	218	H
Arch Cape Sanitary District	12	50	100	56	218	H
Cannon Beach RFPD	-	-	-	-	-	n/a
Clatsop Community College	2	5	10	7	24	L
Falcon Cove Water District	20	50	100	70	240	H
Knappa-Svensen-Burnside RFPD	14	5	10	49	78	L
Lewis and Clark RFPD	-	-	-	-	-	n/a
Port of Astoria	-	-	-	-	-	n/a
Seaside School District	2	5	10	7	24	L
Sunset Empire Transit District	2	5	10	7	24	L

Source: Clatsop County MJNHMP Update Steering Committee, April-Oct. 2019; Clatsop County EOP 2018, p. 18.

Vulnerability Assessment

Drought poses a risk of reduced water availability for communities and agricultural producers during peak demand in late summer. This limits the growth of community development and of overall production of products that have a late summer water demand.

Future Climate Conditions: Drought

Drought conditions, as represented by low summer soil moisture, low spring snowpack, low summer runoff, low summer precipitation, and high summer evaporation are projected to become more frequent in Clatsop County by the 2050s (Dalton, M.M., 2020, p.25).

In Clatsop County, spring snowpack (that is, the snow water equivalent on April 1), summer runoff, summer soil moisture, and summer precipitation are projected to decline while summer evaporation is projected to increase under both lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios by the 2050s (2040–2069). This leads to the magnitude of low summer soil moisture, low spring snowpack, low summer runoff, low summer precipitation, and high summer evaporation expected with a 20% chance in any given year of the historical period being projected to occur much more frequently by the 2050s

under both emissions scenarios (Figure 12). The 2020s (2010–2039) were not evaluated in this drought analysis due to data limitations but can be expected to be similar but of smaller magnitude to the changes for the 2050s (Dalton M.M., 2020, p.24). During the risk assessment meetings in 2019, low summer runoff and low summer soil moisture were noted as being observed in summer months by water supply districts and other plan update participants.

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential drought mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices.

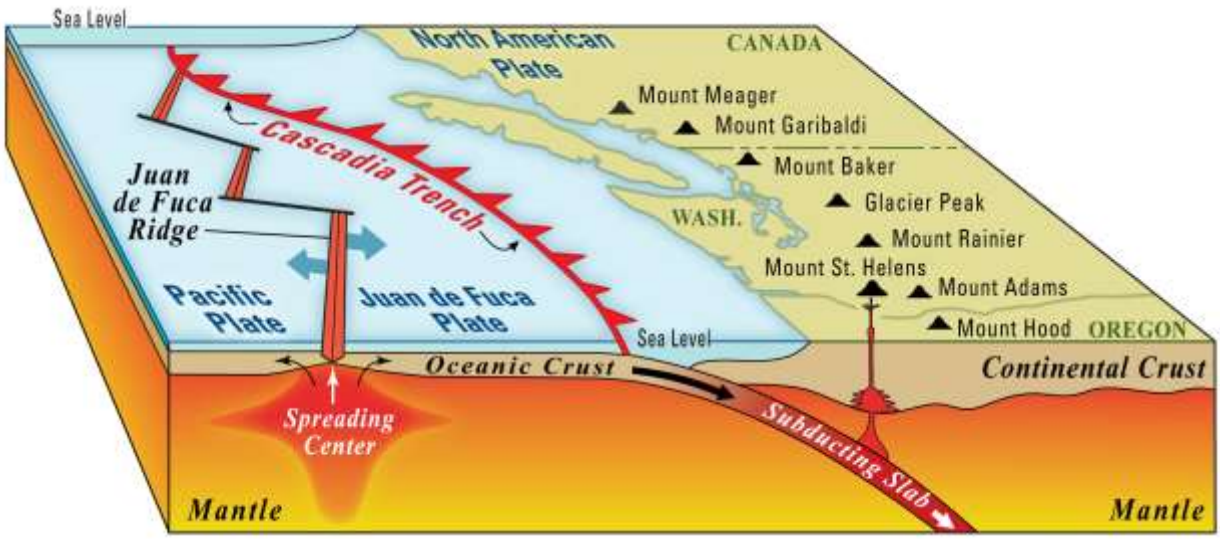
- Coordinate with local watershed organizations and soil and water conservation districts to implement best practices for water management.
- Develop and implement water conservation plans.
- Support the use of water conservation practices by agricultural, industrial, and municipal water users.

3. Earthquake

Causes and Characteristics

Earthquakes in the Pacific Northwest states of Washington and Oregon result from movement called "slip" on faults in a variety of geographic and geologic settings. Earthquakes in much of the region are a consequence of stresses associated with motion of the Juan de Fuca Oceanic Plate to the northeast with respect to the North America Continental Plate at a rate of several centimeters per year. This relative motion is largely made possible because the Juan de Fuca plate descends into the Earth's mantle below the North American continent along what is called the Cascadia Subduction Zone, which extends from northwestern California through western Oregon and western Washington to Vancouver Island, Canada. Relative plate motion that is not accommodated by subduction of the Juan de Fuca plate is accommodated by deformation of the overriding North America plate. Earthquakes are associated with both the subduction process and the deformation of the overriding North America plate. (USGS, 2020).

Figure II-47. Cascadia Subduction Zone



Source: Dzurisin et al., 2013. https://www.usgs.gov/media/images/subduction-juan-de-fuca-plate-beneath-north-american-pla

The US Geological Survey defines Pacific NW earthquakes in three seismological categories: crustal, deep, and megathrust.

"Megathrust" earthquakes (also called "interplate" or "plate boundary" quakes in the context of subduction zone seismicity) result from rupture of the principal interface between the subducting Juan de Fuca plate and the overriding North America plate. The last great megathrust earthquake in the Cascadia subduction zone was in 1700, a 1000–km long rupture that is documented by studies of the resulting tsunami in Japan, by Native American oral traditions, and by geologic deposits from tsunami and offshore turbidity flows caused by the intense shaking and ground deformation associated with the earthquake. Most of the megathrust interface between the Juan de Fuca plate and the North American plate has not been seismically active in the decades during which it has been monitored by seismometers, except perhaps near Cape Mendocino (where a Gorda microplate is commonly

demarcated within the broader Juan de Fuca plate) and at one location offshore from Astoria, Oregon. However, geodetic data show that compressive tectonic strain is currently accumulating across the Cascadia Megathrust as a result of the subduction process. Together with geologic evidence for the 1700 and earlier great earthquakes, the accumulation of compressive tectonic–strain implies that the recent quiescence of most of the Cascadia Subduction Zone Megathrust is temporary and that the ongoing subduction process will cause large and great earthquakes in the future.

"Crustal" earthquakes originate from slip on faults within the crust of the North American Plate. Some of these earthquakes reflect stresses that are generated by the convergence of the Juan de Fuca and North America plates but most are related to stresses originating from the interaction of the North American plate and the Pacific plate in California and Nevada. This interaction results in north–south oriented compressive stresses in the crust throughout the western and northern region. These crustal earthquakes occur in the upper 25 km of the earth's crust on faults oriented roughly east–west and northwest–southeast. In southern Oregon, extensional (pull apart) stresses also cause faulting and crustal earthquakes. Many crustal fault zones have been mapped, including the Seattle Fault Zone, the South Whidbey Island Fault, the Devil's Mountain Fault, the Tacoma Fault in the Puget Sound lowlands, and the Spencer Canyon Fault in central Washington. However, not all of the active faults are mapped, and many crustal earthquakes occur on faults that don't reach the Earth's surface. Crustal earthquakes have included the 1993 M5.6 Scott's Mills, Oregon, the 1993 M5.9 and M6.0 Klamath Falls, Oregon, and the 1996 M5.4 Duvall, Washington earthquakes.

"Deep" earthquakes (also sometimes called "Benioff Zone" or "slab" earthquakes) result from faulting within the down–going Juan de Fuca Plate. These earthquakes are caused by stresses within the subducting plate beneath the plate interface and are due to the deformation of the plate during its slow descent into the earth's mantle beneath the North America plate. Because these earthquakes occur at depth within the descending slab, their causative faults are not visible, and the faults are not mapped or named. Examples of mantle earthquakes include the 2001 M6.8 Nisqually earthquake and very similar earthquakes in 1949 and 1965. These earthquakes occurred in the 45 km — 70 km depth range. Globally, there are deeper earthquakes, but this is the current range of "deep" earthquakes in the PacNW today. Instrumentally recorded mantle earthquakes of the PacNW have had very few aftershocks.

"Volcanic" earthquakes are located near volcanoes and are associated with volcanic processes. The category of volcanic earthquakes includes a variety of earthquake types. Seismograms of many volcanic earthquakes have characteristics that are very similar to those of non–volcanic crustal–earthquakes; these earthquakes are thought to result from the movement of magma and other processes within the magma chamber, including pressure on adjacent faults. During magmatic unrest at Mt. St. Helens in 1980 and 2004, hundreds of thousands of volcanic earthquakes took place.

The term "swarm" is used to denote a sequence of earthquakes in a small geographic area that are of similar size, in contrast to a "main–shock/aftershock sequence", in which a larger "main–shock", perhaps preceded by a few smaller foreshocks, is followed by a sequence of numerous smaller shocks that occur at a generally decreasing rate with time (USGS, 2020).

While all three types of quakes possess the potential to cause major damage, Cascadian Subduction Zone (CSZ) earthquakes pose the greatest danger due to the close proximity to the fault of the Pacific Northwest, the anticipated magnitude of an earthquake event, and the size and speed of arrival of the subsequent tsunami it would cause due to the displacement of water caused by the fault movement. A major CSZ event could generate an earthquake with a magnitude of 9.0 or greater which would result in

devastating damage and loss of life. The proximity of the CSZ to the coastal areas of Oregon make them especially threatened by earthquakes and tsunamis (Madin and Burns, 2013).

Although we discuss CSZ earthquakes and tsunamis as separate hazards in this report, these hazards are closely associated. Their widespread effects and almost simultaneous occurrence present a challenge to planners.

Ultimately, the severity of an earthquake event is a combination of factors from the nature of the hazard, how it presents, and a communities' exposure or vulnerability to it. The type of earthquake, the location of its epicenter, its magnitude, and the amount of ground shaking are the hazard data types most commonly documented in earthquake science—these factors tell scientists what the nature of the earthquake is and who is at risk from it. To manage earthquake risk in building construction and in local regulations, there are additional risk factors that can expose a structure or population to earthquake risk. The ability of the soil and rock to conduct the quake's seismic energy and the degree (i.e., angle) of slope affected by shaking and the composition of slope materials all dictate whether or not a structure will "survive" an earthquake. Further considerations include the potential of the soil and rock to liquefy in a seismic event or the potential of a land mass to "drop" or "subside" in a seismic event, particularly if this drop will result in a site being below sea level after the event.

The specific hazards associated with an earthquake include the following:

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 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 are planes or surfaces in Earth materials along which failure occurs. Such faults can be found deep within the earth or on the surface.

Earthquake-induced landslides are secondary hazards that occur from ground shaking.

Liquefaction occurs when saturated soils substantially lose bearing capacity due to ground shaking, causing the soil to behave like a liquid. This in turn causes soils to lose their strength and their ability to support weight.

Subsidence occurs when an earthquake results in a drop in elevation of the ground surface.

Tsunamis are another secondary hazard created by earthquake events occurring under the ocean. A tsunami 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.

Historic Earthquake Events

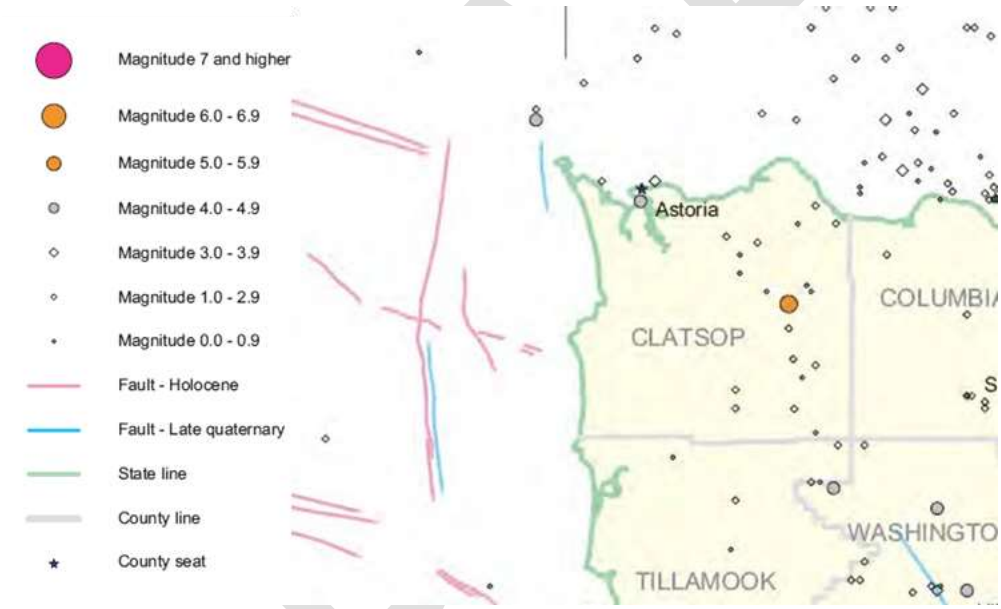
Clatsop County has not been the center point of any recorded earthquakes. The earthquake risk that faces the communities of the Oregon coast has really only come to be understood since the 1960s. Before then, the seismic risk of the Pacific Rim was associated with volcanoes, but earthquakes were not understood to be a natural hazard of high potential magnitude to which Oregon is very vulnerable. On April 13, 1949, a major earthquake (magnitude 6.8) originating near Olympia, Washington caused eight deaths and estimated $25 million in damage. In Oregon, widespread damage was observed, including

injuries in Astoria. This event and then the Alaska earthquake of 1964 with its resulting tsunami that impacted the Oregon coast was a major catalyst for the scientists in the field of seismic study. Emerging tools and scientific vigor set several researchers on the path to discover the Cascadia subduction zone and arrangement of plates in the Pacific Northwest, but also to develop methodologies to document the history of tsunamis that affirm the occurrence of high magnitude earthquakes in the historical record.

In 1989, the devastating Loma Prieta earthquake in the San Francisco Bay Area instigated awareness and action around the risks of earthquakes in Oregon. The science was conclusive enough to be acted upon by policy makers that citizens demanded—the groundswell of knowledge and advocacy coming from the north coast of Oregon. By 1991, the Oregon Seismic Safety Policy Advisory Commission (OSSPAC), or Earthquake Commission, was formed as a result of Senate Bill 96 spurring regional partnerships with other states and scientists, and the support for seismic safety standards in State building code.

Error! Reference source not found. and **Error! Reference source not found.** provide information on the previous occurrences of earthquake hazard events. See **Error! Reference source not found.** for a graph of the frequency of CSZ hazard events that informs the probability of future earthquakes. There is considerable variation in the periodicity of earthquakes in comparison to the human lifetime, but it is widely understood that the Pacific Northwest is "overdue" for a high-magnitude earthquake.

Figure II-48. Map of Selected Earthquakes for Oregon, 1841 through 2002



Source: Niewendorp, C. A. & Neuhaus, M. E.,2003.

Table II-33. Historic Earthquake Events

Date	Magnitude	Location	Details
Aug. 2018 (08/22/2018)	6.2	170 miles west of Coos Bay.	10.0 km depth; MMI: IV.
Aug. 2010 (08/28/2010)	5.2	80 miles offshore from Reedsport.	
Feb. 2001 (02/28/2001)	6.8	Nisqually, WA	400 injured; $2 billion in damage; 'Deep' earthquake.
July 1999 (07/02/1999)	5.9	Satsop, Washington	
Dec. 1993 (12/04/1993)	5.1	Klamath Falls, Oregon	4.8 km depth; MMI: VI.
Sept. 1993 (09/21/1993)	5.9 and 6.0	Klamath Falls, Oregon	2 dead; $10 million in damage from these "crustal" earthquakes; 8.5 and 8.6 km depth respectively.
Mar. 1993 (03/25/1993)	5.6	Scotts Mills, Oregon (east of Woodburn)	$30 million in damage from this "crustal" earthquake; MMI: VI.
Nov. 1980 (11/08/1980)	7.0	off N.CA Coast	19.0 km depth; MMI: VI.
May 1980 (05/18/1980)	5.1	Mt. St. Helens	Associated with eruption.
Jun. 1973 (06/16/1973)	5.6	80 miles offshore from Lincoln City.	
Apr. 1965 (04/29/1965)	6.5	Renton, Washington	7 dead; $50 million in damage
Mar. 1964 (03/28/1964)	9.2	Prince William Sound, Alaska	140 dead; $311 million in damage. Largest recorded earthquake in the U.S.
Dec. 1963 (12/27/1963)	4.5	Oregon	33.0 km depth
Nov. 1962 (11/06/1962)	5.2	Portland, Oregon	16.0 km depth
Dec. 1953 (12/16/1953)	5.0	Portland, Oregon	n/a depth
Apr. 1949 (04/13/1949)	6.8	Olympia, Washington	8 dead; $25 million in damage; 'Deep' earthquake at 70 km depth.
Dec. 1941 (12/19/1941)	5.6	Portland, Oregon	
July 1936 (07/16/1936)	5.8	Milton-Freewater, Oregon	
May 1916 (05/13/1916)	5.7	Richland, Washington	
Apr. 1906 (04/18/1906)	8.3	San Francisco, California	3,000 dead; $374 million in damage
Jan. 1700 (01/26/1700)	9.0	off Pacific NW coast	

Source: USGS, https://earthquake.usgs.gov/earthquakes/; Sullivan, W.L., 2018.

Impacts on Buildings

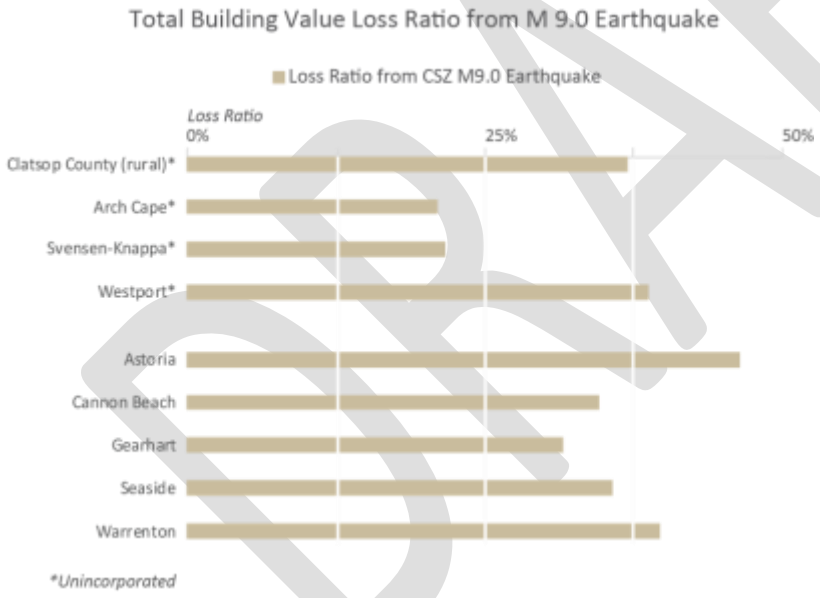
Generally, the older the home is, the greater the risk of damage from natural disasters. This is because stricter building codes have been developed with improved scientific understanding of plate tectonics and earthquake risk. For example, structures built after the late 1960s in the Northwest use earthquake-resistant designs and construction techniques. Those built before 1960 (47.1% of homes in Clatsop County) are not likely to be earthquake resistant. "Unreinforced masonry" (or URM) buildings are known to be the most susceptible to damage.

Clatsop countywide CSZ M9.0 earthquake results (not including buildings or population within the Medium-sized tsunami zone):

- Number of red-tagged buildings: 5,045
- Number of yellow-tagged buildings: 1,314
- Loss estimate: $1,190,540,000
- Loss ratio: 24%
- Non-functioning critical facilities: 36
- Potentially displaced population: 7,029

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020

Figure II-49. Earthquake loss ratio by Clatsop County community



Source: Williams et al, 2020, p.17.

While buildings and other structures can be designed or retrofitted to withstand earthquakes, it can be prohibitively expensive to design for the highest magnitude 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.

Impacts on Infrastructure

Roads, bridges, ports, and utilities (telecom, gas, water, powerlines, etc.) also 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. 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. Following an earthquake event, the cleanup of debris can be a huge challenge for the community.

Ports face the challenge of both the proximity to water and the instability of the large vessels/craft docked at piers and on runways. The high cost of maintenance and the age of the many maritime structures means that the forces associated with an earthquake could easily be catastrophically damaging.

Utilities face the risk of lines breaking, particularly at connections. These are ideal and affordable choices for retrofitting because adding flexibility to a length of pipe at its connection point can help prevent damage. However, gas utilities and all infrastructure using liquid or pressurized fuel should use automatic shut-off valves to prevent leaks, spills, explosions, and fire following a seismic event.

Water impoundments are a risk in an earthquake event due to the weight of water and the fact that containers used for the stationary storage of water (dams, levees, tanks, pools, reservoirs, etc.) may not have the strength of material to withstand the motion of water due to ground shaking. 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. For more information about the dams in Clatsop County, see the Flood hazard section of this plan.

Four dams in Clatsop County have been designated as “high hazard”, meaning they would pose a risk to downstream populations if they failed in an earthquake event. All have Emergency Action Plans in place: Bear Creek, Middle Reservoir, and Wickiup Lake, all managed for water supply by the City of Astoria, and the Seaside City Reservoir (Peterson Point Dam) established in 1996 also used for domestic water supply.

Impacts on Hazardous Materials

One of the most important preparations that can be made for a major earthquake event is to prevent the release of toxic gases and flammable fuels. Not only could the release of chlorine gas for water disinfection be lethal or fires started from liquid or pressurized fuels, the control of these releases is imminently more difficult without power, roads, or structural integrity of untested systems. Due to the importance of these concerns, the State of Oregon recently released a Fuel Plan and Clatsop County is similarly conducting an inventory of county fuel storage sites. Local water providers are required to meet standards for the storage of water treatment chemicals, but local regulations and coordination should be conducted locally to ensure that private entities managing pools or small, private water sources are similarly protecting the public by considering the seismic resilience of their systems to withstand a major earthquake.

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for earthquake was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the appendix. The considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

In ranking this hazard, the scenario considered most likely to be a threat was a Cascadian Subduction Zone M9 earthquake with wide-ranging, catastrophic effects. Coastal counties have a very high risk for a CSZ earthquake event compared to the rest of the state, due to the presence of liquefiable soils and the associated risk of a local tsunami.

For the 2021 Plan Update, the earthquake hazard rankings largely agreed with the previous ranking in 2015 by the Steering Committee of 'high' for the earthquake hazard. The medium rankings result from the assignment of a low history and probability to the event. This may indicate an inability to address such a wide-reaching and catastrophic event due to the location of the jurisdiction.

Table II-34. Hazard Vulnerability Analysis: Earthquake

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	8	50	100	55	212	H
City of Astoria	14	50	100	49	213	H
City of Cannon Beach	2	50	100	35	187	H
City of Gearhart	2	50	100	35	187	H
City of Seaside	2	50	100	35	187	H
City of Warrenton	2	20	100	7	129	M
Arch Cape Water District	2	50	100	7	159	M
Arch Cape Sanitary District	2	50	100	7	159	M
Cannon Beach RFPD	2	50	100	7	159	M
Clatsop Community College	2	50	100	7	159	M
Falcon Cove Water District	2	50	100	35	187	H
Knappa-Svensen-Burnside RFPD	6	50	100	21	177	H
Lewis and Clark RFPD	2	50	100	35	187	H
Port of Astoria	20	50	100	70	240	H
Seaside School District	10	50	100	35	195	H
Sunset Empire Transit District	2	50	100	35	187	H

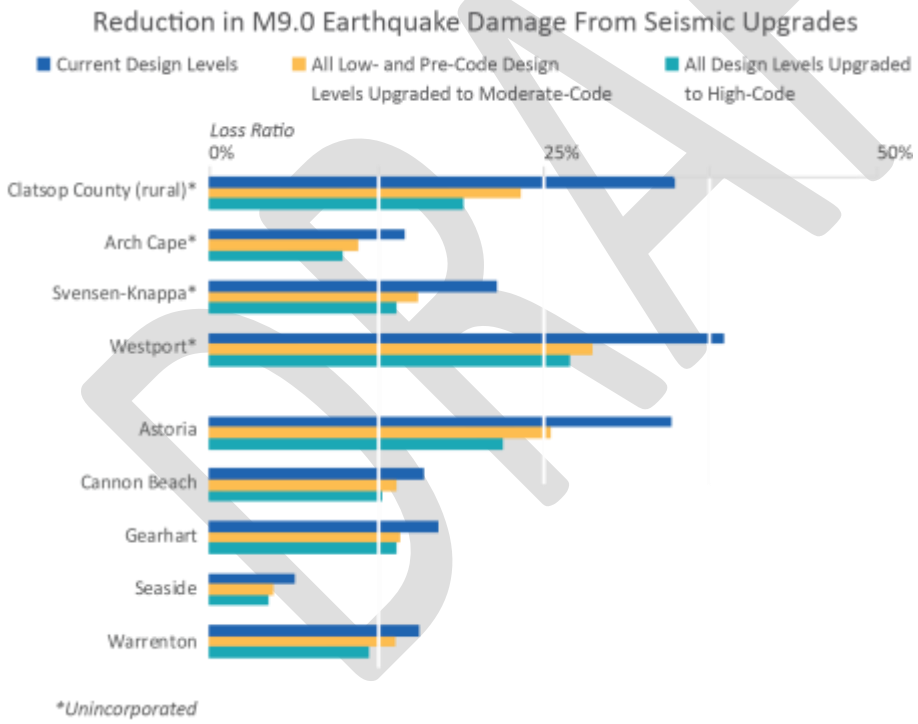
Source: Clatsop County MJNHMP Update Steering Committee, April-Oct., 2019; Clatsop County EOP 2018, p. 18.

Earthquake Vulnerability Assessment

The DOGAMI Natural Hazard Risk Report for Clatsop County conducted in 2018 built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 earthquake hazard (Williams et al, 2020, p.20).

- Very high liquefaction soils are found throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton.
- Building inventory for the City of Astoria is relatively older than other communities in Clatsop County, which implies lower seismic building design codes and thus more vulnerable to earthquake damage. When tsunami damages are disregarded, Astoria's estimated loss ratio from a CSZ earthquake alone is 46% compared to 20%-39% for the other communities in the county.
- 12 (36 when including areas of tsunami inundation) of the 45 critical facilities in the incorporated communities of Clatsop County could be non-functioning due to a CSZ earthquake.
- Because of the liquefaction and landslides, these communities will likely be "islands" disconnected from other communities by severed transportation routes.

Figure II-50. CSZ M9.0 Reduction in Earthquake Damage from Seismic Upgrades



Note: These are the simulated benefits of potential seismic building code upgrades. Loss estimates shown are for buildings outside the tsunami zone only and are reported on the basis of Hazus-MH earthquake loss estimates. Tsunami losses to buildings are assumed to be complete within the inundation area. Source: Williams, 2020, p.20.

Table II-35. Cascadia subduction zone earthquake loss estimates

			(all dollar amounts in thousands)									
			Total Earthquake Damage*		**Earthquake Damage outside of Medium Tsunami Zone**							
			Buildings Damaged		**Buildings Damaged**				**Building Design Level Upgraded to at Least Moderate Code**			
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Sum of Economic Loss**	**Loss Ratio**	**Yellow-Tagged Buildings**	**Red-Tagged Buildings**	**Sum of Economic Loss**	**Loss Ratio**	**Yellow-Tagged Buildings**	**Red-Tagged Buildings**	**Sum of Economic Loss**	**Loss Ratio**
Unincorp. County (rural)	8,214	1,378,964	504,969	37%	619	2,251	480,396	34.8%	648	1,404	321,707	23.3%
Arch Cape	462	113,684	23,820	21%	18	59	16,694	14.7%	9	45	12,676	11.2%
Svensen-Knappa	1,652	178,049	38,280	22%	146	377	38,280	21%	118	236	27,790	16%
Westport	348	24,928	9,592	39%	37	154	9,592	38.5%	59	84	7,157	28.7%
Total Unincorp. County	10,676	1,695,624	576,661	34%	820	2,840	544,962	32%	833	1,769	369,331	22%
Astoria	4,358	1,037,058	477,091	46%	345	1,193	358,585	34.6%	112	1,032	264,785	25.5%
Cannon Beach	2,037	567,876	194,744	34%	55	318	91,424	16.1%	27	287	79,933	14.1%
Gearhart	1,607	359,970	112,552	31%	35	184	61,778	17.2%	12	173	51,618	14.3%
Seaside	4,325	872,504	308,629	35%	16	156	56,116	6.4%	13	140	42,047	4.8%
Warrenton	2,826	493,680	194,338	39%	43	354	77,676	16%	49	296	68,779	14%
Total Clatsop County	25,829	5,026,711	1,864,014	37%	1,314	5,045	1,190,540	23.7%	1,046	3,696	876,491	17.4%

Source: Williams et al, 2020, p.70.

Future Climate Conditions: Earthquake

The February 2020 Clatsop County Future Projections Report does not indicate any increased climate risks specific to the earthquake hazard.

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential actions to address earthquakes are placeholders following the hazard description so the community and other readers understand the some of the mitigation best practices under consideration.

- Evaluate critical facilities for seismic preparedness by identifying structural deficiencies and vulnerabilities to dependent systems (e.g., water, fuel, power).
- Address vulnerabilities of critical facilities. DOGAMI estimates that 88% of critical facilities will be damaged by the CSZ event (includes tsunami), which will have many direct and indirect negative effects on first-response and recovery efforts.
- Conduct awareness campaigns to encourage home and business owners of buildings built before modern codes were adopted; develop incentive programs to encourage retrofits.
- Ensure seismic building codes are strictly enforced, especially for manufactured homes.
- Consider implementing regulations in highly liquefiable soil zone areas; consider implementing regulations in landslide prone areas; or consider using planning to reduce risk.

4. Flood

Causes and Characteristics

Oregon has a history of flooding with flood records dating back to the 1860s. The principal types of flood that are a threat to Clatsop County include:

- Riverine flooding from freshwater rivers and streams;
- Ocean flooding from high tides or wind- driven waves;
- Dams, levees, and tide gates.

Riverine floods occur when water levels in rivers and streams overflow their banks. 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. 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.

FEMA's National Flood Insurance Program (NFIP) requires jurisdictions that regulate development (county and municipalities) to the use of Flood Insurance Rate Maps (FIRMs) for managing the local floodplain. FIRMs depict flood conditions and the associated Flood Insurance Study (FIS) provides key details about the location, source, and nature of flooding in the county. FEMA produces this information via their Risk MAP program. This information can be accessed at the FEMA Flood Map Service Center: https://msc.fema.gov/ or: https://msc.fema.gov/nfhl which launches the National Flood Hazard Layer (NFHL) Viewer.

FEMA has mapped Clatsop County water bodies 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.

There are many large rivers within Clatsop County that either drain into the Pacific Ocean or the Columbia River. The major rivers within the county are the Lewis and Clark, Necanicum, Nehalem, North Fork Nehalem, Skipanon, John Day, Walluski, and Youngs, with the Columbia River defining its northern boundary of the County. All the listed rivers are subject to flooding and can cause damage to buildings within the floodplain. Other flooding effects are due to coastal flooding from the Pacific Ocean for low-lying coastal developments and within Clatsop County's estuaries (Williams et al, 2020).

FEMA issues preliminary maps, confer with the public and public officials about the release of the new information, but then require that the map is adopted into local regulations and that the local flood ordinance is updated to meet the Code of Federal Regulations (CFR) that guides the National Flood Insurance Program. For Clatsop County, Cannon Beach, Gearhart, Seaside, and Warrenton, the most recent FIRM was adopted on June 20, 2018.

Ocean flooding/ Velocity (V) zone designations 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 King tides occur. The Federal Emergency Management Agency (FEMA) has identified and mapped coastal areas subject to direct wave action (V zones) and sand dune overtopping/shallow flooding (AH and AO zones). Ocean storms can be expected every year. El Niño effects, which tend to raise ocean levels, occur about every three to five years (Taylor, G.H. and C.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. It is important to note however, that FEMA maps do not consider future conditions, such as sea level rise. Ocean flooding in the estuaries of the Oregon coast resulting from sea level rise have yet to be mapped.

Infrastructure has a life span as well as a design that is usually based on the conditions that existed prior to construction. There are costs to maintain and to assess the condition of existing structures.

Dam emergencies can be caused by events that reduce stability in the dam. A large snowpack, heavy rain or a combination can cause extreme floods that exceed spillway capacity. Prior to a large flood or when there is an unusual snowmelt, it is important to ensure that dams are not overfilled; it may be prudent to lower water levels in advance of high flows into the reservoir. There is almost always warning of extreme floods, and even more time to prepare for a large snowpack. Earthquakes usually occur with no warning, so it is essential to prepare based on proximity to areas that have a geologic record of large earthquakes. It is also important to inspect a dam after earthquake shaking. Concrete spillways can be subject to serious damage after extreme floods and earthquakes, and dams located on weak foundation materials are also vulnerable. Dam emergencies can also be caused by conditions within the dam that can often be determined by inspections, or by review of design and specification documents. Temporary or permanent restrictions on maximum water levels are sometimes essential until problem conditions are repaired (OWRD, 2011).

Figure II-51. Dams in Clatsop County (NID)

Name	Hazard Level	Height	Storage	Owner	Purpose/Notes
Bear Creek Dam	High	94 ft.	800 acre-feet	City of Astoria	Water Supply/ Bear Cr.
Middle Reservoir	High	39 ft.	168 acre-feet	City of Astoria	Water Supply/ Bear Cr.
Wickiup Lake	High	30 ft.	340 acre-feet	City of Astoria	Water Supply/ Bear Cr.
Seaside City Reservoir	High	45 ft.	170 acre-feet	City of Seaside	Water Supply/ Necanicum R.
Fishhawk Lake	Significant	40 ft.	1,650 acre-feet	Fish Hawk Lake Home Owners Association	No purpose listed/ Fishhawk Cr./ Minimal downstream population.

Source: USACE (2020). National Inventory of Dams. https://nid.sec.usace.army.mil/ords/f?p=105:1:::::: Note: Hazard classifications: High: Failure would present a strong risk for loss of life, annual inspection, Emergency Action Plan (EAP) required. Significant: Failure would present a strong risk for loss of major infrastructure, inspection every 3 years, EAP not required.

Levees and tide gates that may be unmaintained or designed for different conditions may cause flooding under various conditions. There are over 8,000 acres of lowlands in Clatsop County that depend on over 35 miles of dikes for flood control. Many of these dikes are in poor condition and are expensive to maintain and repair. There are a wide array of permitted and unpermitted impoundments on the landscape that pose a risk during heavy precipitation and other stressors that can cause earth movement (earthquake, tsunami, debris flow, even wildfire).

Tide gates are structures designed to protect farm land and other development from salt water and high tides. However, due to the expense and heavy permit burden associated with estuaries that support salmonids, it is very expensive to fix them when they break. Most tide gates are well past the end of their useful life and may be impossible to operate—making it difficult to drain freshwater flood flows. Thus tide gates can result in back flooding at these locations—resulting in erosion, structure failure, and variations in the local fresh-salt water chemistry that may not benefit native species or estuarine products like oysters.

Historic Flood Events

The following table provides information on the previous occurrences of flood events.

Table II-36. Historic Flood Events

Date	Location	Event Type	Magnitude	Details
Jan. 2018 (01/18/2018)	N. Oregon Coast	Flood, Coastal Erosion	3 ft. waves	A strong stationary low pressure system brought high seas with wave heights up to 37'. Seaside and Cannon Beach had water in their streets.
Oct. 2017 (10/21/2017)	N. Oregon Coast	High Wind, Heavy Rain	53 mph. on Megler Bridge	A very potent atmospheric river brought strong winds to the north Oregon Coast and Coast Range on October 21st. What followed was a tremendous amount of rain for locations along the north Oregon Coast and Coast Range.
Nov. 2016 (11/24/2016)	Bradwood, Clatsop County	Heavy Rain	3.52 in. of rain	A moist Pacific front moving slowly across the area produced heavy rainfall, resulting in flooding of several rivers across Northwest Oregon and at least two landslides.
Dec. 2007 (12/01/2007-12/03/2007)	Clatsop County	High Wind, Heavy Rain, Mudslides	A series of powerful Pacific storms brought straight-line winds, rain, and mudslides.	A series of powerful Pacific storms Dec. 1-3, 2007 brought days of sustained straight-line winds and rain, resulting in mudslides, downed power lines and trees. A Presidential Disaster Declaration was warranted by $180 million in damage in the state, power outages for several days, and five deaths attributed to the storm.
Dec. 2006 (12/14/2006, 12/15/2006)	Clatsop, Tillamook Counties	High Wind, Heavy Rain		$10,000 in damages.
Nov. 2006 (11/05/2006-11/08/2006)	Clatsop County	High Wind, Heavy Rain		Severe storms, flooding, landslides, mudslides.

Date	Location	Event Type	Magnitude	Details
Dec. 2004 (12/08/2004-12/09/2004)	W. Oregon	Winter Storm, High Wind, Heavy Snow, High Surf	2.5 ft. of snow on Mt Hood; Lightning in Astoria; 25 ft. Surf	A large powerful Pacific storm brought a wide variety of weather to Northwestern Oregon. High winds along the Coast heralded the approach of the storm early in the morning. A City employee was struck by lightning.Heavy rain accompanied this storm resulting in mud slides. The storm also generated high seas, which created high surf along the Northern and Central Oregon Coast the next day. Buoys 20 miles off the Oregon Coast reported maximum seas of 25 to 26 feet.
Jan. 2004 (01/27/2004-01/29/2004)	Clatsop	Heavy Rain	4 in. rain in Seaside; 4.29 in. rain at Astoria Airport	A series of strong Pacific storm systems brought heavy rain to Northwest Oregon.
Dec. 2003 (12/12/2003 - 12/14/2003)	Clatsop	Heavy Rain	1-3 in.	A strong very moist Pacific system moved into the are producing heavy rains.
Mar. 2003	Clatsop	Heavy Rain	1-3 in.	Heavy rains once again moved into Northwest Oregon. Many stations reported 1 to 3 inches during the same 24-hour period.
Jan 2003 (01/29/2003-01/31/2003)	Clatsop	Heavy Rain, Floods	1-3 in.	Heavy rains associated with a strong Pacific weather system brought 2 days of heavy rains to the area. Numerous locations reported 1 to 3 inches. These heavy rains filled many small streams, 2 feet of water covered Highway 101 between Seaside and Cannon Beach.
Jan. 2002	N. Oregon Coast	Winter Storm: High Winds, Heavy Rains	63 mph.	A winter storm brought high winds, heavy rain, and warmer temperatures to the area, resulting in flooding and mud and landslides. High winds knocked out power along the coast from Cannon Beach and Seaside to Warrenton for varying periods of timeReported winds included Cannon Beach 40 to 45 mph with gusts to 63 mph.
2001	Clatsop	n/a		A dike failure required a significant emergency repair effort to prevent significant flood losses.
Aug. 2001 (08/22/2001-08/23/2001)	Clatsop	Heavy Rain		n/a – Unknown if above event is connected to this Aug. event.
Dec. 1996 (12/26/1996-12/31/1996)	N. Oregon Coast	Heavy Rain, Floods	16 rivers flooded	Heavy rains caused 16 rivers in NW Oregon to flood during the last week of December 1996 and into early January 1997. Dozens of homes were flooded on various rivers and numerous highways were rendered impassable.
Nov. 1996 - Dec. 1996	Five Western States	Heavy Rain, Freezing Rain/Heavy Wet Snow	6-18 in. rain west of the Cascades; 8 in. in 24 hrs. in Coast Range	During the period from mid-November to mid-December 1996, many areas received above-normal precipitation, greatly increasing the snowpack over mid and high elevations. Three sequential storms brought moderate to heavy rain, with the last creating a rain-on-snow event which resulted in incredible amounts of runoff.

Date	Location	Event Type	Magnitude	Details
Nov. 1996 (11/18/1996-11/20/1996)	N. Oregon Coast	Heavy Rain, Floods	11 rivers reached flood stage	Road damage from landslides; high velocity flows, damage from erosion and undermining of structures. Heavy rainfall over Oregon caused many rivers in Northwestern Oregon to flood. The first small streams began flooding on November 18th with 11 larger rivers reaching flood stage on the 19th and 20th. Major rivers such as the lower reaches of the Willamette remained above flood stage until November 23rd. Initial damage estimates from this flooding exceeded $3 million.
Feb. 1996 (2/5/1996-2/9/1996)	N. Oregon Coast	Floods, Debris Flow	Astoria 7.68 in. rain in 3 days	A river of subtropical atmospheric moisture flowed above northern Oregon producing very heavy rainfall, particularly in the northwestern part of the state. Runoff from heavy rains and melting mountain snow caused major floods upon many northern Oregon rivers. Six rivers set all time high river stage records, and 7 people lost their lives as a direct result of flooding. Statewide damage was estimated at over 285 million dollars with an estimated five thousand homes destroyed. Numerous mudslides were triggered, disrupting transportation in mountainous areas of western Oregon.
Nov. 1991	Oregon Coast	High Wind, High Surf	25 ft. waves	This slow-moving storm generated 25-foot waves and resulted in damage to buildings, boats, and transmission lines.
1982	Clatsop	Dike failure		Caused almost $200,000 in damage (Clatsop EOP, 2018).
Nov.-Dec. 1977	Western Oregon	Heavy Rain, Floods	n/a	Rain on snow event; $16.5 million in damages.
Jan. 1972	Western Oregon	Heavy Rain, Floods	n/a	Record flows on coastal rivers.
Dec. 1964 (12/24/1964)	Oregon	Floods, Heavy Rain, Winter Storm	100-year flood event; Benchmark	The Christmas flood of 1964 was driven by a series of storms, known as atmospheric rivers or “pineapple expresses,” that battered the region producing as much as 15 inches of rain in 24 hours at some locations. The combination of heavy rain, melting snow, and frozen ground caused extreme runoff, erosion and flooding.
Dec. 1964 - Jan. 1965	Oregon	Floods, Heavy Rain, Winter Storm		Rain on snow event; record flood on many rivers.
Mar. 1964	Oregon Coast	Flood	n/a	n/a
Jan. 1956	Western Oregon	High Wind, Heavy Rain, Mudslides		Heavy rains, high winds, mud slides resulted in estimated damages of $95,000.
May - June 1948	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.
May 1928	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.

Date	Location	Event Type	Magnitude	Details
June 1913	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.
Feb. 1907	Western Oregon	Flood	n/a	
June 1894	Columbia River Basin	Flood	33 ft. in Portland	Rain on snow event; Rocky Mountain snow melt.
May - June 1884	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.
June 1880	Columbia River Basin	Flood	27.4 ft. in Portland	Rain on snow event; Rocky Mountain snow melt.
Mar. 1876	Columbia River Basin	Flood	< 27.0 ft in Portland	Rain on snow event; Rocky Mountain snow melt.
Jan. 2002	N. Oregon Coast	Winter Storm: High Winds, Heavy Rains	63 mph.	A winter storm brought high winds, heavy rain, and warmer temperatures to the area, resulting in flooding and mud and landslides. High winds knocked out power along the coast from Cannon Beach and Seaside to Warrenton for varying periods of time. A private single engine plane was flipped by the gusty winds at the Astoria Regional Airport in Warrenton. Reported winds included Cannon Beach 40 to 45 mph with gusts to 63 mph.
Aug. 2001 (08/22/2001-08/23/2001)	Clatsop	Heavy Rain	n/a	n/a
Dec. 1996 (12/26/1996-12/31/1996)	N. Oregon Coast	Heavy Rain, Floods	16 rivers flooded	Heavy rains caused 16 rivers in NW Oregon to flood during the last week of December 1996 and into early January 1997. Dozens of homes were flooded on various rivers and numerous highways were rendered impassable.
Nov. 1996 - Dec. 1996	Five Western States	Heavy Rain, Freezing Rain/Heavy Wet Snow	6-18 in. rain west of the Cascades; 8 in. in 24 hrs. in Coast Range	During the period from mid-November to mid-December 1996, many areas received above-normal precipitation, greatly increasing the snowpack over mid and high elevations. Three sequential storms brought moderate to heavy rain, with the last creating a rain-on-snow event which resulted in incredible amounts of runoff.
Nov. 1996 (11/18/1996-11/20/1996)	N. Oregon Coast	Heavy Rain, Floods	11 rivers reached flood stage	Road damage from landslides; high velocity flows, damage from erosion and undermining of structures. Heavy rainfall over Oregon caused many rivers in Northwestern Oregon to flood. The first small streams began flooding on November 18th with 11 larger rivers reaching flood stage on the 19th and 20th. Major rivers such as the lower reaches of the Willamette remained above flood stage until November 23rd. Initial damage estimates from this flooding exceeded $3 million.

Date	Location	Event Type	Magnitude	Details
Feb. 1996 (2/5/1996-2/9/1996)	N. Oregon Coast	Floods, Debris Flow	Astoria 7.68 in. rain in 3 days	A river of subtropical atmospheric moisture flowed above northern Oregon producing very heavy rainfall, particularly in the northwestern part of the state. Runoff from heavy rains and melting mountain snow caused major floods upon many northern Oregon rivers. Six rivers set all time high river stage records, and 7 people lost their lives as a direct result of flooding. Statewide damage was estimated at over 285 million dollars with an estimated five thousand homes destroyed. Numerous mudslides were triggered, disrupting transportation in mountainous areas of western Oregon.
Nov. 1991	Oregon Coast	High Wind, High Surf	25 ft. waves	This slow-moving storm generated 25-foot waves and resulted in damage to buildings, boats, and transmission lines.
Nov.-Dec. 1977	Western Oregon	Heavy Rain, Floods	n/a	Rain on snow event; $16.5 million in damages.
Jan. 1972	Western Oregon	Heavy Rain, Floods	n/a	Record flows on coastal rivers.
Dec. 1964 (12/24/1964)	Oregon	Floods, Heavy Rain, Winter Storm	100-year flood event; Benchmark	The Christmas flood of 1964 was driven by a series of storms, known as atmospheric rivers or "pineapple expresses," that battered the region producing as much as 15 inches of rain in 24 hours at some locations. The combination of heavy rain, melting snow, and frozen ground caused extreme runoff, erosion and flooding.
Dec. 1964 - Jan. 1965	Oregon	Floods, Heavy Rain, Winter Storm		Rain on snow event; record flood on many rivers.
Mar. 1964	Oregon Coast	Flood	n/a	n/a
Jan. 1956	Western Oregon	High Wind, Heavy Rain, Mudslides		Heavy rains, high winds, mud slides resulted in estimated damages of $95,000.
May - June 1948	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.
May 1928	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.
June 1913	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.
Feb. 1907	Western Oregon	Flood	n/a	
June 1894	Columbia River Basin	Flood	33 ft. in Portland	Rain on snow event; Rocky Mountain snow melt.
May - June 1884	Columbia River Basin	Flood	n/a	Rain on snow event; Rocky Mountain snow melt.

Date	Location	Event Type	Magnitude	Details
June 1880	Columbia River Basin	Flood	27.4 ft. in Portland	Rain on snow event; Rocky Mountain snow melt.
Mar. 1876	Columbia River Basin	Flood	< 27.0 ft. in Portland	Rain on snow event; Rocky Mountain snow melt.

Source: NOAA Storm Events Database, https://www.ncdc.noaa.gov/stormevents/, accessed 12/2/2019.

Impacts on Homes

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. 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.

Impacts on Infrastructure

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. 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. 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.

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
- 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

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for flood was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the appendix. The considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

For the 2021 Risk Assessment, the sixteen jurisdictions indicated the following risk levels for flood:

Table II-37. Hazard Vulnerability Analysis: Flood

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	12	40	80	67	199	H
City of Astoria	16	35	80	56	187	H
City of Cannon Beach	2	20	40	14	76	L
City of Gearhart	2	10	20	7	39	L
City of Seaside	10	50	100	35	195	H
City of Warrenton	2	50	100	35	187	H
Arch Cape Water District	2	10	20	7	39	L
Arch Cape Sanitary District	2	10	20	7	39	L
Cannon Beach RFPD	2	20	40	14	76	L
Clatsop Community College	20	40	60	70	190	H
Falcon Cove Water District	2	25	50	7	84	M
Knappa-Svensen-Burnside RFPD	16	20	40	56	132	M
Lewis and Clark RFPD	20	50	50	70	190	H
Port of Astoria - Airport	10	50	100	70	230	H
Port of Astoria - Marine	10	25	50	7	92	M
Seaside School District	2	25	50	70	147	M
Sunset Empire Transit District	10	50	100	7	167	H

Source: Clatsop County MJNHMP Update Steering Committee, April. 2019-Jan. 2021; Clatsop County EOP 2018, p. 18.

Flood Vulnerability Assessment

The flood summary below presents only the information for the 100-year flood zone.

Clatsop countywide 100-year flood loss:

- Number of buildings damaged: 2,529
- Loss estimate: $40,951,000
- Loss ratio: 0.8%
- Damaged critical facilities: 14
- Potentially displaced population: 4,498

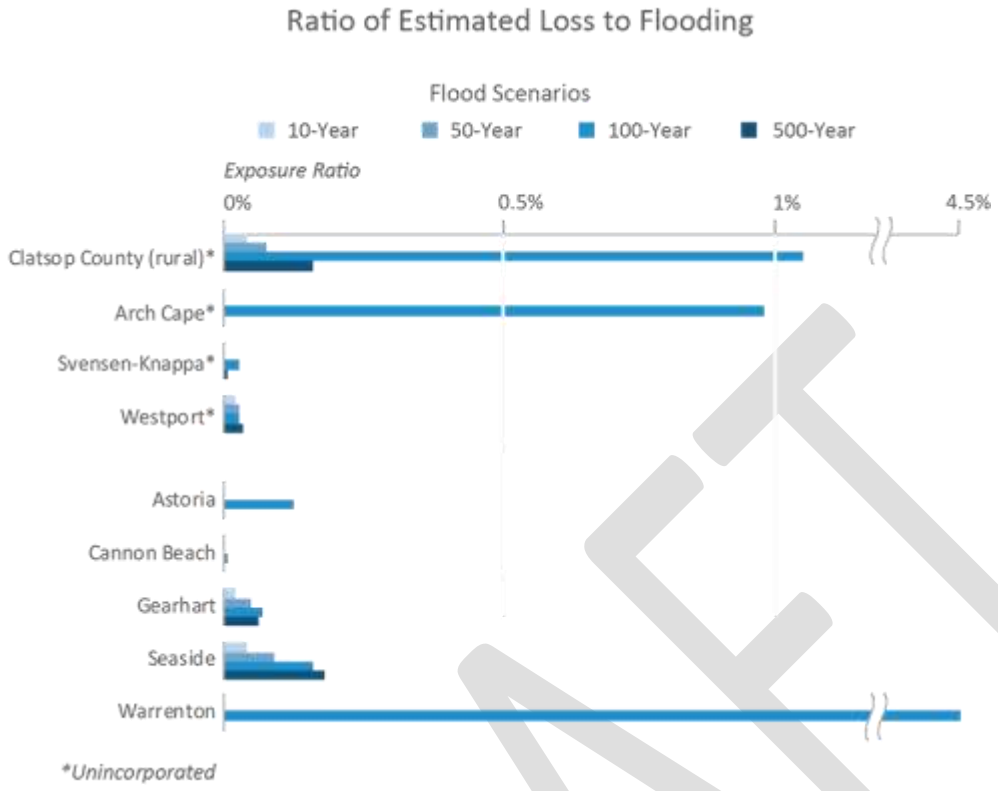
Source: Williams et al, 2020.

The DOGAMI Natural Hazard Risk Report for Clatsop County (Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, pp. 27-28) identified locations within the study area that are comparatively more vulnerable or at greater risk to flood hazard:

- Flood exposure to 1,070 buildings and over $20 million in potential losses from a 100-year flood is estimated to be within the leveed areas in Warrenton.
- The developed area between Astoria and Warrenton along Youngs Bay is subject to 100-year flooding. Many buildings in this area are estimated to be damaged from this type of flood.
- Based on best available data, which is subject to change, the downtown portion of Warrenton is vulnerable to flooding and only a small percentage of buildings are elevated above the estimated level of flooding.

Low-lying coastal areas are particularly vulnerable to flood hazards that can be exacerbated by high tides. Levees pose a risk both of failure that could allow held-back waters to pour into the levee-protected area, but also in preventing proper drainage during precipitation events. The areas of Miles Crossing and Jeffers Gardens suffer annual levee breaches as well as episodic flooding from precipitation due to levees (Golightly, J., Lewis & Clark Fire risk assessment, 2019).

Figure II-52. Flood loss estimates by Clatsop County community.



Note: In addition to the four riverine flood scenarios, coastal flooding information is only available for the 100-year flood scenario for portions of Clatsop County (rural) and the communities of Arch Cape, Astoria, Cannon Beach, Gearhart, Seaside, and Warrenton. Source: Williams et al, 2020, p. 27.

National Flood Insurance Program (NFIP) in Clatsop County

Table II-38. National Flood Insurance Program (NFIP) Insurance Information

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-FIRM Claims Paid	Substantial Damage Claims	Total Paid Amount
Clatsop County	$124,234,600	64	34	9	$1,549,745
Astoria	$27,375,800	0	0	0	$0
Cannon Beach	$136,039,400	10	6	0	$263,199
Gearhart	$56,665,900	3	3	0	$16,305
Seaside	$240,131,400	17	17	1	$109,168
Warrenton	$49,747,900	2	2	0	$11,478

Source: FEMA Community Information System, 02/07/2020.

Table II-39. Community Rating System (CRS) Information

Jurisdiction	CRS Class Rating	Last Community Assistance Visit
Clatsop County	10	1/9/2014
Astoria	10	4/21/2000
Cannon Beach	7	12/16/2015
Gearhart	10	4/20/2000
Seaside	10	2/24/2005
Warrenton	10	4/25/2000

Source: FEMA Community Information System, 02/07/2020.

Table II-40. NFIP Repetitive Loss & Severe Repetitive Loss Properties by Type

Jurisdiction	Total	Repetitive Loss Structures	Severe Repetitive Loss Properties	RL Single Family	SRL Single Family	RL Other	SRL Other
Clatsop County	7	6	1	6	1	0	0
Astoria	0	0	0	0	0	0	0
Cannon Beach	0	0	0	0	0	0	0
Gearhart	1	1	0	1	0	0	0
Seaside	0	0	0	0	0	0	0
Warrenton	2	2	0	2	0	0	0
Total	10	9	1	9	1	0	0

Source: FEMA Region X, Regional Flood Insurance Liaison. 9/23/2020.

Table II-41. National Flood Insurance Program (NFIP) Policy Information

Jurisdiction	Effective FIRM and FIS	Initial FIRM Date	Pre-FIRM Policies	Total Policies	Single Family	2 to 4 Family	Other Residential	Non-Residential	Minus Rated A Zone	Minus Rated V Zone
Clatsop County	6/20/2018	7/3/1978	7/26/1900	443	407	6	1	29	14	1
Astoria	9/17/2010	8/1/1978	1/17/1900	83	26	1	42	14	42	0
Cannon Beach	6/20/2018	9/1/1978	5/25/1900	370	313	13	2	42	5	1
Gearhart	6/20/2018	5/15/1978	4/15/1900	186	142	4	39	1	4	0
Seaside	6/20/2018	9/5/1979	2/24/1901	802	486	40	238	38	18	0
Warrenton	6/20/2018	5/15/1978	2/12/1900	157	113	12	0	32	3	0

Source: FEMA Community Information System, 02/07/2020.

Table II-42. Flood loss estimates

			(all dollar amounts in thousands)											
			10% (10-yr)			2% (50-yr)			1% (100-yr)*			0.2% (500-yr)		
Community	Total Number of Buildings	Total Estimated Building Value ($)	Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio	Number of Buildings	Loss Estimate	Loss Ratio
Unincorp. County (rural)	8,214	1,378,964	110	555	0.0%	199	1,039	0.1%	1,044	14,547	1.1%	346	2,236	0.2%
Arch Cape	462	113,684	0	0	0.0%	0	0	0.0%	15	1,113	1.0%	0	0	0.0%
Svensen-Knappa	1,652	178,049	0	0	0.0%	0	0	0.0%	6	44	0.0%	1	5	0.0%
Westport	348	24,928	2	5	0.0%	2	7	0.0%	2	7	0.0%	2	9	0.0%
Total Unincorp. County	10,676	1,695,624	112	560	0.0%	201	1,046	0.1%	1,067	15,711	0.9%	349	2,249	0.1%
Astoria	4,358	1,037,058	0	0	0.0%	0	0	0.0%	71	1,302	0.1%	0	0	0.0%
Cannon Beach	2,037	567,876	0	0	0.0%	0	0	0.0%	3	38	0.0%	0	0	0.0%
Gearhart	1,607	359,970	12	81	0.0%	26	173	0.0%	34	245	0.1%	33	238	0.1%
Seaside	4,325	872,504	33	346	0.0%	219	765	0.1%	352	1,416	0.2%	469	1,619	0.2%
Warrenton	2,826	493,680	0	0	0.0%	0	0	0.0%	1,253	22,240	4.5%	0	0	0.0%
Total Clatsop County	25,829	5,026,711	145	987	0.0%	308	1,985	0.0%	2,529	40,951	0.8%	616	4,107	0.1%

Source: Williams et al, 2020, p.72.

Table II-43. Flood Exposure

			1% (100-yr)*				
Community	Total Number of Buildings	Total Population	Potentially Displaced Residents from Flood Exposure	% Potentially Displaced Residents from Flood Exposure	Number of Flood Exposed Buildings	% of Flood Exposed Buildings	Number of Flood Exposed Buildings Without Damage**
Unincorp. County (rural)	8,214	9,477	1,175	12.4%	1,175	14.3%	131
Arch Cape	462	183	9	5.1%	22	4.8%	7
Svensen-Knappa	1,652	3,013	17	0.6%	7	0.4%	1
Westport	348	498	0	0.0%	3	0.9%	1
Total Unincorp. County	10,676	13,171	1,201	9.1%	1,207	11.3%	140
Astoria	4,358	9,464	151	1.6%	146	3.4%	75
Cannon Beach	2,037	1,683	1	0.0%	5	0.2%	2
Gearhart	1,607	1,462	50	3.4%	48	3.0%	14
Seaside	4,325	6,455	760	12%	352	8%	166
Warrenton	2,826	4,987	2,335	47%	1,253	44%	85
Total Clatsop County	25,829	37,223	4,498	12%	3,011	12%	482

*1% results include coastal flooding source. ** Building first-floor height is above flood elevation. Source: Williams et al, 2020, p.73.

Flood Hazard Codes and Overlay Districts

Clatsop County

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.

City of Astoria

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. The City's current effective date for the Flood Insurance Rate Maps is September 17, 2010. The City objected to the 2012 revised maps as they appeared to have inaccurate data and changed the flood zoning along the Columbia River to a Velocity Zone. The City continues to work with FEMA on revising the maps.

City of Cannon Beach

The City of Cannon Beach has participated in the National Flood Insurance Program since September 1, 1978. Flood insurance is available to all property owners within the City through that program. While the City has not experienced any major flooding since a tsunami associated with the Alaska Good Friday earthquake in March of 1964, the threat of tsunamis and other flood events is always present. The City's current effective date for the Flood Insurance Rate Maps is September 17, 2012.

City of Gearhart

The City of Gearhart participates in the National Flood Insurance Program. In April 2018, Article 5 Flood Hazard Overlay Zone of the Gearhart Overlay Ordinance was updated to reflect the required sections of Title 44 of the Code of Federal Regulations per the FEMA National Flood Insurance Program. The new FEMA Flood Insurance Rate Maps for Gearhart became effective June 20, 2018.

City of Seaside

The City of Seaside Planning Department manages the Flood Damage Prevention Ordinance:

Flood Damage Prevention - City Ordinance - Chapter 152 - Amendments 2018

It is the purpose of this chapter to regulate 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. Amendments adopted in 2018 ensure compliance with the new FEMA Flood Insurance Rate Maps that became effective June 20, 2018.

City of Warrenton

The City of Warrenton has participated in the National Flood Insurance Program since 1978. The City 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 2018 with the update of FEMA maps with an effective date of June 20, 2018.

Future Climate Conditions: Flood

- Coastal rain-dominated watersheds may experience an increase in winter flood risk due to projected greater precipitation and warmer winter temperatures, in addition to increases in the frequency and intensity of flood-producing atmospheric river events.
- Flood risk from the Columbia River is not expected to change due to projected decreases in peak flows and the fact that it is highly managed for flood control.
- Coastal wetland ecosystems are sensitive to rising sea levels, increases in coastal storms and wave height, warming air and water temperatures, changing precipitation patterns and freshwater runoff, saltwater intrusion, and ocean acidification, which can lead to changes in biological, chemical, and physical processes; shifts in species and biodiversity loss; and altered location and spatial extent of tidal wetlands.
- The Necanicum River Estuary is projected to gain potential tidal wetland area as sea level rises.
- Sea level rise and changing wave dynamics are key climate change impacts expected to increase the risk of coastal erosion and flooding hazards on the Oregon Coast. Local sea level rise in Clatsop County is projected to reach 0.8 to 4.8 feet by 2100. These estimates include vertical land movement trend estimates and are based on two global sea level scenarios used in the 2018 US National Climate Assessment. The likelihood of a 4-foot flood event, that is, water reaching four feet above mean high tide, ranges from 4%-38% by the 2030s, 19%-100% by the 2050s, and 98-100% by 2100 (Dalton M.M., 2020, p.38). Climate change is expected to exacerbate coastal erosion in Clatsop County. By 2100 or before, assets and people within the 4-foot inundation zone are highly likely to be impacted or displaced—including 3,407 people, $138 million in property value, and a half-mile of state, county, and local roads (Dalton M.M., 2020, p.38). “The projected increase in local sea levels along the Oregon coast raises the starting point for storm surges and high tides making coastal hazards more severe and more frequent in the future (Climate Central, 2019; Dalton, M.M., 2020, p.35).”
- Local citizens can observe and help document the impacts of climate change. Twice a year, high tides in Oregon are higher than usual. These extreme high tides, commonly called "King Tides," occur when the moon is closest to the Earth, and the Earth is closest to the sun. Because these events are associated with localized flooding and erosion, they are being used to measure and educate the community about the potential impacts of sea level rise and changing wave dynamics. A citizen science photo documentation project can be viewed or participated in online at www.oregonkingtides.net.

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential flood mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices.

- For jurisdictions that participate in the NFIP:
    - Enforce minimum NFIP requirements by implementing the flood ordinance and permitting requirements;
    - Consider adopting higher standards such as adding freeboard to base flood elevation requirements (e.g. +1' or +2' BFE);
    - Regulate to the 500-year floodplain rather than the 100-year;
    - Explore enhanced measures to achieve standing in CRS;
    - Encourage the purchase of flood insurance by sending a flood awareness message out in early fall.
- Find opportunities to increase flood water storage areas.
- Relocate or elevate non-flood proofed structures to above the base flood elevation.
- Add flood vents, elevate HVAC and electrical equipment, or add flood-resistant materials to buildings built before modern flood code was adopted; develop incentive programs to encourage retrofits.
- Address repetitive loss and severe repetitive loss structures using FEMA's property acquisition or "buyout" program (Flood Management Assistance or FMA) to remove structures that have repeatedly flooded in the past.
- Create more permeable surfaces within urban areas, especially large parking lots.

5. Landslide

Causes and Characteristics

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) gravity, the driving forces that cause the material to move down slope, and 2) friction, the 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.

Clatsop County has significant chronic risks from landslides, particularly in steep developed areas such as the City of Astoria and on forested slopes subject to heavy rainfall each winter. However, the potential for catastrophic risk is posed by an earthquake that could trigger landslides resulting in road closures and isolation. 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. There is a strong correlation between intense winter rainstorms and the occurrence of rapidly moving landslides (debris flows).

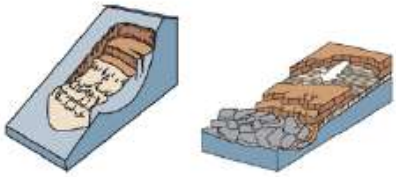
The DOGAMI factsheet, Landslide Hazards in Oregon, <https://www.oregongeology.org/pubs/fs/landslide-factsheet.pdf> summarizes landslides into four categories:

- **Slides**: This kind of landslide exists when the slide material moves in contact with the underlying surface. Here the slide moves along a failure plane or shear zone and either occurs by moving along a curved surface (called a rotational slide) or along a flat surface (called a translational slide). Triggers for slides include heavy rain, rapid snow melt, grading slopes, or adding material or water weight to a slide area such as a moderate to steep slope, in weak soil and rock.
- **Flows**: This type of landslide occurs when a slurry of water, soil, rock, and debris moves rapidly downhill scouring the slope along its path and building momentum as it moves. Flows are triggered by any concentration of water on a steep slope, commonly resulting from heavy precipitation or rapidly-melting snow. Rapidly moving flow landslides are often referred to as a debris flow.
- **Spreads**: When cohesive materials extend over liquefied layers they fail. This type of landslide is primarily associated with gentle slopes near open bodies of water and is particularly a risk during earthquake events. A flow landslide is typically rapid moving and tends to increase in volume as it moves down slope and scours out its channel.
- **Topples or Falls**: This type of landslide involves the rapid, nearly vertical 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 as it commonly occurs along coastal highways where bedrock in steep canyons has been cut into.

Figure II-53. Landslide Types and Processes

Falls are near-vertical, rapid movements of masses of materials, such as rocks or boulders. The rock debris sometimes accumulates as talus at the base of a cliff.

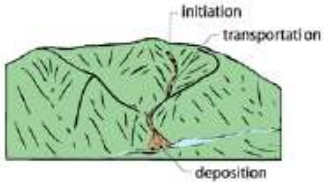
Topples are distinguished by forward rotation about some pivotal point, below or low in the mass.



Slides are downslope movement of soil or rock on a surface of rupture (failure plane or shear-zone).

- **Rotational** slides move along a surface of rupture that is curved and concave.
- **Translational** slides displace along a planar or undulating surface of rupture, sliding out over the original ground surface.

Spreads are commonly triggered by earthquakes, which can cause liquefaction of an underlying layer and extension and subsidence of commonly cohesive materials overlying liquefied layers.



Channelized Debris Flows commonly start on a steep, concave slope as a small slide or earth flow into a channel. As this mixture of landslide debris and water flows down the channel, it pick ups more debris, water, and speed, and deposits in a fan at the outlet of the channel.

Earth Flows commonly have a characteristic "hourglass" shape. The slope material liquefies and runs out, forming a bowl or depression at the head.

Complex landslides are combinations of two or more types. A common complex landslide is a slump-earth flow, which usually exhibit slump features in the upper region and earth flow features near the toe.

Source: USGS, 2004.

Figure II-54. Landslide Causes: Geological, Morphological, and Human

LANDSLIDE CAUSES

1. Geological causes
   a. Weak or sensitive materials
   b. Weathered materials
   c. Sheared, jointed, or fissured materials
   d. Adversely oriented discontinuity (bedding, schistosity, fault, unconformity, contact, and so forth)
   e. Contrast in permeability and/or stiffness of materials

2. Morphological causes
   a. Tectonic or volcanic uplift
   b. Glacial rebound
   c. Fluvial, wave, or glacial erosion of slope toe or lateral margins
   d. Subterranean erosion (solution, piping)
   e. Deposition loading slope or its crest
   f. Vegetation removal (by fire, drought)
   g. Thawing
   h. Freeze-and-thaw weathering
   i. Shrink-and-swell weathering

3. Human causes
   a. Excavation of slope or its toe
   b. Loading of slope or its crest
   c. Drawdown (of reservoirs)
   d. Deforestation
   e. Irrigation
   f. Mining
   g. Artificial vibration
   h. Water leakage from utilities

Source: USGS, 2004.

Impacts to Infrastructure

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.

Historic Landslide Events

Landslides accompany nearly every major storm system that impacts western Oregon. In recent events, particularly noteworthy landslides accompanied storms in 1964, 1966, 1982, 1996, and 2007. Two major landslide-producing winter storms occurred in Oregon during November 1996. Intense rainfall triggered over 9,500 landslides and debris flows that resulted in eight fatalities throughout the state. 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 (GeoScience, 2008).

Astoria's Landslide Risk

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 of Astoria has been experiencing and documenting their significant landslide risk since 1932, which is summarized in Burns, W. J. and Mickelson, K. A. *Landslide inventory, susceptibility maps, and risk analysis for the City of Astoria, Clatsop County, Oregon* (Open-File Report O-13-05). Portland, OR: Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-13-05.htm

This study uses LiDAR data along with historical record and geologic analysis to map susceptibility of both shallow and deep landslides.

> The shallow-seated landslide susceptibility mapping protocol (Burns, 2008a) was used to create a shallow-seated landslide susceptibility maps of the City of Astoria. Roughly 55% of the city is classified as highly susceptible to shallow-seated landslides; roughly 25% as moderately susceptible to shallow-seated landslides, and 20% as less susceptible to shallow-seated landslides. The deep-seated landslide susceptibility mapping protocol (Burns, 2008b) was used to create a deep-seated susceptibility maps of the City of Astoria. Roughly 37% of the city is classified as highly susceptible to deep-seated landslides; roughly 30% as moderately susceptible, and 33% as less susceptible to deep-seated landslides. Again, these results indicated a high susceptibility to both shallow and deep seated landslides.

Eighty-three of the landslides in the inventory are thought to have moved in the last 150 years with 17 slide events documented in the landslide inventory database between 1932 and 2007.

The City of Astoria Areas of High Water and Past Slides map originally developed in 1974 and updated on an ongoing basis 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:

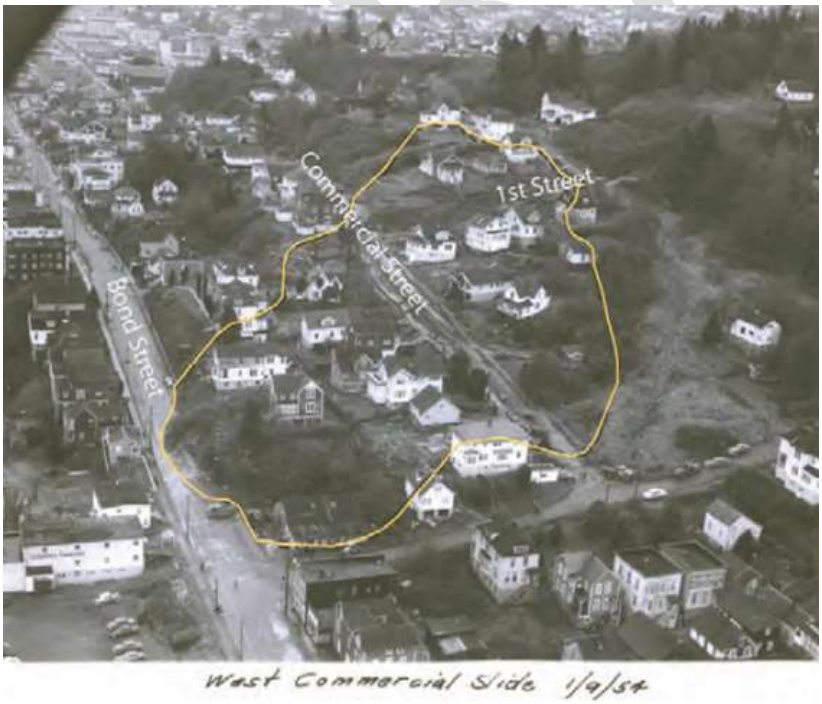
- Map Section A – a total of 7 slide areas
- Map Section B – a total of 9 small slide areas – the most recent in 1998
- Map Section C – 6 small to medium slides and two large slides.
- One of the large slides, known as the Bond Street slide occurred originally in 1954, and was triggered again in January 2007. This slide continued to move during the period 2010-2015. Mitigation of the landslide area and infrastructure is a top priority of the City. See the figure below.

Figure II-55. Bond Street Landslide Impact Area, Astoria

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.

Figure II-56. Bond Street Landslide, Astoria, 1954



Source: City of Astoria

Figure II-57. Bond Street Landslide, Astoria, 2005.

Source: City of Astoria. Note: Photos of the Bond Street landslide, see the toe along Bond Street (left) and the head scarp along First Street (right).

- 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 the figure below.

Figure II-58. Historic Landslide Impact Area. Astoria

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 Upper town 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.

Figure II-59. City of Astoria's potable water main threatened by an active landslide.

Sources: City of Astoria.

Table II-44. Historic Landslide Events

Date	Street/Name	City/Location	Details
Jan. 2021	300 Block of Alameda, between Floral and Alameda Avenue	City of Astoria	This area slid in 1982. Home damaged and ultimately demolished. The 2021 slide damaged two homes.
Jan. 2021	Hwy 30 east of Liberty Lane	City of Astoria	Large amount of material damaged at least one vehicle and closed Hwy 30 for multiple days.
Jan. 2020	Ecola State Park; Crescent Beach Trail and other locations	N of Cannon Beach	An active landslide closed the park indefinitely due to road problems, a trail shearing off slope, and slope instability.
Nov. 2017	6th and Duane Streets	City of Astoria	Landslide adjacent to 5th and Duane Street slide. No damage to homes or infrastructure.
2013	5th and Duane Streets	City of Astoria	This area slid in 1991, 1992, 2006, and again in 2012-2013. Home and infrastructure damaged.
2009	Near Astoria's Water Main	SE of City of Astoria city limits	An active landslide threatens the City of Astoria's potable water main.
Dec. 2007	Woodsen Slide at Hwy 30	Westport Slough	Destroyed several residential structures; covered the highway with mud, debris.
2006	Irving Avenue between 4th and 10th Streets to Exchange	City of Astoria	This slide originally occurred in 1905 and continued to creep. In 1991, 1992, and 2006 additional portions slid. 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.
Jan. 2005	Bond Street Slide: West Commercial Street (at 1st St.)	City of Astoria	~16 homes destroyed in 1954; Reactivated in 2005, the re-activation of the Bond Street slide disrupted water infrastructure. The water distribution system is the only water supply for fire protection. Two streets were damaged beyond repair creating dead end streets.
Nov. 1996	Winter storm of 1996 affected Irving Avenue area between 4th and 10th Streets to Exchange	Across Oregon.	8 fatalities; storm triggered over 9,500 landslides and debris flow events; Resulted in passage of OR SB 12 which led to mapping and standards for development in landslide areas.
1950	Irving Street at 22nd Street	City of Astoria	23 homes destroyed

Source: City of Astoria, C.390; GeoScience, 2008; DOGAMI O-13-05, 2013; Daily Astorian, Feb. 2020.

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for landslide was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the appendix. The considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction. The Clatsop County Steering Committee created the following rankings for the landslide hazard during their risk assessment meetings for the 2021 plan update.

Table II-45. Hazard Vulnerability Analysis: Landslide

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	20	14	26	48	108	M
City of Astoria	20	50	100	70	240	H
City of Cannon Beach	2	40	70	50	162	M
City of Gearhart	2	25	30	35	92	M
City of Seaside	2	25	50	7	84	M
City of Warrenton	-	-	-	-	0	n/a
Arch Cape Water District	6	40	80	49	175	H
Arch Cape Sanitary District	6	40	80	49	175	H
Cannon Beach RFPD	20	50	100	70	240	H
Clatsop Community College	20	40	30	42	132	M
Falcon Cove Water District	2	50	100	7	159	M
Knappa-Svensen-Burnside RFPD	16	5	10	56	87	M
Lewis and Clark RFPD	20	5	10	70	105	M
Port of Astoria	2	25	50	35	112	M
Seaside School District	10	25	10	70	115	M
Sunset Empire Transit District	2	50	50	7	109	M

Source: Clatsop County MJNHMP Update Steering Committee, Apr. 2019-Jan. 2021; Clatsop County EOP 2018, p. 18.

Landslide 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 as the incidence of landslides and their impact on people and property can be accelerated by community development. Increasing population in western Oregon and the resultant growth in housing development 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. 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.

Clatsop countywide landslide exposure (High and Very High susceptibility):

- Number of buildings: 7,335
- Exposure value: $1,203,216,000
- Percentage of exposure value: 24%
- Critical facilities exposed: 23
- Potentially displaced population: 12,145

Williams et al, , 2020.

The 2020 *Natural hazard risk report for Clatsop County*, identified locations within the study area that are comparatively more vulnerable or at greater risk to landslide hazard:

- The landslide hazard for Astoria poses the biggest natural hazard risk to the community. Over half of the community is within areas deemed either very high or high susceptibility to landslide hazard.
- The steep coastal terrain of Cannon Beach and Arch Cape have developed areas that are considered very high and high susceptibility to landslide hazard.

Table II-46. Landslide Exposure

			(all dollar amounts in thousands)								
			Very High Susceptibility			**High Susceptibility**			**Moderate Susceptibility**		
Community	**Total Number of Buildings**	**Total Estimated Building Value ($)**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**	**Number of Buildings**	**Building Value ($)**	**Percent of Building Value Exposed**
Unincorp. County (rural)	8,214	1,378,964	952	133,908	9.7%	1,561	146,865	11%	2,284	300,221	22%
Arch Cape	462	113,684	69	17,412	15%	66	13,960	12%	167	40,595	36%
Svensen-Knappa	1,652	178,049	119	12,201	7%	600	56,657	32%	441	55,810	31%
Westport	348	24,928	116	7,207	29%	19	2,859	12%	17	1,402	6%
Total Unincorp. County	10,676	1,695,624	1,256	170,728	10%	2,246	220,342	13%	2,909	398,028	23%
Astoria	4,358	1,037,058	2,343	398,233	38%	547	179,873	17%	1,356	407,853	39%
Cannon Beach	2,037	567,876	365	81,833	14%	52	25,075	4.4%	606	169,724	30%
Gearhart	1,607	359,970	0	0	0.0%	55	9,783	2.7%	558	130,786	36%
Seaside	4,325	872,504	364	91,486	11%	46	15,908	1.8%	638	173,610	20%
Warrenton	2,826	493,680	0	0	0%	61	9,955	2.0%	484	81,122	16%
Total Clatsop County	25,829	5,026,711	4,328	742,280	15%	3,007	460,936	9.2%	6,551	1,361,123	27%

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, p.74.

Future Climate Conditions: Landslide

The February 2020 Clatsop County Future Projections Report does not indicate any increased climate risks specific to the landslide hazard.

Risk Reduction Recommendations

- The science of risk reduction is an emerging field. These potential landslide mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices. Create modern landslide inventory and susceptibility maps and use in planning and regulations for future development.
- Control storm water in landslide-prone areas.
- Monitor ground movement in high susceptibility areas.
- Implement grading codes, especially in high susceptibility areas.

6. Tsunami

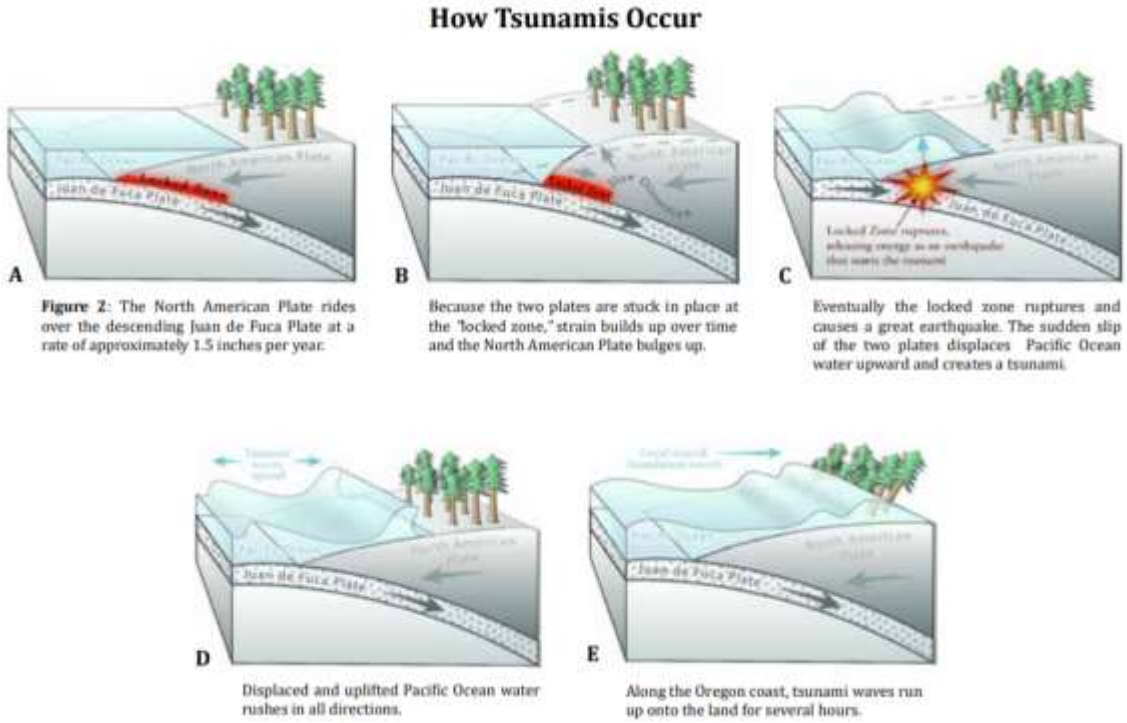
Tsunamis are a low frequency, high severity natural hazard in Oregon that are restricted to coastal areas—unfortunately, a significant amount of the lands available for development in Clatsop County are subject to tsunami risk.

Causes and Characteristics

A tsunami is a series of waves that can travel great distances from its origin and can cause serious flooding and damage to coastal communities. 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 500mph—when this incredible force reaches shore it has enough energy to destroy human settlements and flatten river channels for several miles upstream. There are two sources of tsunamis that can affect Clatsop County:

- **Local Tsunami**: Generated by an earthquake immediately offshore of the Oregon Coast (e.g., a CSZ earthquake) and would result in a tsunami coming onshore within 10 to 20 minutes following the earthquake.
- **Distant Tsunami**: Generated by a distant earthquake (e.g., large event occurring off a distant coastline, such as Japan) and would result in a tsunami coming onshore 4 or more hours following an earthquake on another subduction zone.

Figure II-60. Tsunami Generation



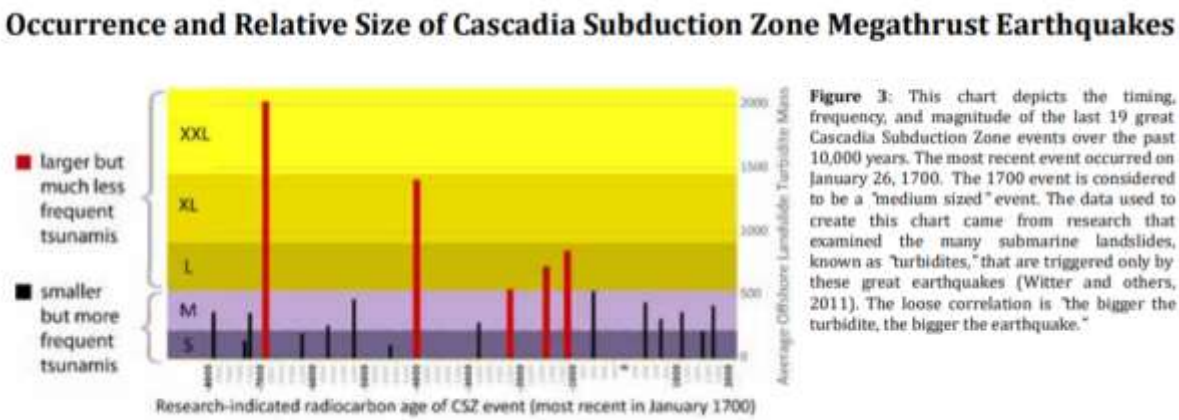
Source: DOGAMI, 2013. TIM for Gearhart & Seaside.

Historic Tsunami Events

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 resulting tsunami 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 in Oregon (DOGAMI, 2013). 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.

The most recent tsunami triggered by a local Cascadia subduction zone earthquake occurred on January 23, 1700 (DOGAMI, 2013). It is known to have been a magnitude 9.0 earthquake, and the resulting local tsunami was a 'medium sized' event.

Figure II-61. Frequency of CSZ Events in the Geologic Record



Source: DOGAMI, 2013. TIMs for Gearhart & Seaside.

Table II-47. Historic Tsunami Events in Historical Record

Date	Magnitude	Location	Details
Feb. 2001 (02/28/2001)	6.8	Puget Sound	400 injured; $2 billion in damage
Nov. 1980 (11/08/1980)	7.0	off Oregon Coast	
May 1980 (05/18/1980)	5.1	Mt. St. Helens	Eruption Triggered
Jun. 1973 (06/16/1973)	5.6	80 miles offshore from Lincoln City.	
May-July 1968	up to 5.1	Adel, Oregon (east of Lakeview)	

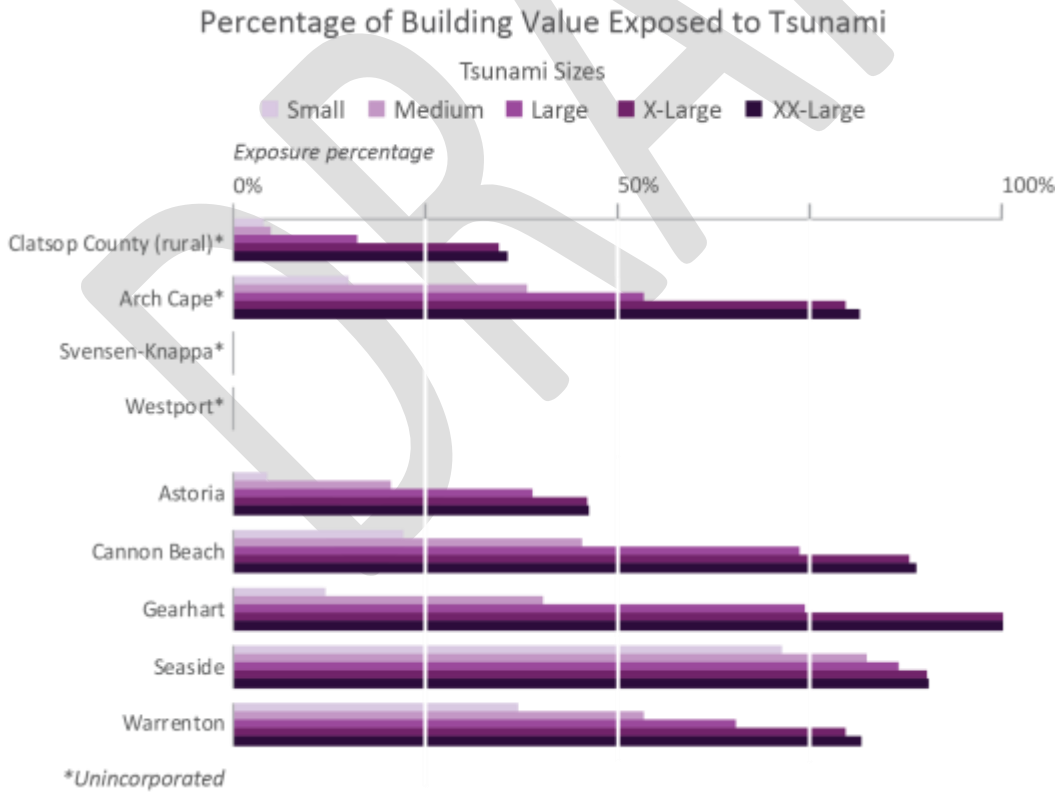
Date	Magnitude	Location	Details
Apr. 1965 (04/29/1965)	6.5	Renton, Washington	7 dead (where?); $50 million in damage.
Mar. 1964 (03/28/1964)	9.2	Prince William Sound, Alaska	140 dead; $311 million in damage. Largest recorded earthquake in the U.S.

Sources: USGS, https://earthquake.usgs.gov/earthquakes/events/alaska1964/; Sullivan, W.L., 2018.

Potential Impacts

The combination of earthquake and tsunami will have a significant impact to the entire coastal and estuarine portions of rural Clatsop County. Low-lying areas within coastal and estuarine communities are predicted to be inundated by the Medium-sized tsunami scenario. Approximately a third of the county's buildings have exposure to tsunami inundation from the Medium-sized scenario. In some communities a very high percentage (50% - 80%) of development is exposed to tsunami hazard. Over 11,000 permanent residents could be impacted from a CSZ tsunami event and require medical and shelter services. Because there is high risk of tsunami along the entire coast and estuarine areas of Clatsop County, awareness is important for future planning and mitigation efforts in the areas at risk (Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, p.22).

Figure II-62. Tsunami Inundation Exposure by Clatsop County community



Source: Williams et al, 2020, p.23.

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for tsunami was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the Appendix. The considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

In ranking the tsunami hazard in 2003, 2008, 2015, and 2019, Clatsop County jurisdictions rated vulnerability as "high" risk for an impactful 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.

Table II-48. Hazard Vulnerability Analysis: Tsunami

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	6	50	100	55	210	H
City of Astoria	8	35	90	14	147	M
City of Cannon Beach	2	50	80	55	187	H
City of Gearhart	2	50	100	35	187	H
City of Seaside	2	50	100	35	187	H
City of Warrenton	2	50	100	35	187	H
Arch Cape Water District	10	40	70	35	155	M
Arch Cape Sanitary District	10	40	70	35	155	M
Cannon Beach RFPD	10	50	100	35	195	H
Clatsop Community College	2	35	100	7	144	M
Falcon Cove Water District	2	50	100	56	208	H
Knappa-Svensen-Burnside RFPD	2	20	40	7	69	L
Lewis and Clark RFPD	2	50	100	35	187	H
Port of Astoria	2	50	100	35	187	H
Seaside School District	10	50	100	70	230	H
Sunset Empire Transit District	10	50	100	35	195	H

Source: Clatsop County MJNHMP Update Steering Committee, April-Oct., 2019; Clatsop County EOP 2018, p. 18.

Tsunami in the DOGAMI Natural Hazard Risk Report

The *Natural Hazard Risk Report for Clatsop County, Oregon including the Cities of Astoria, Cannon Beach, Gearhart, Seaside, Warrenton, and the Unincorporated Communities of Arch Cape, Svensen-Knappa, and Westport* (Williams et al, 2020) is the primary risk information source used for this plan update.

"The tsunami hazard data used in this report are from George R. Priest and others (2013). Priest's study modeled areas of expected inundation from five local (CSZ) tsunami scenarios and two distant source scenarios and created a series of inundation maps. The distant source tsunami scenarios were not used in this report. The local tsunami scenarios used in this report for exposure analysis were CSZ "t-shirt" sizes of Small (Sm), Medium (M), Large (L), Extra Large (XL), and Extra-Extra Large (XXL).

The estimated recurrence interval associated with each local source tsunami scenario is as follows (Priest and others, 2013):

- XXL 1,200 years
- XL 1,050–1,200 years
- L 650–800 years
- M 425–525 years
- SM 300 years

For this risk assessment, DOGAMI compared the locations of buildings and critical facilities to the geographic extent of the local source tsunami inundation zones to assess the exposure for each community. The exposure results shown below are for the Medium scenario only. The total dollar value of exposed buildings was summed for the study area and is reported below. DOGAMI was also able to estimate the number of people at risk to tsunami hazard.

Because every community in the DOGAMI Natural Hazard Risk Report study is relatively near the Pacific Ocean or the Columbia River estuary, nearly all communities would be affected by the largest of the DOGAMI calculated tsunami scenarios. All communities built along the open coast will be significantly impacted from a tsunami; communities built along the bays and estuaries will be affected to a lesser extent" (Williams et al, 2020.)

Clatsop countywide CSZ M9.0 tsunami exposure (Medium tsunami scenario):

- Number of buildings exposed: 8,810
- Exposure value: $1,705,987,000
- Percentage of exposure value: 34%
- Critical facilities exposed: 33
- Potentially displaced population: 11,331

Source: Williams et al, 2020, p.22.

Tsunami Vulnerability Assessment

The DOGAMI Natural Hazard Risk Report for Clatsop County conducted in 2018 built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 tsunami hazard:

- A very high percentage (40%-80%) of developments all along the Pacific Coast of Clatsop County is exposed to the medium scenario tsunami.
- In some of the larger scenarios, 80%-100% of Arch Cape, Cannon Beach, Gearhart, Seaside, and Warrenton would be inundated by a tsunami.
- Nearly all of the critical facilities in the communities of Cannon Beach, Gearhart, Seaside, and Warrenton could be non-functioning due to a medium scenario tsunami.

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.

For Clatsop County communities, there is little doubt about the risk and potential impacts of a Cascadia Subduction Zone earthquake and tsunami event as summarized by this excerpt from the SSD Land Use Application Narrative by Winterbrook Planning, June 8, 2017 (p.20):

"…research completed by Oregon State University marine geologist and geophysicist Chris Goldfinger and the U. S. Geological Service predicts that there is an estimated 80-90% chance of a magnitude 8 or greater and estimated 20-30% chance of a magnitude 9 or greater Cascadia Subduction Zone earthquake occurring off of the northern Oregon Coast in the next 50 years, which would likely result in a tsunami with wave heights of up to 100 feet at the shoreline."

Table II-49. Tsunami Exposure

		(all dollar amounts in thousands)																
			Small (Low Severity)			Medium (Moderate Severity)			Large (High Severity)			X Large (Very High Severity)			XX Large (Extreme Severity)		
Community	Total Number of Buildings	Total Estimated Building Value ($)	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed
Unincorp. County (rural)	8,214	1,378,964	879	52,749	3.8%	1,040	67,075	4.9%	1,801	221,393	16%	3,145	475,022	34%	3,222	490,567	36%
Arch Cape	462	113,684	69	16,910	15%	162	43,350	38%	233	60,639	53%	360	90,490	80%	372	92,486	81%
Svensen-Knappa	1,652	178,049	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Westport	348	24,928	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Total Unincorp. County	10,676	1,695,624	948	69,659	4.1%	1,202	110,425	6.5%	2,034	282,032	17%	3,505	565,512	33%	3,594	583,053	34%
Astoria	4,358	1,037,058	151	45,225	4.4%	422	211,577	20%	746	402,271	39%	936	475,812	46%	950	480,166	46%
Cannon Beach	2,037	567,876	357	124,607	22%	799	256,840	45%	1,523	417,186	74%	1,768	498,404	88%	1,792	503,608	89%
Gearhart	1,607	359,970	259	42,678	12%	808	144,823	40%	1,318	267,235	74%	1,607	359,970	100%	1,607	359,970	100%
Seaside	4,325	872,504	3,301	621,310	71%	3,776	718,702	82%	3,904	753,787	86%	4,028	786,052	90%	4,035	787,368	90%
Warrenton	2,826	493,680	1,346	182,788	37%	1,803	263,619	53%	2,101	321,770	65%	2,419	392,963	80%	2,482	402,572	82%
Total Clatsop County	25,829	5,026,711	6,362	1,086,267	22%	8,810	1,705,987	34%	11,626	2,444,281	49%	14,263	3,078,712	61%	14,460	3,116,737	62%

Source: Williams et al, 2020.

Future Climate Conditions: Tsunami

The February 2020 Clatsop County Future Projections Report does not indicate any increased climate risks specific to the tsunami hazard.

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential tsunami mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices.

- Consider local regulations in the high tsunami hazard zone, such as some restrictions to future development.
- Consider relocating fire, police, and emergency response facilities that are vulnerable to tsunami hazard.
- Use the DLCD guide on preparing for the CSZ tsunami: http://www.oregon.gov/LCD/OCMP/docs/Publications/TsunamiGuide20170130.pdf
- Consider relocating or retrofitting structures with vulnerable populations (e.g. schools, hospitals, and nursing homes) that are within high tsunami hazard zones.
- Evaluate the community evacuation plan, including consideration for viable vertical evacuation options.
- Build “tsunami towers” in coastal cities.
- Expand tsunami evacuation infrastructure.

7. Volcanic Event

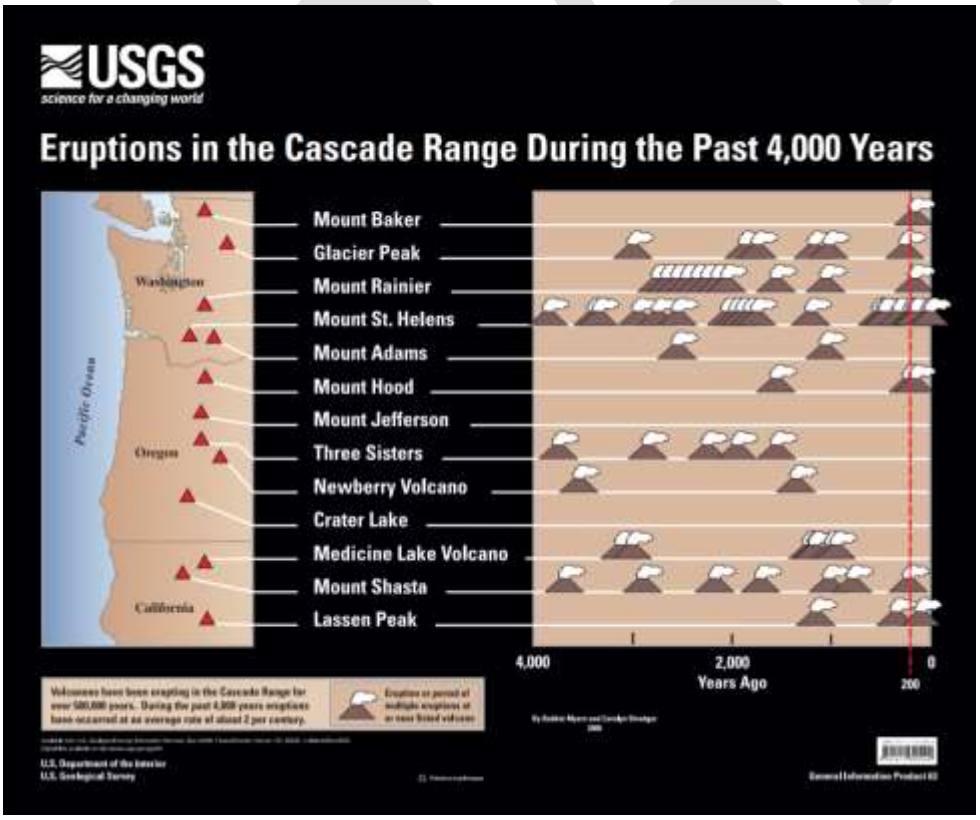
Volcanoes are potentially destructive natural phenomena, constructed as magma ascends and then erupts onto the earth's surface.

Causes and Characteristics

The Cascade Range in Washington, Oregon, and northern California is one of the most volcanically active regions in the United States, with thirteen active volcanoes. Seven Cascade volcanoes have erupted in the past 200 years and future eruptions are certain. 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). Cascade volcanoes tend to erupt explosively, and these eruptions have occurred at an average rate of 1-2 per century during the last 4,000 years.

These snow-clad peaks are part of a 1,000 mile-long chain of mountains, which extend from southern British Columbia to northern California. As the human population increases in the Pacific Northwest, areas near volcanoes are being developed as communities and recreational use expands (such as for skiing, hiking, camping, etc.) As a result, people and property in the region are at growing risk from volcanic activity.

Figure II-63. Eruptions in the Cascade Range during the Past 4,000 Years



Source: Myers, 2008.

The effects of a major volcanic event can be widespread and devastating. Volcanoes produce a variety of hazards that can destroy property and kill people. Large explosive eruptions can endanger people with and property hundreds of miles away and even affect the global climate. Volcanic eruptions can trigger other disasters such as landslides, debris flows and floods, water pollution (which can result in fish kills or reduced productivity), air pollution, and even soil contamination can result from a volcanic eruption (Jones, 2019).

Eruption columns and clouds result from an explosive eruption that 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.

Ash is comprised of a fine, sharp particle that is extremely dangerous to breathe. It is heavy when it accumulates and chemically bonds to surfaces so it is difficult to remove. It then combines with water to add more weigh and damaging power on hillslopes, roads, and structures. Finally, it is toxic so it takes 1-3 years to sufficiently dilute or absorb a small amount like what fell on Clatsop County in 1980 from the Mt. Saint Helens eruption.

A lahar, a river of volcanic mud and debris, can result from a variety of volcanic activity. Lahar, an Indonesian word for volcanic mudflow, is a mixture of water, mud, and volcanic rock flowing swiftly along a channel draining a volcano. Lahars can form during or after eruptions, or even during periods of inactivity. They are among the greatest threats volcanoes pose to people and property. Lahars can occur with little to no warning, and may travel great distances at high speeds, destroying or burying everything in their paths.

Lahars form in many ways. They commonly occur when eruptions melt snow and ice on snow-clad volcanoes; when rains fall on steep slopes covered with fresh volcanic ash; when crater lakes, volcano glaciers or lakes dammed by volcanic debris suddenly release water; and when volcanic landslides evolve into flowing debris. Lahars are especially likely to occur at erupting or recently active volcanoes.

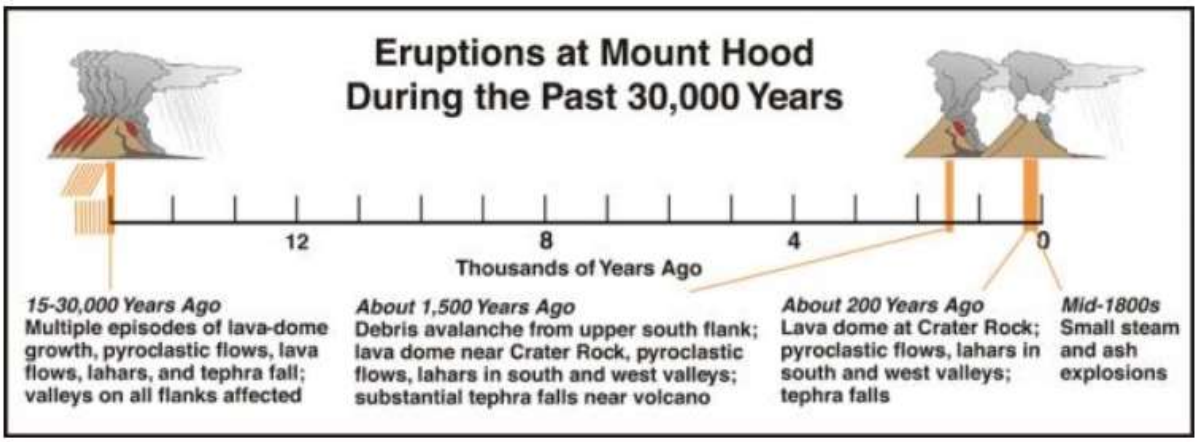
Because lahars are so hazardous, U.S. Geological Survey scientists pay them close attention. They study lahar deposits and limits of inundation, model flow behavior, develop lahar-hazard maps, and work with community leaders and governmental authorities to help them understand and minimize the risks of devastating lahars (Major, 2018).

Although there are no active volcanoes in Clatsop County (the closest volcano is Mt. Hood), it is to understand 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.

Historic Volcanic Events

According to the Department of Geology and Mineral Industries (DOGAMI), Mt. Hood and Mt. St. Helens are the two volcanoes that could impact Clatsop County. Of all the Washington volcanoes, only Glacier Peak (north of Mt. Rainier) and Mt. Saint Helens have generated very large explosive eruptions in the past 15,000 years. (https://volcanoes.usgs.gov/volcanoes/glacier_peak/) Mt. Hood is 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. There have been no recorded effects from eruptions of Mt. Hood in the past century. However, during the 1900s there were numerous small lahars and debris avalanches, preceded by steam explosions and ash explosions in the mid-1800s.

Figure II-64. Eruptions from Mount Hood, Oregon, during the past 30,000 years



Source: USGS, 2012. https://volcanoes.usgs.gov/volcanoes/mount_hood/mount_hood_geo_hist_94.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 18, 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. Larger, longer lasting eruptions have occurred in the volcano's past and are likely to occur in the future. The following table provides information on the previous occurrences of hazard events. Clatsop County experienced ash fall from some of the minor eruptions after the major one in 1980 and also saw impacts from debris flow down the Columbia River.

Table II-50. Historic Volcanic Events

Date	Event	Location	Details
May 1980 (05/18/1980)	Eruption	Mt. St. Helens	
1781	Most recent eruptive period began	Mt. Hood, White River and Sandy River valleys	https://volcanoes.usgs.gov/volcanoes/mount_hood/

Source: USGS, https://earthquake.usgs.gov/earthquakes/events/alaska1964/; Sullivan, W.L., 2018.

Potential Impacts

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.

Table II-51. Volcanoes closest to Clatsop County

Volcano	Distance from Clatsop County	Last Event
Mt. Hood	95 mi	1856-1865
Mt. Jefferson	115 mi	Between 35,000 and 100,000 years ago
Mt. St Helens	60 mi	May 18, 1980
Mt. Adams	90.4 mi	More than 3,500 years ago
Mt. Rainier	~150 mi	1882

Source: USGS

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for a volcanic event was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the appendix. The considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

While ash fall is the primary risk for Clatsop County, the City of Astoria and the Port of Astoria also identify debris flow as a potential hazard. Most of Clatsop County is isolated climatically from the impacts of volcanic gases such as those emitted from a volcanic event before, during, or after a volcanic eruption due to its proximity to the Pacific Ocean and Columbia River. Due to the distance from Cascadian volcanoes the County Steering Committee has previously estimated volcanic ash fall as a 'low' risk. A low ranking indicates that less than 1% of the population or regional assets are likely to be affected by a major event. A 'low' ranking also indicates that one event is not likely to occur more than once in a 75-100-year period.

Table II-52. Hazard Vulnerability Analysis: Volcanic Ashfall

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	3	38	20	14	75	L
City of Astoria	8	5	80	21	114	M
City of Cannon Beach	2	5	10	7	24	L
City of Gearhart	2	5	10	7	24	L
City of Seaside	2	5	10	7	24	L
City of Warrenton	2	25	50	7	84	M
Arch Cape Water District	2	5	10	7	24	L
Arch Cape Sanitary District	2	5	10	7	24	L
Cannon Beach RFPD	2	25	50	7	84	M
Clatsop Community College	2	45	90	7	144	M
Falcon Cove Water District	2	5	10	7	24	L
Knappa-Svensen-Burnside RFPD	2	20	40	7	69	L
Lewis and Clark RFPD	2	5	10	7	24	L
Port of Astoria	2	25	50	7	84	M
Seaside School District	2	5	10	7	24	L
Sunset Empire Transit District	2	35	10	7	54	L

Source: Clatsop County MJNHMP Update Steering Committee, April-Oct., 2019; Clatsop County EOP 2018, p. 18.

Table II-53. Hazard Vulnerability Analysis: Volcanic Debris Flow

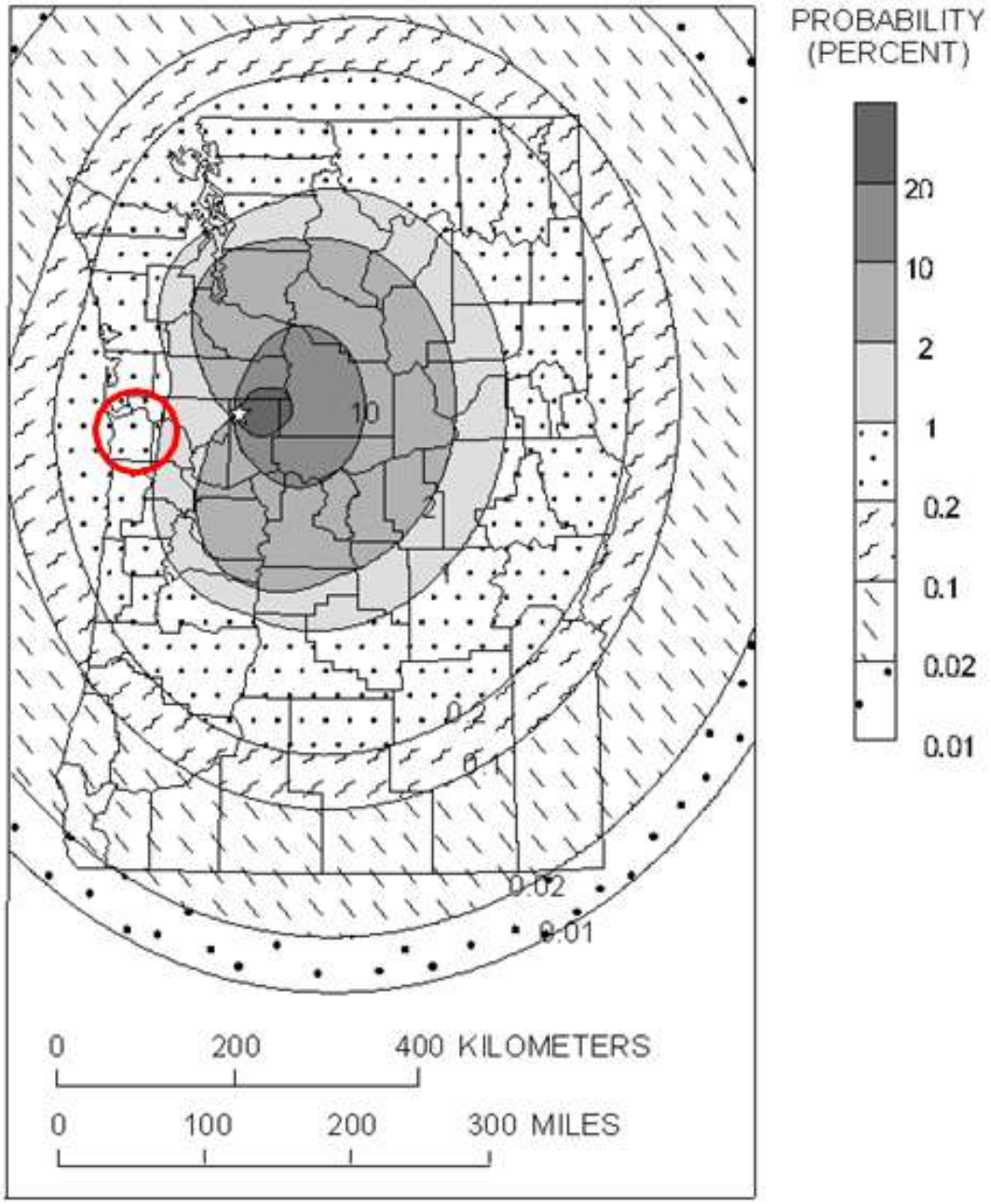
Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
City of Astoria	2	10	50	7	69	L
City of Cannon Beach	2	10	30	6	48	L

Source: Clatsop County MJNHMP Update Steering Committee, April-Oct., 2019.

Vulnerability Assessment

To identify the areas that are likely to be affected by future events, prehistoric 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 the following figure.

Figure II-65. Probability of significant impacts of a Mount Saint Helen eruption



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

Future Climate Conditions: Volcanic Events

The February 2020 Clatsop County Future Projections Report does not indicate any increased climate risks specific to the volcanic ashfall or debris flow hazard.

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential volcanic event mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices.

- Identify the type and amount of Personal Protective Equipment (PPE) would be needed for vulnerable populations and essential workers for one or two ash fall scenarios. Develop recommendations for health and safety of the general population.
- Identify the best practices that would need to be provided in public announcements in an ash fall event. Consider risks to livestock, agricultural products, homes (roofs, air systems), vehicles (paint, air systems), commercial and industrial equipment.

8. Wildfire

Wildfires are a common and widespread natural hazard in Oregon; the state has a long and extensive history of wildfire.

Causes and Characteristics

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.

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 occur where wildland and developed areas come together with vegetation and structural development to provide fuel. The wildland/urban interface (sometimes called rural interface in small communities or outlying areas) can be divided into three categories.

- 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 fire, also known as forest or rangeland fires, occur in national forests and parks, private timberland, and on public and private rangeland. The main fuel source is natural vegetation. A wildland fire can become an interface fire if it encroaches on developed areas.

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.

Fire has been a major force in shaping the existing forest and other plant communities since long before the country was settled. Humans will always be the major contributing factor to fire starts during all

weather conditions. Of the three fire behavior components (fuel, weather, topography), fuels are the one variable that humans can easily influence and modify. This plan is aimed at reducing fire effects by reducing fuel loading. A reduction in fuel loading will create conditions that are essential to safety and efficiency in fire suppression efforts.

- 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.
- 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.
- 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.

Ignition of a wildfire may occur naturally from lightning or from human causes such as debris burns, arson, careless smoking, recreational activities, or from late season slash pile burning caught in a dry east wind when firefighting resources are deescalated after the end of fire season.

- Many of the significant fire events in Clatsop County occur as a result of carelessness with fire. During periods of high fire danger when temperatures soar into the upper 80's and 90's Clatsop County sees a large influx of people trying to escape the heat in the valley. Every Fourth of July the coastline of Clatsop County is major draw for people celebrating the Fourth with the use of illegal and legal fireworks.
- Clatsop County has had several fires that have occurred in November, December and February when Oregon Department of Forestry's seasonal firefighters are not employed.

The increase in residential development in interface areas also contributes to 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.

Historic Wildfire Events

Clatsop County has not had many significant wildfires in the past. This is mostly due to its wet climate. The following table lists the costliest fires in Clatsop County since 1960. The following table provides information on the previous occurrences of hazard events.

Table II-54. Historic Wildfire Events

Date	Location	Description	Notes
Nov. 13, 2014	Arch Cape Fire #2	~100 acres	Daily Astorian article
2013	Arch Cape (& Falcon Cove) Fire	~300 acres	Daily Astorian article
Oct. 27, 2007	Crane/Crusher Fire	68 acres	n/a
Nov. 23, 2002	Elk Mountain Fire	40-60 acres	Cost: $22,989; Cause: Debris burning; 06N/07W/04.
Sept. 9, 1988	Strum Creek Fire	45 acres	Cost: $237,363; Cause: Debris burning; 05N/06W/04.
June 30, 1985	McFarlane Creek Fire	125 acres	Cost: $87,257; Cause: Debris burning; 05N/06W/34.
Aug. 3, 1977	Oldy 17 Fire	834 acres	Possibly Fire 77521062; 1977; 483 ac.; Cost: $443,101; Cause: Debris burning; 05N/08W/02.
Oct. 17, 1976	Cronin Creek Fire	483 acres	See above.
Aug. 21, 1973	Crawford Ridge Fire	110-112 acres	Cost: $50,814; Cause: Smoking; 05N/06W/31.
Aug. 28, 1939	Saddle Mountain Fire	207,000 acres	Largest recorded fire this century.
1933-1951	Tillamook Burn	355,000 acres	The Tillamook Burn was a catastrophic series of large forest fires in the northern Oregon Coast Range Mountains beginning in 1933 and striking at six-year intervals through 1951.
Dec. 1922	Downtown Astoria	n/a	Only recorded urban wildfire; Likely a structure fire (ODF)

Source: Ballou, B., 2004; ODF, 2012; https://oregonencyclopedia.org/articles/tillamook_burn/#.Xyb-BChKhPY

Potential Impacts

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 review the Oregon NHMP or the Oregon Technical Resource Guide.

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.

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. 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.

Scotch broom (Cytisus scoparius) is found along the east and west coasts of North America and in Idaho, Montana, and Utah. Native to northern Africa and parts of Europe, it was first introduced to North America on the east coast and was later introduced to California as an ornamental. From the 1850s through the early 1900s, Scotch broom was frequently planted in gardens. Later, it was used for erosion control along highway cuts and fills. It is now considered as an invasive species as it is very prolific and spreads easily. Scotch broom flourishes in full sunlight in dry, sandy soils, but it can survive under a wide variety of soil conditions. However, it does not tend to survive in very arid or cold areas. Scotch broom invades dry hillsides, pastures, forest clearings, dry scrublands, dry riverbeds, and waterways. Several characteristics contribute to its success as an invasive plant: (1) although it loses its leaves during dry conditions, the photosynthetic tissue in its stems allows it to grow throughout

the year; (2) its roots host nitrogen-fixing bacteria, which helps the plant to establish in nutrient-poor soils; and (3) it produces abundant seeds that remain viable in the soil for many years. In addition, Scotch broom is slightly toxic and unpalatable to livestock. Scotch broom, an invasive plant, is prevalent in Clatsop County and can create a fire hazard as it burns very well.

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for wildfire was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the Appendix. The considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

In ranking this hazard, a "medium" wildfire event of less than 500 acres in late fall was the scenario considered most likely to be a threat. Coastal counties have historically been low risk for wildfire compared to the rest of the state and historically most fires have been contained while small in size. The example often used was that of a slash pile burn that gets out of control in east wind conditions after fire season has closed across the West, late October or beyond. One concern is that if an event occurred late in the season, there could be a lack of firefighting mutual aid resources available.

A conflagration is not expected, but of course, the history of the Tillamook Burn makes it understood that a larger event is possible. Clatsop County fire defense resources are well-coordinated and conduct regular mutual aid/response which, alongside geography and widespread road access, minimizes the risk of a large event threatening densely-populated areas. Fires are sometimes difficult to access or locate, but an extensive network of roads in timbered areas provides for defensible corridors and wildland firefighting access.

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, 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 2021 plan update risk assessments produced the following rankings for wildfire risk:

Table II-55. Hazard Vulnerability Analysis: Wildfire

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	10	17	34	42	103	M
City of Astoria	16	25	70	56	167	H
City of Cannon Beach	2	25	50	40	117	M
City of Gearhart	2	5	10	28	45	L
City of Seaside	2	25	50	7	84	M
City of Warrenton	2	5	10	28	45	L
Arch Cape Water District	16	25	100	56	192	H
Arch Cape Sanitary District	16	25	100	56	192	H
Cannon Beach RFPD	10	50	100	70	230	H
Clatsop Community College	2	5	10	7	24	L
Falcon Cove Water District	10	50	100	35	195	H
Knappa-Svensen-Burnside RFPD	20	15	30	70	135	M
Lewis and Clark RFPD	10	25	50	70	155	M
Port of Astoria	2	5	10	35	52	L
Seaside School District	2	50	100	7	159	M
Sunset Empire Transit District	2	5	10	7	24	L

Source: Clatsop County MJNHMP Update Steering Committee, Apr., 2019-Jan. 2021; Clatsop County EOP 2018, p. 18.

Wildfire Vulnerability Assessment

Wildfire risk is high for hundreds of homes in the low-laying forested areas in the unincorporated county along the Columbia River. Other locations that are comparatively more vulnerable or at greater wildfire risk include the communities of Warrenton, Westport, and to a lesser extent Astoria and Svensen-Knappa. However, moderate wildfire hazard is present throughout the entire county, especially along transportation corridors and is a potential threat for most communities (Williams et al, 2020, pp. 37-40).

This report is the primary risk information source used for this plan update:

Williams, M. C., Anthony L. H., & O'Brien, F. E. (2020). Natural Hazard Risk Report for Clatsop County, Oregon, Including the Cities of Astoria, Cannon Beach, Gearhart, Seaside, and Warrenton and the Unincorporated Communities of Arch Cape, Svensen-Knappa, and Westport (Open-File Report O-20-16). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-20-16.htm

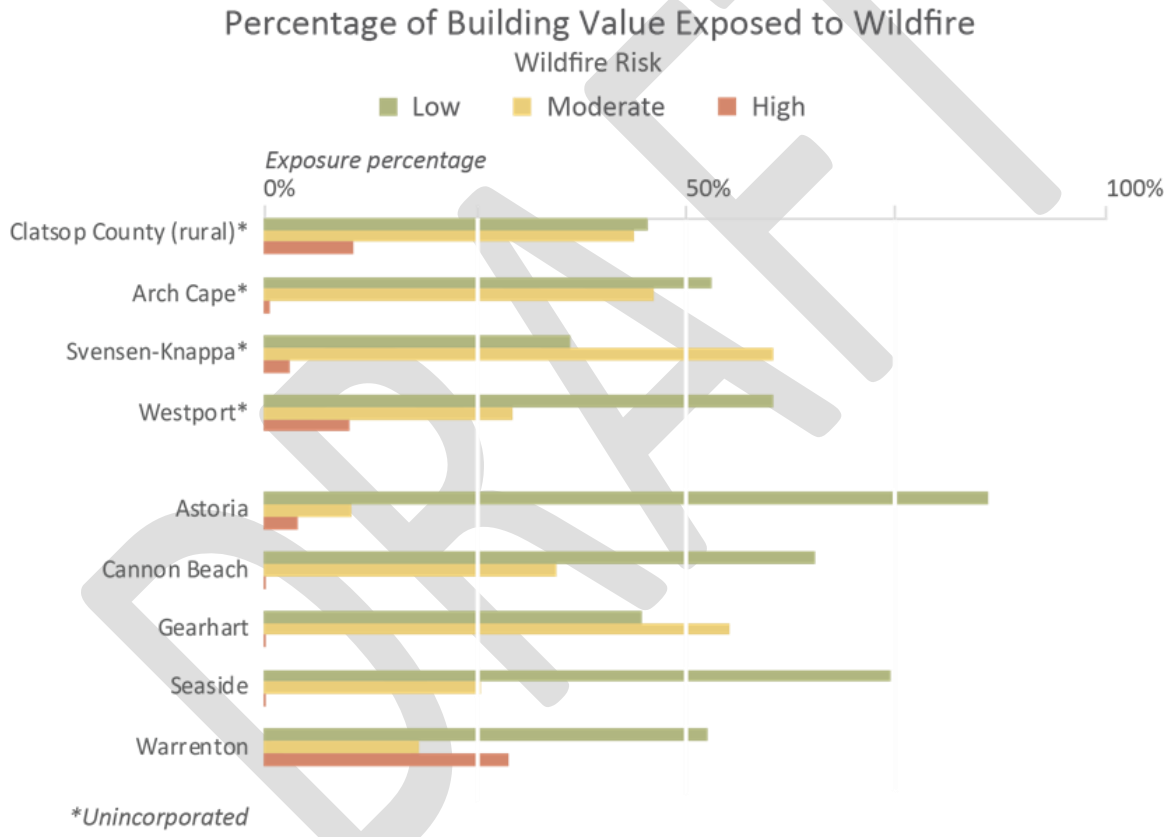
The wildfire summary below presents only the information for those areas ranked as 'high hazard', see the full DOGAMI report for loss estimates for other levels of wildfire risk.

Clatsop countywide wildfire exposure (High hazard):

- Number of buildings: 2,467
- Exposure value: $340,091,000
- Percentage of exposure value: 6.8%
- Critical facilities exposed: 9
- Potentially displaced population: 3,467

Source: Williams et al, 2020.

Figure II-66. Wildfire hazard exposure by Clatsop County community.



Source: Williams et al, 2020, p. 37. DLCD Note: Unincorporated areas beyond Arch Cape, Svensen-Knappa, and Westport may have significant risk, but that information is included in the Clatsop County (rural) values.

Table II-56. Wildfire Exposure

			(all dollar amounts in thousands)					
			High Hazard			Moderate Hazard		
Community	Total Number of Buildings	Total Estimated Building Value ($)	Number of Buildings	Building Value ($)	Percent of Building Value Exposed	Number of Buildings	Building Value ($)	Percent of Building Value Exposed
Unincorp. County (rural)	8,214	1,378,964	1,324	145,792	11%	4,083	605,685	44%
Arch Cape	462	113,684	3	838	1%	227	52,459	46.1%
Svensen-Knappa	1,652	178,049	58	5,607	3%	993	107,642	60%
Westport	348	24,928	63	2,524	10%	82	7,334	29%
Total Unincorp. County	10,676	1,695,624	1,448	154,762	9.1%	5,385	773,120	46%
Astoria	4,358	1,037,058	151	41,326	4%	681	106,239	10%
Cannon Beach	2,037	567,876	4	565	0.1%	877	196,905	35%
Gearhart	1,607	359,970	2	148	0.0%	929	198,891	55%
Seaside	4,325	872,504	2	347	0%	915	223,486	25.6%
Warrenton	2,826	493,680	860	142,943	29%	645	90,771	18%
Total Clatsop County	25,829	5,026,711	2,467	340,091	6.8%	9,432	1,589,414	32%

Source: Williams et al, 2020, p.76.

Interface Communities

In recent years, the population of Clatsop County has moved further and further into traditional resource land including forested lands. This has produced a significant increase in threats to life and property and has pushed existing fire protection beyond its original or current design capabilities. Approximately 90% of the land in Clatsop County is forested and susceptible to wildfire (ODF, 2014).

The 2018 DOGAMI Natural hazard risk report for Clatsop County identified locations within the study area that are comparatively more vulnerable or at greater risk to wildfire hazard. Wildfire risk is high for hundreds of homes in the low-laying forested areas in the unincorporated county along the Columbia River. This area also includes the communities of Warrenton, Westport, and to a lesser extent Astoria and Svensen-Knappa. The following communities within Clatsop County are considered "Interface Communities":

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

Community Wildfire Protection Plan

The Clatsop County fire defense partnership operates under the Clatsop County Community Wildfire Protection Plan (CWPP). Developed by the local coordinating group comprised of rural fire protection districts, local government, state and federal agencies, and community-based organizations, the plan mission is to reduce the risk from wildland fire to life, property and natural resources in the County.

Goals

1. Protect against potential losses to life, property and natural resources from wildland fire;
2. Build and maintain active participation from each Fire Protection District;
3. Set realistic expectations for reducing wildland fire risk;
4. Identify actions for fire protection;
5. Access and utilize federal and other grant dollars;
6. Identify incentives for fire protection and community participation;
7. Promote visible projects and program successes;
8. Monitor the changing conditions of wildland fire risk and citizen action over time;
9. Institutionalize fire-related programs and sustain community efforts for fire protection;
10. Establish and maintain escape route and adjacent corridors.

CWPP 2012: Wildland Fire Risk Assessment

The Clatsop County Community Wildfire Protection Plan wildland fire risk assessment analyzes the potential losses to life, property, and natural resources. Objectives of the risk assessment are to identify Communities at-Risk and the Wildland-Urban Interface, develop and conduct a wildland fire risk assessment, and identify and prioritize hazardous fuels treatment projects. The analysis takes into consideration a combination of factors defined below:

- Risk: Potential and frequency for wildland fire ignitions (based on past occurrences)
- Hazard: Conditions that may contribute to wildland fire (fuels, slope, aspect, elevation, and weather)
- Values: People, property, community infrastructure, natural and other resources that could suffer losses in a wildfire event.
- Protection Capability: Ability to mitigate losses, prepare for, respond to, and suppress wildland and structural fires.
- Structural Vulnerability: Characteristics influencing the vulnerability of structures during a wildland fire event (roof type and building materials, access to the structure, and whether or not there is defensible space or fuels reduction around the structure.)

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, the 2015 Clatsop County NHMP Steering Committee ranked wildfire risk as “moderate” which indicates that 1-10% of the population or region assets are likely to be affected by a major wildfire emergency or disaster. These incidents would most likely occur in the interface communities.

Wildfire Smoke

The air quality risks associated with local or regional wildfire events is approached as a public health issue in Clatsop County. Smoke from wildfire impacts area residents every year during wildfire season. In 2019 the fires were bad in Central Oregon and Canada, and unseasonable southwestwardly winds brought smoke to the County. Last year the Lincoln County fire impacted residents.

Air quality is expected to worsen due to climate change, in part due to the impact of wildfire smoke.

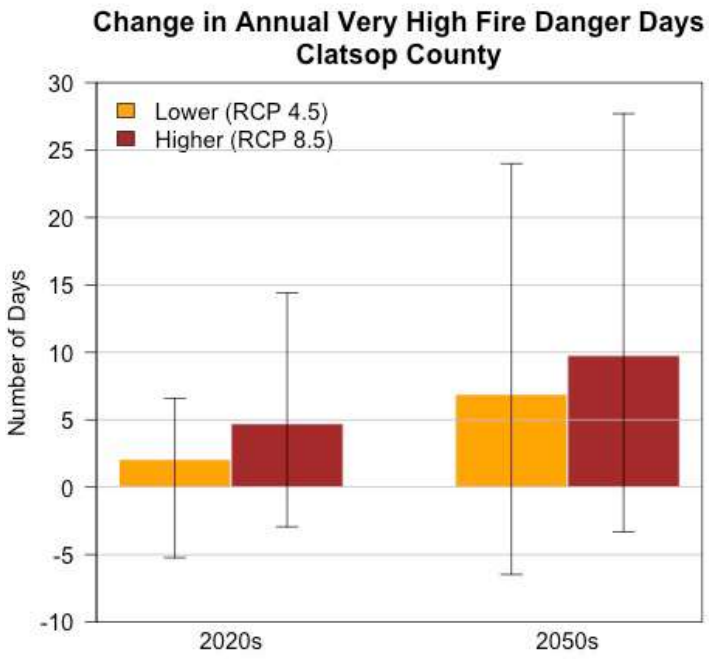
Future Climate Conditions: Air Quality

Climate change impacts are anticipated to increase the frequency, duration, and intensity of extreme heat due to continued warming temperatures (Dalton, M.M., 2020, p. 13). Associated risks to air quality of warmer temperatures include increased ground level ozone pollution, increased smoke and particulates from wildfires, and more potent pollen seasons, resulting in increased risk of respiratory and cardiovascular illness, increased allergies, and greater rates of asthma. While woodstove smoke and diesel emissions are other contributors of particulates, wildfires are primarily responsible for the days when air quality standards for PM2.5 are exceeded in western Oregon. The number of “smoke wave” days in Clatsop County is projected to increase (Dalton, M.M., 2020, p. 28).

Future Climate Conditions: Wildfire

Wildfire risk is expressed in the frequency of very high fire danger days—and the frequency of very high fire danger days is expected to increase under future climate change scenarios for Clatsop County. Under the higher emissions scenario by the 2050s, the number of very high fire danger days is expected to increase by 10 days compared to the historic baseline—this translates to an annual increase of about 27% (Dalton M.M., 2020, p.27).

Figure II-67. Change in Annual Very High Fire Danger Days



Source: Dalton M.M., 2020, p.27.

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential wildfire mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices.

- Maintain buffer areas from forestland around buildings, especially in the fire-prone wildland-urban interface.
- Reduce fuel loads in buffer areas; clear along roads and other areas that can act as firebreaks in a wildfire event.
- Consider regulating development in wildfire urban interface areas.
- Evaluate post-wildfire geologic hazards including flood, debris flows, and landslides.

9. Windstorm and Winter Storm

Causes and Characteristics

Destructive windstorms and severe winter events typically occur in fall and winter in Clatsop County, from October through March. Severe summer weather is associated with thunderstorms which can cause tornadoes and water spouts (NOAA, 2018). Severe winter weather produces high winds, rain, freezing rain, ice, and snow. A windstorm can be any of the following type of events: straight-line wind, down-slope wind, thunderstorm, downburst, or tornado.

Severe winter storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. 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. **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, snow, sleet, and hail. Of these, **freezing rain** can be the most damaging mechanism of this hazard as ice deposition can be almost uniform across the landscape and can cause the most widespread isolation when downed trees paralyze the local transportation system.

High winds are a regular occurrence throughout Clatsop County. Destructive windstorms are less frequent, but the manner in which they occur are consistent. They usually form over the North Pacific during the cool months (October through March), move along the coast and swing inland in a northeasterly direction. The extensive list of Historic Storm Events provides significant context for the frequency, magnitude, and impacts associated with wind and winter storm events in Clatsop County.

Figure II-68. Wind Zones in the U.S.

Source: FEMA, n.d.

A windstorm is generally a short duration event involving straight-line winds and/or gusts in excess of 50 mph. Clatsop County also experiences the following types of wind: down-slope wind, thunderstorm, downburst, and tornado.

- Straight-line wind. This type of wind event is the most common. The wind is considered, in general, to blow in a straight line. Straight-line wind speeds range from very low to very high. High winds associated with intense low pressure can last for upward of a day at a given location. Straight-line winds occur throughout the U.S.
- Down-slope wind. Wind flowing down the slope of mountains is referred to as down-slope wind. Down-slope winds with very high wind speeds frequently occur in Alaska and Colorado. In the continental U.S., mountainous areas are referred to as "special wind regions". If the local building department has not established the basic speed, use of regional climatic data and consultation with a wind engineer or meteorologist is advised.
- Thunderstorm. This type of storm can rapidly form and produce high wind speeds. Approximately 10,000 severe thunderstorms occur in the U.S. each year, typically in the spring and summer. Besides producing high winds, they often create heavy rain. Hail and tornadoes are also sometimes produced. Thunderstorms commonly move through an area quite rapidly, often causing high winds for only a few minutes at a given location.
- Downburst. Also known as microburst, it is a powerful downdraft associated with a thunderstorm. When the downdraft reaches the ground, it spreads out horizontally and may form one or more horizontal vortex rings around the downdraft. The life-cycle of a downburst is usually between 15 to 20 minutes. Observations suggest that approximately 5% of all thunderstorms produce a downburst, which can result in significant damage in a localized area.
- Tornado. This is a violently rotating column of air extending from the base of a thunderstorm to the ground. The Fujita scale categorizes tornado severity based on observed damage. The six-step scale ranges from F0 (light damage) to F5 (incredible damage). Weak tornadoes (F0 and F1) are most common, but strong tornadoes (F2 and F3) frequently occur. Violent tornadoes (F4 and F5) are rare. Tornado path widths are typically less than 1,000 feet; however, widths of approximately 1 mile have been reported. Tornadoes are responsible for the greatest number of wind-related deaths each year in the U.S. (Smith, 2017).

The Oregon Coast and Columbia Gorge fall into what FEMA defines as a “special wind region” due to the occurrence of both straight-line and down-slope winds.

Although **severe summer weather** resulting in tornadoes is not common in Oregon, most **tornadoes** are caused by intense local thunderstorms that are common in summer between April and October. Tornadoes have been reported in most of the counties throughout the state since 1887, but they are most prevalent in Northwest Oregon. However, tornadoes are considered the most concentrated and violent storms produced by earth’s atmosphere, with winds in excess of 300 mph.

Figure II-69. FEMA Special Wind Regions

Figure II-70. What is a Waterspout?

A waterspout is a whirling column of air and water mist. Waterspouts fall into two categories: fair weather waterspouts and tornadic waterspouts.

Fair weather waterspouts usually form along the dark flat base of a line of developing cumulus clouds. This type of waterspout is generally not associated with thunderstorms. While tornadic waterspouts develop downward in a thunderstorm, a fair weather waterspout develops on the surface of the water and works its way upward. By the time the funnel is visible, a fair weather waterspout is near maturity. Fair weather waterspouts form in light wind conditions so they normally move very little. Tornadic waterspouts are tornadoes that form over water, or move from land to water. They have the same characteristics as a land tornado. They are associated with severe thunderstorms, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Historic Storm Events

Clatsop County has had the following winter storms and wind events in its history. The flood impacts of precipitation associated with these storms are covered in the flood chapter of this plan. The following table provides information on the previous occurrences of hazard events.

Table II-57. Historic Wind and Winter Storms Events

Date	Location	Event Type	Magnitude	Details
Feb. 2019 (02/12/2019)	Coast Range of NW Oregon	Heavy Snow	1 to 2 feet of snow in Columbia Gorge	Back-to-back low-pressure systems dropping south along the coast of British Columbia and Washington brought cold air south into NW Oregon as well as plenty of moisture. Seine Creek SNOTEL around 2000 feet recorded 8 inches of snow in a 7-hour period.
Feb. 2019 (02/08/2019-02/09/2019)	Coast Range of NW Oregon	Heavy Snow	6 to 12 inches of snow was observed above 1000 feet elevation	A low-pressure system brought arctic air and heavy snow south out of Canada into the Columbia Basin and Coast Range.
Jan. 2019 (01/15/2019)	N. Oregon Coast	High Wind	65 mph on Astoria-Megler Bridge	A strong low-pressure system moving up the coast from the south brought strong southerly winds across all of northwest Oregon.
Dec. 2019 (12/20/2018)	N. Oregon Coast	High Wind	75 mph on Astoria-Megler Bridge	A low-pressure system tracked northeast toward Victoria Island. The trailing cold front moved onto the coast, bringing strong southerly winds ahead of the front to the coast and the coast range.
Dec. 2019 (12/17/2018)	N. Oregon Coast	High Wind, High Surf	65 mph on Astoria-Megler Bridge	A strong low-pressure system over the Gulf of Alaska brought a strong cold front through. This generated strong winds across northwest Oregon, resulting in heavy rain, flooding, and coastal erosion.
Dec. 2019 (12/14/2018)	N. Oregon Coast	High Wind	43 mph on Astoria-Megler Bridge	A strong low pressure system tracked northeast into British Columbia. The associated cold front brought with it strong southerly winds on the north and central Oregon coast.
Nov. 2018 (11/26/2018)	N. Oregon Coast	High Wind	78 mph on Astoria-Megler Bridge	A strong cold front moved onto the coast, bringing high winds, mainly to beaches and headlands along the coast.
April 2018 (04/10/2019)	N. Oregon Coast	High Wind	61 mph on Astoria-Megler Bridge	A shortwave lifting NNE brought a quick-hitting cold front into northwest Oregon. The front brought a short period of high winds to beaches and headlands along the coast.
April 2018 (04/07/2019)	N. Oregon Coast	High Wind	64 mph on Astoria-Megler Bridge	A strong low-pressure system tracking northeast towards Vancouver Island generated strong winds along the Coast and in the Willamette Valley.
Mar. 2018 (03/08/2019)	N. Oregon Coast	High Wind	69 mph	Strong low-pressure system moving up from the south brought high winds to the Coast and Coast Range.
Feb. 2018 (02/21/2018)	N. Oregon Coast	Winter Weather	1" of snow in Astoria	Low-pressure system drifting southward along the Oregon Coast pulled cold air all the way to the coast and brought snow levels down to sea level. One (indirect) fatality resulting from icy streets.

Date	Location	Event Type	Magnitude	Details
Feb. 2018 (02/18/2018)	Coast Range of NW Oregon	Heavy Snow	6-7 inches of snow on Coast Range summits	Cold low-pressure system brought 5 to 10 inches of snow which accumulated quickly. ODOT weather stations recorded 6-7 inches of snow at summits through the Coast Range.
Jan. 2018 (01/27/2018)	N. Oregon Coast	High Wind	62 mph on Astoria-Megler Bridge	A strong cold front moving into western Oregon brought strong southerly winds to the north Oregon beaches and headlands and coastal communities along Oregon's central coast.
Jan. 2018 (01/23/2018)	N. Oregon Coast	High Wind	63 mph on Astoria-Megler Bridge	Low pressure moving into British Columbia pushed a cold front across western Oregon. This brought strong southerly winds to the coastal beaches and headlands.
Jan. 2018 (01/18/2018)	Seaside	Hail	1.00 -2.00 in. hail	A broad low-pressure system off the coast of Washington and Oregon destabilized the atmosphere enough to generate a severe thunderstorm that moved through Seaside, dropping large hail.
Dec. 2017 (12/29/2017)	N. Oregon Coast	High Wind	67 mph on Astoria-Megler Bridge	A strong cold front moved through the area, bringing high winds mainly to beaches and headlands, but also to a few higher elevation spots in the Coast Range as well.
Oct. 2017 (10/21/2017)	N. Oregon Coast	High Wind, Heavy Rain	53 mph on Astoria-Megler Bridge	A very potent atmospheric river brought strong winds to the north Oregon Coast and Coast Range on October 21st. What followed was a tremendous amount of rain for locations along the north Oregon Coast and Coast Range.
Oct. 2017 (10/18/2017)	N. Oregon Coast	High Wind	47 mph on Astoria-Megler Bridge	A low-pressure system moving eastward into the Pacific Northwest brought a strong cold front which generated southerly sustained winds up to 47 mph along the Oregon Coast.
Apr. 2017 (04/07/2017)	N. Oregon Coast	High Wind	73 mph	A strong low-pressure system moved northeasterly up the Oregon coast, creating a strong pressure gradient that brought strong winds to all of northwest Oregon. The event brought down many trees across the area and two fatalities.
Feb. 2017 (02/08/2017 - 02/09/2017)	N. Oregon Coast	High Wind	71 mph	A warm front starting the snow in the Columbia Gorge came through on the 7th, then a trailing cold front moved through on the 8th through the 9th bringing high winds to the Oregon Coast and Coast Range and snow and ice to the Columbia Gorge.
Feb. 2017 (02/05/2017 - 02/06/2017)	N. Oregon Coast	Heavy Snow	5.5 in. of snow	A low-pressure system with an associated cold front brought impactful snow and high winds to the Oregon Coast.
Jan. 2017 (01/17/2017 - 01/18/2017)	N. Oregon Coast	High Wind	63 mph	An approaching low-pressure system brought rain across the Columbia River and freezing conditions in other counties.
Jan. 2017 (01/10/2017 - 01/11/2017)	Coast Range of NW Oregon	Heavy Snow	12 in. in Banks, OR	A strong low-pressure system moved up from the southwest and overran an existing cold, deep airmass. Surface temperatures as precipitation started were just above freezing, but with heavy showers, precipitation quickly turned over to snow during the early evening hours. Embedded thunderstorms enhanced snowfall rates around the Portland Metro area for a crippling snowstorm Tuesday evening.

Date	Location	Event Type	Magnitude	Details
Jan. 2017 (01/07/2017 - 01/08/2017)	Coast Range of NW Oregon	Winter Storm	0.89 in. of ice (liquid equivalent while temperatures were well below freezing)	A broad shortwave trough brought multiple rounds of precipitation, including a wintry mix of snow and ice for many locations across Northwest Oregon.
Dec. 2016 (12/19/2016)	N. Oregon Coast	High Wind	47 mph on Astoria-Megler Bridge	A warmer low-pressure system moved into to Northwest Oregon, bringing high winds along the North and Central Oregon Coast. Cold east winds through the Columbia River Gorge continued for the first part of the event, leading to light accumulations of snow and sleet in portions of far northwest Oregon.
Dec. 2016 (12/08/2016)	Coast Range of NW Oregon	Heavy Snow	3-6 in. of snow	A strong frontal system brought strong east winds and a mix of snow, sleet, and freezing rain
Nov. 2016 (11/24/2016)	N. Oregon Coast	High Wind	65 mph at Cannon Beach	A strong cold front moving southeastward onto the Coast brought high winds to the Northwest Oregon Coast.
Nov. 2016 (11/24/2016)	Bradwood, Clatsop County	Heavy Rain	3.52 in. of rain	A moist Pacific front moving slowly across the area produced heavy rainfall, resulting in flooding of several rivers across Northwest Oregon and at least two landslides.
Nov. 2016 (11/12/2016)	N. Oregon Coast	High Wind	45 mph on Astoria-Megler Bridge	A low-pressure system tracking northeastward off the Coast brought high winds to the far North Oregon Coast.
Oct. 2016 (10/15/2016)	N. Oregon Coast	High Wind	61 mph on Clatsop Spit	A deepening low-pressure system passed north along the Coast bringing strong winds to Northwest Oregon.
Oct. 2016 (10/14/2016)	Clatsop Spit (Ft. Stevens, Hammond)	Hail	1.0 -1.5 in. diameter	Behind the front that moved through on October 13, unstable airmass generated strong convective showers and thunderstorms. A few of these thunderstorms produced tornadoes, strong winds, hail, and heavy rain.
Mar. 2016 (03/05/2016)	N. Oregon Coast	High Wind	52 mph on Astoria-Megler Bridge	A cold front produced a burst of strong winds for the north Oregon Coast in the early morning.
Mar. 2016 (03/01/2016)	N. Oregon Coast	High Wind	52 mph	A cold front backed by a deep surface low resulted in strong winds across Northwest Oregon. Thunderstorms along the front produced damaging winds. Strong winds ahead of the front blew down a weak tree onto a moving vehicle, and resulted in one fatality.
Feb. 2016 (02/05/2016)	N. Oregon Coast	High Wind	45 mph	A low-level jet stream ahead of an occluded front produced several hours of strong winds to the North Oregon coast.
Jan. 2016 (01/28/2016)	N. Oregon Coast	High Wind	69 mph gusts	A strong cold front produced a few hours of high winds along the North Oregon Coast.

Date	Location	Event Type	Magnitude	Details
Dec. 2015 (12/22/2015 - 12/24/2015)	Coast Range of NW Oregon	Heavy Snow	6-14 in. of snow	Moist onshore winds produced a steady stream of showers over the area with snow levels between 1000 and 2000 feet. This resulted in heavy snow for the Northern Oregon Cascades and Coast Range.
Dec. 2015 (12/21/2015)	N. Oregon Coast	High Wind	59 mph gusts	High winds impacted Northwest Oregon as a 980 millibar low moved onshore in Pacific County, Washington. The winds resulted in widespread tree damage and power outages.
Dec. 2015 (12/17/2015, 12/21/2015)	N. Oregon Coast	High Wind	51-59 mph	Two events in five days. 1) A low-pressure system resulted in strong winds along the Northern and Central Oregon Coast. 2) High winds impacted Northwest Oregon as a 980 millibar low moved onshore in Pacific County, Washington. The winds resulted in widespread tree damage and power outages.
Dec. 2015 (12/06/2015, 12/07/2015, 12/08/2015, 12/10/2015, 12/12/2015)	N. Oregon Coast	High Wind	40-56 mph gusts	Five events in seven days. Several weather stations along the North Oregon Coast measured high winds with sustained winds ranging between 40 and 45 mph. The Clatsop and Tillamook County Emergency Managers reported several trees downed from the winds with widespread power outages.
Nov. 2015 (11/17/2015)	N. Oregon Coast	High Wind	40-50 mph gusts	A cold front produced strong winds that resulted in a lot of downed trees, power outages, and road closures.
Oct. 2015 (10/31/2015)	N. Oregon Coast	High Wind	45 mph sustained winds on Astoria-Megler Bridge	A strong front produced a burst of strong winds as it moved across northwest Oregon.
Oct. 2015 (10/10/2015)	N. Oregon Coast	High Wind	63 mph peak gusts on Astoria-Megler Bridge	A strong cold front produced a brief burst of strong winds across the northwest Oregon coast and coast range.
Aug. 2015 (08/29/2015)	N. Oregon Coast	High Wind	58 mph with gusts to 90 mph. at Oceanside	An unusually early and strong low pressure system resulted in high winds along the coast and strong winds inland. Downed trees and power lines resulted in power outages, minor damage, and traffic delays.
Mar. 2015 (03/15/2015)	N. Oregon Coast	High Wind	59 mph	A surface low produced strong gusty winds across Northwest Oregon as it moved north offshore the Central and Northern Oregon coasts before making landfall in Southwest Washington. Soils were well saturated due to a prolonged period of heavy rain, and many trees were downed impacting life and property.
Feb. 2015 (02/07/2015)	N. Oregon Coast	High Wind	64 mph. on the Astoria-Megler Bridge	A surface low moved from south to north just offshore the coast from the Central Oregon Coast to the South Washington Coast, and produced a burst of strong winds.
Feb. 2015 (02/05/2015)	N. Oregon Coast	High Wind	47 mph. gusts to 62 mph. on the Astoria-Megler Bridge	A low-level jet stream ahead of a cold front brought a burst of strong winds to the North Oregon Coast.

Date	Location	Event Type	Magnitude	Details
Jan. 2015 (01/17/2015)	N. Oregon Coast	High Wind	60 mph gusts	A frontal system accompanied by an upper jet resulted in a burst of gusty winds for the Northwest Oregon Coast, Coast range and Cascades.
Feb. 2014 (02/15/2014)	N. Oregon Coast	High Wind	72 mph gusts on Clatsop Spit, other Clatsop locations	A strong cold front produced strong winds for the North Oregon coast and coast range on February 15, 2014. Highways 26 and 53 were closed due to downed trees. Several weather stations along the entire North Oregon coast measured high winds on February 15, 2014. The strongest wind gust was 86 mph which was measured at Garibaldi NOS (TLB03). Pacific City (AT297), Astoria-Megler Bridge (ODT76), and Clatsop Spit (3CLO3) measured peak wind gusts between 69 and 72 mph.
Feb. 2014 (02/06/2014)	N. Oregon Coast	Heavy Snow	4-8" snow	A preceding cold arctic airmass combined with a moist Pacific storm resulted in widespread heavy snow for Northwest Oregon including the coast and the Willamette Valley. A 30-mile wide band of heavy snow set up along the Oregon coast in the morning on the 6th and resulted in 4 to 8 inches of snow from Tillamook to Manzanita.
Nov. 2012 (11/18/2012-11/19/2012)	N. Oregon Coast	High Wind	78 mph	A strong pacific frontal system brought high winds to the Coast and coast range of Northwest Oregon. Strong winds were reported at Garibaldi with sustained winds of 59 kts with gusts to 83 mph. Strong winds were also reported at Pacific City and Clatsop spit with wind gusts to 68 mph.
Dec. 2010 (12/13/2010)	Clatsop, Ft. Stevens	High Wind, Thunderstorm	64 mph	A strong cold pool of air aloft produced a very unstable airmass over western Oregon. A vigorous low-pressure center was just off the Washington Coast with a surface trough moving through western Oregon. This trough served as a focus for thunderstorms during the day. These thunderstorms produced strong, gusty winds in several locations. Strong, gusty winds were reported at Clatsop Spit with sustained winds of 35 mph and gusts to 56 mph.
Mar. 2009 (03/07/2009-03/08/2009 and 03/14/2009-03/15/2009)	N. Oregon Coast	Heavy Snow	6" snow	Ahead of a deep, incoming trough, a weather system brought snow to some higher elevations in northwest Oregon. Then, a potent late season frontal system brought heavy snow to the higher elevations of northwest Oregon.
Dec. 2008 (12/26/2008)	N. Oregon Coast	High Wind	63 mph on Clatsop Spit	A strong Pacific winter storm system brought high winds to the coastal region northwest Oregon.
Dec. 2008 (12/24/2008 - 12/25/2008)	Coast Range of NW Oregon	Winter Storm Heavy Snow	11 - 15 in. of snow over two days	A snow storm on Christmas Day left 6 to 10 inches of snow in the Coast Range of northwest Oregon.
Dec. 2008 (12/12/2008 - 12/13/2008)	Coast Range of NW Oregon	Heavy Snow	8-10 in. of snow on the Coast Range passes	A strong and very cold Pacific system brought heavy snow accumulations to northwest Oregon.

Date	Location	Event Type	Magnitude	Details
Dec. 2008 (12/12/2008)	N. Oregon Coast	High Wind	41 mph with gusts to 70 mph on Clatsop Spit	A strong Pacific winter storm system brought high winds to the coastal region and Cascades of northwest Oregon. The strong winds ahead of the approaching frontal system caused several power outages along the coast and resulted in nearly $8 million in estimated property and crop damages for Clatsop, Lane, Tillamook, and Lincoln Counties.
Nov. 2008 (11/08/2008, 11/11/2008)	N. Oregon Coast	High Wind	40-50 mph with gusts to 70 mph	A typical late-fall Pacific low-pressure system brought strong winds to the coast of northwest Oregon.
Dec. 2007 (12/01/2007-12/03/2007)	Clatsop County	High Wind, Heavy Rain, Mudslides	Gusts 85-130 mph on the North Coast; 3.5 in rain Astoria	A series of powerful Pacific storms Dec. 1-3, 2007 brought straight-line winds, rain, and mudslides resulting in Presidential Disaster Declaration; $180 million in damage in the state, power outages and communication isolation for several days, and five deaths attributed to the storm.
Nov. 2007	Clatsop, Tillamook Counties	storm with high winds		$10,000 in damages.
Dec. 2006 (12/14/2006, 12/15/2006)	Clatsop, Tillamook Counties	High Wind, Heavy Rain		$10,000 in damages.
Nov. 2006 (11/05/2006-11/08/2006)	Clatsop County	High Wind, Heavy Rain		Severe storms, flooding, landslides, mudslides.
Mar. 2006 (03/20/2006)	Clatsop, Tillamook, Lincoln, Lane Counties	High Wind	60 mph, 75 mph	Two windstorm events with winds measured at 60 mph and 75 mph resulted in $75,000 and $211,000 in estimated property damage among all four coastal counties; the storms also impacted 10 other counties outside of Region 1.
Feb. 2006	Clatsop, Tillamook, Lincoln, Lane Counties	High Wind	77 mph	More than $200,000 in estimated property damage among all four coastal counties; the storm also impacted nine other counties outside of Region 1.
Jan. 2006	Clatsop, Tillamook, Lincoln, Lane Counties	High Wind	86 mph, 103 mph	Two storm events with high winds of 86 mph and 103 mph resulted in $388,888 in property damage among all four coastal counties; the storm also impacted 5 other counties outside Region 1.

Date	Location	Event Type	Magnitude	Details
Dec. 2004 (12/08/2004-12/09/2004)	W. Oregon	Winter Storm, High Wind, Heavy Snow, High Surf	2.5' of snow on Mt Hood; Lightning in Astoria; 25' Surf	A large powerful Pacific storm brought a wide variety of weather to Northwestern Oregon. High winds along the Coast heralded the approach of the storm early in the morning. At 10 AM Astoria Building Inspector Jim Byerley was struck by lightning crossing a street in downtown Astoria. He was shaken and sore, examined at Columbia Memorial Hospital and released. Heavy rain accompanied this storm resulting in mud slides. The storm also generated high seas, which created high surf along the Northern and Central Oregon Coast the next day. Buoys 20 miles off the Oregon Coast reported maximum seas of 25 to 26 feet.
Jan. 2004 (01/27/2004-01/29/2004)	Clatsop	Heavy Rain	4" in Seaside; 4.29" Astoria Airport	A series of strong Pacific storm systems brought heavy rain to Northwest Oregon.
Mar. 2003	Clatsop	Heavy Rain	1”-3"	Heavy rains once again moved into Northwest Oregon. Many stations reported 1 to 3 inches during the same 24-hour period.
Jan 2003 (01/29/2003-01/31/2003)	Clatsop	Heavy Rain, Floods	1”-3"	Heavy rains associated with a strong Pacific weather system brought 2 days of heavy rains to the area. Numerous locations reported 1 to 3 inches. These heavy rains filled many small streams, 2 feet of water covered Highway 101 between Seaside and Cannon Beach.
Jan. 2002	N. Oregon Coast	Winter Storm: High Winds, Heavy Rains	63 mph	A winter storm brought high winds, heavy rain, and warmer temperatures to the area, resulting in flooding and mud and landslides. High winds knocked out power along the coast from Cannon Beach and Seaside to Warrenton for varying periods of time. A private single engine plane was flipped by the gusty winds at the Astoria Regional Airport in Warrenton. Reported winds included Cannon Beach 40 to 45 mph with gusts to 63 mph.
Aug. 2001 (08/22/2001-08/23/2001)	Clatsop	Heavy Rain	n/a	n/a
Jan. 2000	Clatsop, Tillamook	High Wind	70 mph	Strong winds associated with a strong offshore storm buffeted the North and Central Oregon Coast. Cannon Beach reported gusts to 70 mph and Astoria reported gusts to 59 mph.
Jan. 1999	Clatsop, Tillamook	High Wind	61 mph	A Pacific storm caused gusts of 61 mph in Cannon Beach.
Jan. 1998 (01/11/1998-01/12/1998)	Clatsop, Tillamook	Ice Storm	6" snow, 1 fatality	The event began when an arctic front brought very cold air from Alaska, resulting in widespread snow. Snow turned to freezing rain in the Gorge Monday, and persisted there and within the reach of strong east winds blowing out of the west end of the Gorge. Trees and large tree limbs were knocked down over a large area, and there were widespread power outages. One fatality, a 43 year old man was found dead from exposure in the back yard of his home in Astoria.

Date	Location	Event Type	Magnitude	Details
Jan. 1998 (01/05/1998)	Seaside, Clatsop County	Tornado	F0	A weak tornado did minor damage to the Kinni-Kinnic Lodge and an adjacent home on Beach Street in Seaside (estimated property damage was $3,000).
Dec. 1997 (12/22/1997)	Clatsop, Tillamook	Heavy Snow	3" of snow	A weak Pacific storm dumped three inches of snow on Wilson river and Sunset summit passes in the Coast Range before the snow turned to rain.
Nov. 1997	Western Oregon	High Wind, High Surf	gusts to 89 mph at Florence	Severe beach erosion; trees toppled.
Nov. 1997 (11/19/1997)	N. Oregon Coast	High Wind	80 mph	A powerful Pacific storm brought high winds to the Oregon coast. The highest wind speeds reported included sustained 60 mph with gusts to 80 mph at Tillamook.
Dec. 1996 (12/29/1996 - 12/30/1996)	N. Oregon Coast	High Wind	55 mph gusting to 66 mph at Cannon Beach	The first in a series of strong Pacific storms lashed the North Oregon Coast with winds up to 110 mph.
Dec. 1996 (12/26/1996-12/31/1996)	N. Oregon Coast	Heavy Rain, Floods	16 rivers flooded	Heavy rains caused 16 rivers in NW Oregon to flood during the last week of December 1996 and into early January 1997. Dozens of homes were flooded on various rivers and numerous highways were rendered impassable.
Nov. 1996 - Dec. 1996	Five Western States	Heavy Rain, Freezing Rain/Heavy Wet Snow	6-18" West of the Cascades; 8" in 24 hrs in Coast Range	During the period from mid-November to mid-December 1996, many areas received above-normal precipitation, greatly increasing the snowpack over mid and high elevations. Three sequential storms brought moderate to heavy rain, with the last creating a rain-on-snow event which resulted in incredible amounts of runoff.
Nov. 1996 (11/18/1996-11/20/1996)	N. Oregon Coast	Heavy Rain, Floods	11 rivers reached flood stage	Heavy rainfall over Oregon caused many rivers in Northwestern Oregon to flood. The first small streams began flooding on November 18th with 11 larger rivers reaching flood stage on the 19th and 20th. Major rivers such as the lower reaches of the Willamette remained above flood stage until November 23rd. Initial damage estimates from this flooding exceeded $3 million.
Dec. 1995	Statewide	High Wind	Over 100 mph	Wind gusts of over 100 mph; e.g. Sea Lion Caves gusts to 119 mph. The storm followed the path of Columbus Day Storm (Dec. 1962) and resulted in four fatalities, many injuries, and widespread damage (FEMA-1107-DR-Oregon).
Feb. 1994	Warrenton	Tornado		Damage in a local park.
Jan. 1993	Oregon Coast	High Wind	98 mph	Inauguration Day Storm resulted in a major disaster declaration in Washington State. Tillamook wind gusts to 98 mph resulted in widespread damage, especially in the Nehalem Valley.

Date	Location	Event Type	Magnitude	Details
Nov. 1991	Oregon Coast	High Wind, High Surf	25-foot waves	This slow-moving storm generated 25-foot waves and resulted in damage to buildings, boats, and transmission lines.
Jan. 1991	Most of Oregon	High Wind	Gusts of 57 mph at Seaside	75-foot trawler sank NW of Astoria
Feb. 1990	Oregon Coast	High Wind	53 mph	Wind gusts resulted in damage to docks, piers, and boats.
Jan. 1990 (01/24/1990)	Statewide	High Wind	100 mph wind gusts	One fatality; damaged buildings; falling trees resulted in a disaster declaration in Oregon (FEMA-853-DR-Oregon).
Mar. 1988	North and Central Coast	High Wind	wind gusts 55-75 mph	One fatality near Ecola State Park; uprooted trees.
Dec. 1987	Oregon Coast / NW Oregon	High Wind	winds on coast 60 mph	Saturated ground enabled winds to uproot trees.
Jan. 1987	Oregon Coast	High Wind	wind gusts to 96 mph at Cape Blanco	Significant erosion occurred along highways and beaches; several injuries.
Jan. 1986	North and Central Coast	High Wind	75 mph winds	Damaged trees, buildings, and power lines.
Nov. 1981 (11/13/1981, 11/15/1981)	Oregon Coast, North Willamette Valley	High Wind		Back to back windstorms
Mar. 1971	Most of Oregon	High Wind		Falling trees took out power lines; building damage; notable damage in Newport.
Feb. 1971 (02/13/1971)				wind/rain
Oct. 1967	Western Oregon	High Wind	winds on Oregon Coast 100–115 mph	Significant damage to buildings, agriculture, and timber.
Oct. 1967 (10/03/1967)	Clatsop County, Warrenton	Tornado	F1	$25k in property damage; Impact area: 0.5 mi x 70 yds.
Oct. 1966	Seaside	Tornado	F0	Windows broken, telephone lines down, outdoor signs destroyed.

Date	Location	Event Type	Magnitude	Details
Oct. 1966 (10/20/1966)	Near Astoria Airport	Tornado/ Waterspout	F0	Began over ocean and moved inland; several homes and commercial buildings damaged.
Dec. 1964 (12/24/1964)	Oregon	Floods, Heavy Rain, Winter Storm	100-year flood event; Benchmark; 15 inches of rain in 24 hours	The Christmas flood of 1964 was driven by a series of storms, known as atmospheric rivers or "pineapple expresses," that battered the region producing as much as 15 inches of rain in 24 hours at some locations. The combination of heavy rain, melting snow, and frozen ground caused extreme runoff, erosion and flooding. https://www.usgs.gov/news/christmas-flood-1964
Mar. 1963	NW Oregon Coast	High Wind	100 mph gusts (unofficial)	widespread damage
Oct. 1962 (10/12/1962)	Statewide	High Wind	131 mph	Oregon's most destructive storm, the Columbus Day Windstorm Event, produced a barometric pressure low of 960 mb and resulted in wind speeds of 131 mph on the Oregon coast resulting in 23 fatalities and $170 million in damages.
Nov. 1958	Northern/ Northwest Oregon	High Wind	Gusts to 75 mph at Astoria	Wind gusts across the Oregon, Idaho, Montana, Wyoming resulted in damage to buildings and utility lines; wind gusts to 75 mph at Astoria; gusts to 131 mph at Hebo.
June 1957 (06/05/1957)	Clatsop	High Wind	96 mph gusts	Thunderstorm, Wind
Jan. 1956	Western Oregon	High Wind, Heavy Rain, Mudslides		Heavy rains, high winds, mud slides resulted in estimated damages of $95,000.
Dec. 1955 (12/29/1955)	Western Oregon	High Wind	up to 90 mph	Wind gusts at North Bend up to 90 mph resulted in significant damage to buildings and farms.
Dec. 1951	Most of Oregon	High Wind	60–100 mph	Winds 60-100 mph and a barometric pressure low of 968.5 mb near Astoria resulted in many damaged buildings and telephone/power lines down.
Nov. 1951	Most of Oregon	High Wind	40–60 mph with 75–80 mph gusts	Winds 40–60 mph with 75–80 mph gusts resulted in widespread damage, especially to transmission lines.
Apr. 1931	Western Oregon	High Wind	78 mph	Wind speeds up to 78 mph resulted in widespread damage.
Jan. 1921	Oregon Coast/ Lower Columbia	High Wind	130 mph gusts in Astoria	Winds recorded at 113 mph at the mouth of the Columbia River; 130 mph in Astoria.

Date	Location	Event Type	Magnitude	Details
Jan. 1880	Western Oregon	High Wind	65-80 mph	Very high winds, 65-80 mph near Portland, resulted in flying debris and fallen trees.

Sources: NOAA Storm Events Database, https://www.ncdc.noaa.gov/stormevents/, accessed 12/2/2019. Oregon DOT weather sensor is located on Astoria-Megler Bridge ; FEMA < http://www.fema.gov/news/disasters_state.fema?id=41>, Taylor and Hatton, 1999, The Oregon Weather Book, pp. 130-137; Tillamook County NHMP, 2018; Oregonian, https://www.oregonlive.com/weather/2007/12/buildingsized_waves_stunning_w.html .

Potential Impacts

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.

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.

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 with above-ground utility lines. A windstorm can knock down trees and power lines which results in road closures, power outages, and tons of debris. Fallen trees block roads and rails for long periods, which can affect emergency and commercial operations. Clatsop County works with utility companies in identifying problem areas and tree maintenance/removal is an ongoing mitigation action.

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.

HVA: Hazard Vulnerability Analysis

The hazard impact and community vulnerability for windstorm and winter storms was assessed and ranked by each jurisdiction via the Hazard Vulnerability Analysis process. See a description of the HVA process in the Appendix. The considerations that informed the rankings can be found in the Community Risk Profile for each jurisdiction.

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. During the 2019 risk assessment interviews, windstorms and winter storms ranked as the most severe hazard for all sixteen jurisdictions. Wind and winter weather happen annually and some jurisdictions (Clatsop County Public Works, e.g.) are addressing this hazard incrementally by building capacity and mitigating the primary risks (via vegetation and drainage management programs, e.g.) However, the severe isolation of the 2007 severe windstorm and winter storm event is still very prominent in the mind of the community. The population centers of Clatsop County were cut off from all communication, supplies, and travel for nearly two weeks.

Table II-58. Hazard Vulnerability Analysis: Windstorm and Winter Storms

Jurisdiction	History	Vulnerability	Maximum Threat	Probability	Total	Risk Level
Unincorporated Clatsop County	13	47	92	64	217	H
City of Astoria	20	30	100	63	213	H
City of Cannon Beach	15	35	80	60	190	H
City of Gearhart	20	50	100	70	240	H
City of Seaside	20	50	100	70	240	H
City of Warrenton	16	40	80	56	192	H
Arch Cape Water District	20	50	100	70	240	H
Arch Cape Sanitary District	20	50	100	70	240	H
Cannon Beach RFPD	20	50	100	70	240	H
Clatsop Community College	20	40	60	70	190	H
Falcon Cove Water District	20	50	50	70	190	H
Knappa-Svensen-Burnside RFPD	20	50	100	70	240	H
Lewis and Clark RFPD	20	50	100	70	240	H
Port of Astoria	20	50	100	70	240	H
Seaside School District	18	45	90	63	216	H
Sunset Empire Transit District	20	50	100	35	205	H

Source: Clatsop County MJNHMP Update Steering Committee, April-Oct., 2019; Clatsop County EOP 2018, p. 18.

Windstorm and Winter Storm Vulnerability Assessment

Damage data and loss estimates related to windstorms and winter storms are not consistently collected except in the case of severe events when a request for public and/or individual assistance is made as part of a disaster declaration request. These 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 rural Clatsop County (excludes cities).

Future Climate Conditions: Windstorm and Winter Storm

- Climate change will cause very little, if any, change to the frequency or intensity of windstorms in the Pacific Northwest.
- Cold extremes are still expected from time to time, but with less frequency and intensity as the climate warms. Under the higher emissions scenario, by the 2050s, the coldest night of the year is projected to increase by about 6 degrees F (range 0-10 degrees F) and annually have one less day per year below freezing.
- Regionally, the occurrence of rain-on-snow, or precipitation occurring as rain instead of snow, is likely to increase which could contribute to deficits in late-summer water supply for regional agricultural producers or higher temperatures for cold water-dependent fish like trout and salmon.

Risk Reduction Recommendations

The science of risk reduction is an emerging field. These potential storm mitigation actions are listed along with the hazard description so that readers understand the type of mitigation actions being considered or that might be considered current best practices.

- Develop and implement hazard tree and vegetation management best practices/programs.
- Promote tree planting projects on private and public properties using 'right tree, right place' methods.
- 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 at risk during a major winter storm event.

C. Community Risk Profiles

1. Unincorporated Clatsop County

Clatsop County and the larger community has a robust and complex history of geohazard policy development that has informed its consideration of all hazards. The emergence of scientific knowledge and understanding of the risk of earthquakes in the Pacific Northwest in the past four decades has put Clatsop County in the spotlight as the north coast of Oregon has become widely understood to be at very high risk of a tsunami in the event of a Cascadia earthquake event. Further, the proximity to the Columbia River and its estuary and extensive coast line present the risk of coastal erosion and flooding, but not in a manner that is easy to predict or as severe as could be expected due to the protective nature of the beachhead and the upstream dams controlling the river flow.

Hazard Vulnerability Analysis

The Natural Hazards section of this plan described the hazards affecting Clatsop County in detail. Clatsop County staff ranked hazards as a part of this planning process across meetings occurring June (4th) and August (21st and 27th), 2019, resulting in the following determination of risk for the rural and unincorporated areas of the County.

Table II-59. Clatsop County Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ash Fall	Wildfire	Wind/Winter Storm
Unincorporated Clatsop County (rural)	M	H	H	H	L	H	L	L	H

Source: Clatsop County, 2019.

Drought

Drought risk was ranked for limitations on development. As two water providers have had to limit development in the County due to water supply, this is a concern. Olney-Walluski Water Association will not give new connections and Falcon Cove Beach Water District has moratorium on new development.

Earthquake

Earthquake risk was ranked for a Cascadia earthquake event scenario. The 2018 DOGAMI Natural hazard risk report for Clatsop County indicates that very high liquefaction soils are found throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton (Williams et al, 2020).

Building inventory for the City of Astoria is relatively older than other communities in Clatsop County, which implies lower seismic building design codes and thus more vulnerable to earthquake damage. When tsunami damages are disregarded, Astoria's estimated loss ratio from a CSZ earthquake alone is 46% compared to 20%-35% for the other communities in the county (Williams et al, 2020).

Flood

Flood risk was ranked based on the annual, primarily coastal, flooding that occurs in the County, putting infrastructure and structures at risk. Annually, Highway 202 and tide gates get overwhelmed with high tides, as do areas in the City of Seaside. During the 1996 flood, coastal flooding inundated the Surf Pines area near Gearhart.

Landslide

Landslide risk for Clatsop County is ubiquitous—more than half of all the buildings in the County are at risk of at least moderate susceptibility to landslide risk. See the Landslide Exposure table on page 171. Landslide risk is a priority for the Community Development Department who regulates construction and land development. Otherwise, landslides are largely addressed by Clatsop County Public Works as individual events that impact public infrastructure like roads and bridges.

Tsunami

Tsunami risk was ranked for a Cascadia earthquake event scenario.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

Generally the community is at low risk from a wildfire event due to high coastal humidity, but in the intermittent dry periods with east winds from summer to late fall, wildfire risk can elevate quickly. Table II-56. Wildfire Exposure indicates that 11% of Clatsop County is subject to high wildfire risk and 44% is subject to moderate risk.

Windstorm and Winter Storm

Windstorm and winter storm risk was ranked based on the 2007 storm event. All of the community is considered at risk from windstorms and winter storms annually. The primary impacts are interruptions in electricity, communication, and travel. However, the scenario considered is the 2007 event that resulted in downed power and communication lines that led to closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. The lack of access to Portland hospitals and the inability to communicate with people with medical needs were two major life safety concerns.

Regular Maintenance of Infrastructure

Clatsop County maintains a regular schedule of maintenance on its assets and collaborates with local and state partners on the maintenance of shared resources. These activities are implemented via Capital Improvement Plans (CIPs) and other efforts.

Examples include:

- Inspection and repair of bridges (with ODOT and cities).
- Prioritization, design, and funding proposals for bridge replacement/major repair (with ODOT and cities).
- Annual road repair (chip seal) and resurfacing of priority roads.
- Regular maintenance of the road right-of-way for visibility and safety from trees and other hazards.
- Managing parks and open space.
- Management and regular repair of County facilities.

Risk Assessment Summary

Table II-60. Unincorporated Clatsop County critical facilities.

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Brownsmead RFPD	X	X	-	-	-	-
Camp Rilea - National Guard Training Center	-	X	-	X	-	-
Elsie/Vinemaple RFPD	-	X	-	X	-	-
Gearhart Rural Fire District	-	-	-	-	-	-
Hamlet Rural Fire Dist	-	X	-	-	-	-
Jewell School	-	X	-	X	-	-
John Day-Fern Hill Fire Station	-	X	-	X	-	-
Lewis & Clark Elementary	-	X	-	X	X	-
Lewis & Clark RFPD	X	X	X	-	X	-
Miles Crossing Sanitary Sewer Dist	X	-	X	-	X	-
Mist-Birkenfeld RFPD	-	-	-	-	-	-
Mist-Birkenfeld RFPD - Fishhawk Lake	-	X	-	X	-	-
Olney-Walluski Volunteer Fire & Rescue	-	-	-	X	-	-
Olney-Walluski Water Association	-	X	-	X	-	-
Oregon Military Department	-	X	-	-	X	-
Shoreline Sanitary District	-	X	-	-	-	-
Sundown Sanitation District	-	X	-	-	X	-
Wauna Water District	-	X	-	X	-	-
Wickiup Water District	-	X	-	X	X	-
Youngs River-Lewis & Clark Water	X	X	X	X	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020.

Table II-61. Unincorporated community of Arch Cape critical facilities

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Arch Cape Dom Water Supply	-	X	-	X	-	-
Arch Cape Fire Station	-	-	-	-	-	-
Arch Cape Sanitary District	-	X	-	-	-	-
Cannon Beach Fire and Rescue Arch Cape	-	X	X	-	-	-

Source: Williams et al, 2020.

Table II-62. Unincorporated community of Svensen-Knappa critical facilities

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Clatsop County Public Works	-	X	-	-	-	-
Clatsop County Sheriff	-	X	-	-	-	-
Hilda Lahti Elementary School	-	X	-	-	-	-
Knappa High School	-	X	-	-	-	-
Knappa Svensen RFPD	-	X	-	-	-	-
Knappa Water Association	-	X	-	X	-	-

Source: Williams et al, 2020.

Table II-63. Unincorporated community of Westport critical facilities

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Westport Heights Water System	-	X	-	X	-	-
Westport Water Association	-	X	-	X	-	-
Westport Wauna RFPD	-	-	-	-	-	-

Source: Williams et al, 2020.

The Natural Hazard Risk Report for Clatsop County assessed the risk of unincorporated Clatsop County as a whole and specific unincorporated communities. The tables below show the detailed results of the HAZ-US analysis. This analysis focused on geohazards (coastal erosion, earthquake, landslide, and tsunami) and included flood and wildfire, but did not produce results for wind/winter storm, drought, or a volcanic event.

Hazard Profile

Table II-64. Unincorporated Clatsop County Hazard Profile

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Unincorporated Clatsop County	9,477	8,214	20	1,378,964,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	1,175	12%	1,044	4	14,547,000	1.1%
*Earthquake**	*CSZ M9.0 Deterministic*	2,275	24%	2,870	14	480,396,000	35%
Earthquake (within Tsunami Zone)		235	2.5%	480	2	24,573,000	1.8%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	1,042	11%	1,040	3	67,075,000	4.9%
Tsunami	Senate Bill 379 Regulatory Line	1,064	11%	1,086	4	135,415,000	9.8%
Landslide	High and Very High Susceptibility	2,836	30%	2,513	11	280,773,000	20%
Coastal Erosion	High Hazard	4	0.0%	20	0	2,595,000	0.2%
Wildfire	High Hazard	1,618	17%	1,324	6	145,792,000	11%

*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

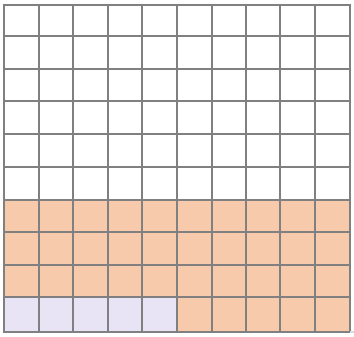
Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another. Colors correspond to colors in Table II-14.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Note: the statistics in this section do not include the unincorporated communities of Arch Cape and Svensen-Knappa-Burnside. Those data tables can be found in the Arch Cape Water and Knappa Fire Risk Profile sections. Source: Williams et al, 2020.

Figure II-71. Unincorporated Clatsop County loss ratio from Cascadia subduction zone event.



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Table II-65. Unincorporated community of Arch Cape hazard profile.

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Arch Cape	183	462	4	113,684,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	9	5.1%	15	0	1,113,000	1.0%
*Earthquake**	*CSZ M9.0 Deterministic*	20	11%	76	2	16,694,000	15%
Earthquake (within Tsunami Zone)		6	3.5%	32	1	7,126,000	6.3%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	59	32%	162	1	43,350,000	38%
Tsunami	Senate Bill 379 Regulatory Line	88	48%	253	1	63,972,000	56%
Landslide	High and Very High Susceptibility	57	31%	135	1	31,372,000	28%
Coastal Erosion	High Hazard	16	8.9%	50	0	12,270,000	11%
Wildfire	High Hazard	1	0.7%	3	0	838,000	0.7%

Source: Williams et al, 2020.. *Earthquake losses were calculated for buildings outside of Medium tsunami zone.

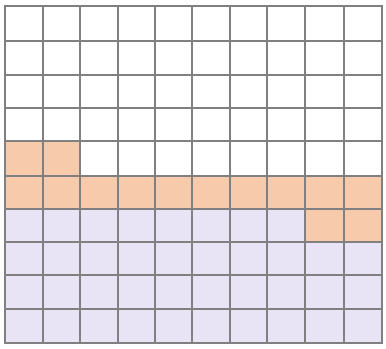
Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Source: Williams et al, 2020.

Figure II-72. Unincorporated community of Arch Cape loss ratio from Cascadia subduction zone event.



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Table II-66. Unincorporated community of Svensen-Knappa hazard profile.

Community Overview					
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)	
Svensen-Knappa	3,013	1,652	6	178,049,000	

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	17	0.6%	6	0	44,000	0.0%
*Earthquake**	*CSZ M9.0 Deterministic*	782	26%	523	6	37,280,000	21%
Earthquake (within Tsunami Zone)		0	0.0%	0	0	0	0.0%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	0	0.0%	0	0	0	0.0%
Tsunami	Senate Bill 379 Regulatory Line	10	0.3%	8	0	660,000	0.4%
Landslide	High and Very High Susceptibility	1,129	38%	719	1	68,858,000	39%
Wildfire	High Hazard	112	3.7%	58	0	5,607,000	3.1%

*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

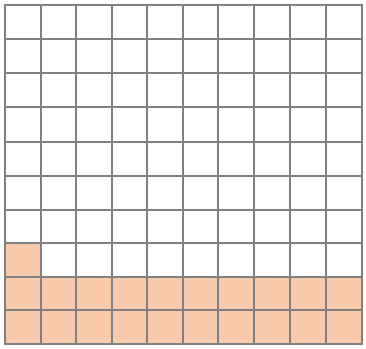
Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Source: Williams et al, 2020.

Table II-67. Unincorporated community of Svensen-Knappa loss ratio from Cascadia event.



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Table II-68. Unincorporated community of Westport hazard profile.

Community Overview					
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)	
Westport	498	348	3	24,928,000	

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	0	0.0%	2	0	7,000	0.0%
*Earthquake**	*CSZ M9.0 Deterministic*	220	44%	191	2	9,592,000	38%
Earthquake (within Tsunami Zone)		0	0.0%	0	0	0	0.0%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	0	0.0%	0	0	0	0.0%
Tsunami	Senate Bill 379 Regulatory Line	0	0.0%	0	0	0	0.0%
Landslide	High and Very High Susceptibility	215	43%	135	2	10,066,000	40%
Wildfire	High Hazard	60	12%	63	0	2,524,000	10%

*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

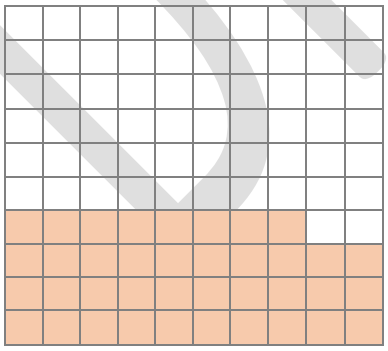
Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" the level of flooding (base flood elevation).

Source: Williams et al, 2020.

Figure II-73. Unincorporated community of Westport loss ratio from Cascadia subduction zone event.



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Plans and Policies

Table II-69. Clatsop County Plans and Policies

Plan/ Policy Name	Date	Author/ Owner	Description	Relation to Natural Hazard Mitigation
Clatsop County Comprehensive Plan	1979-1980; Update underway 2019-2021	Clatsop County Community Development Dept.	The Clatsop County Comprehensive Plan is an official public document that is adopted by the county as the policy guide to development decisions.	Goal 7 chapter addresses areas subject to natural disasters (county-wide) Update website: https://www.co.clatsop.or.us/landuse/page/comprehensive-plan-update
Flood Overlay Zone and Floodplain Ordinance	2018	Clatsop County Community Development Dept.	Part of the Comprehensive Plan.	Guides the development in the floodplain in adherence with FEMA's National Flood Insurance Program.
Geohazard Overlay Zone	Updated 2020	Clatsop County Community Development Dept.	Part of the Comprehensive Plan.	Guides the development in areas susceptible to landslides.
Clatsop County Transportation System Plan	2015	Clatsop County Community Development Dept.	Guides the development of roads, bridges, and related infrastructure.	Tsunami Evacuation Facilities plan is pending and would be an amendment to the TSP.
Beaches and Dune Overlay Zone		Clatsop County Community Development Dept.	This policy prohibits removal of soil and sand from the overlay area. Erosion control plans are required for all excavation activities in the coastal 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.
Dredged Material Disposal plan		Clatsop County Community Development Dept.	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.	Guidance for activities related to coastal erosion.

Mitigation Actions

Figure II-74. Clatsop County Mitigation Actions

Hazard	Clatsop County 2021-2026 Mitigation Actions	Priority	Timeline	Status and Explanation	Lead Dept./ Funding
Multi Hazard	Centralize County 911 system.	M	2-5 yrs.		County Mgr Sheriff
Multi Hazard	Develop a pre-plan of how to accommodate visitors to the coast following a major disaster.	H	6-12 mo.	Proposed mitigation priority	CCEM
Multi Hazard	Develop Post-Disaster Recovery Plans for communities in Clatsop County.	M	2-5 yrs.	Proposed mitigation priority	CCEM
Multi Hazard	Develop a debris management plan.	H	1-3 yrs.	In progress Debris Plan development anticipated FY2021-21	CCEM
Multi Hazard	Relocate County Public Works outside the tsunami inundation zone.	H	2-5 yrs.	Public process & assessment underway	County Mgr
Multi Hazard	Develop emergency shelter facilities throughout the County.	H	6-24 mo.	Identification & assessment completed in 2018.	CCEM
Multi Hazard	Develop an inventory of available generators and fuel distribution.	H	6-24 mo.	In-progress: Fuel Plan development set for FY2021	CCEM
Multi Hazard	Outreach and education to community organizations active in disasters that may be designated relief sites regarding emergency response and recovery.	M	6-24 mo.	In progress: COAD development	CCEM
Earthquake	Retrofit County bridges that are identified by a seismic vulnerability assessment (County priority action)	M	2-5 yrs.	Ongoing	Public Works

Hazard	Clatsop County 2021-2026 Mitigation Actions	Priority	Timeline	Status and Explanation	Lead Dept./ Funding
Earthquake	Prepare public facilities for earthquake events with seismic retrofits.	H	2-5 yrs.	Ongoing	ALL
Earthquake	Prepare County lifelines for seismic risk	H	2-5 yrs	Ongoing	ALL
Earthquake	Develop incentive programs to encourage homeowners to perform seismic retrofits.	M	1-3 yrs.	Proposed mitigation priority	Building Codes
Tsunami	Identify viable sites for vertical evacuation construction.	H	1-3 yrs.	Proposed mitigation priority	CCEM
Tsunami	Implement Tsunami Hazard Inundation overlay and develop regulations Maps for hazard mitigation planning.	H	1-3 yrs.	Proposed mitigation priority	Community Development
Tsunami	Establish long-term supply and staging areas outside of inundation zones.	H	1-3 yrs.	Proposed mitigation priority	CCEM
Tsunami	Upgrade and improve tsunami evacuation routes.	H	1-2 yrs.	Ongoing.	CCEM
Tsunami	Assess tsunami evacuation assembly areas for short- and long-term use to identify and make needed improvements.	H	1-2 yrs.	Proposed mitigation priority	CCEM
Flood	Explore public support for becoming a Community Rating System (CRS).	M	1-2 yrs	Proposed mitigation priority	Community Development
Flood	Engage and support the Diking Districts in respect to accreditation of the County's levees.	M	2-5 yrs	Proposed mitigation priority	Community Development
Landslide	Develop alternative transportation routes around slide-prone areas in County.	H	1-3 yrs.	Proposed mitigation priority	CCEM
Wildfire	Develop informational materials to inform the community about how to protect themselves and their assets from wildfire.	H	6-12 mos.	In progress	CCEM

Completed Items

The action items in this section were identified by whole community process in 2008 during the initial NHMP development. Most have been removed from the Action Item table because they are completed in entirety or to such an extent that they have become of an established resource and part of routine operations.

- Develop and implement a Community Wildfire Protection Plan
- Seismic retrofit of old Hamlet Fire Station.
- Relocate Arch Cape Fire Station out of the tsunami inundation and flood zones.
- Establish a tree maintenance, removal, and outreach program for Clatsop County roads and highways affected by winds from the coast or Columbia River corridor (connectors to Hwy 30 and Hwy 101).
- Rebuild four Seaside School District schools outside of the tsunami inundation zone.
- Increase public education and outreach in natural hazards which affect the north coast and develop informational materials to inform the community about how to protect themselves and their assets from hazards.
- Improve public notification and warning system.
- Update the Clatsop County Comprehensive Plan to address hazard mitigation and climate adaptation. Specifically, the Comp Plan will be the mechanism used to address coastal erosion and drought.
- Prepare civic officials with information about natural hazards that affect their districts and how they can be mitigated.
- Prepare private residents and homes and business owners and facilities for earthquake events.
- Post-disaster pet/animal shelter.
- Mitigate the risk of communicable disease in vulnerable, congregate settings.
- CERT Program Support
- Conduct preliminary research on the development of a County Land Use Ordinance relating to Tsunami Hazards.
- Develop a County-wide tsunami evacuation and risk assessment and plan.
- Establish a tree maintenance, removal and outreach program for Clatsop County roads and highways affected by winds from the coast or Columbia River corridor.
- Develop emergency shelter facilities throughout the County.
- Public Emergency Information Boards.

Recommended Items

This section contains action items that were suggested during the NHMP process in 2008, but were removed from the table because they require additional scoping or public process.

- Partner with Clatsop Community College on mitigation efforts
- Evaluate the feasibility of undergrounding utilities where appropriate.
- Identify funding sources to address all hazards.
- Engage and support the Diking Districts in respect to accreditation of the County's levees.
- Establish high ground commercial districts (above tsunami lines).

- Encourage home weatherization programs.
- Relocate or elevate/harden the 30 Clatsop County critical facilities in the distant tsunami zone.
- Upgrade Wickiup Grange to become shelter for both short- and long-term disasters.
- Coordinate with utilities to assess and retrofit fuel, electricity, communications, and other systems.
- Work with local power and communications utilities on hardening and undergrounding their distribution corridors.

2. City of Astoria

The Astoria Community Risk Profile 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.

Hazard Vulnerability Analysis

On October 1, 2019, a risk assessment meeting was held with 15 City of Astoria staff as a part of the plan update process. Their review of the hazards affecting the City resulted in the following table and description by hazard below.

Table II-70. City of Astoria Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Volcanic Debris	Wildfire	Wind/Winter Storm
Astoria	H	M	H	H	H	M	M	L	H	H

Source: City of Astoria Risk Assessment meeting, Oct.1, 2019. Note: The Natural Hazards section of this plan describes the hazards affecting the City of Astoria in detail.

Coastal Erosion

Astoria's proximity to 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. Astoria also experiences River erosion on north side along the Columbia River with east winds that cause high waves on the River. These locations are highlighted in the figure 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.

Figure II-75. Areas subject to Coastal Erosion

Source: Astoria Staff – February 13, 2008 Work Session

Drought

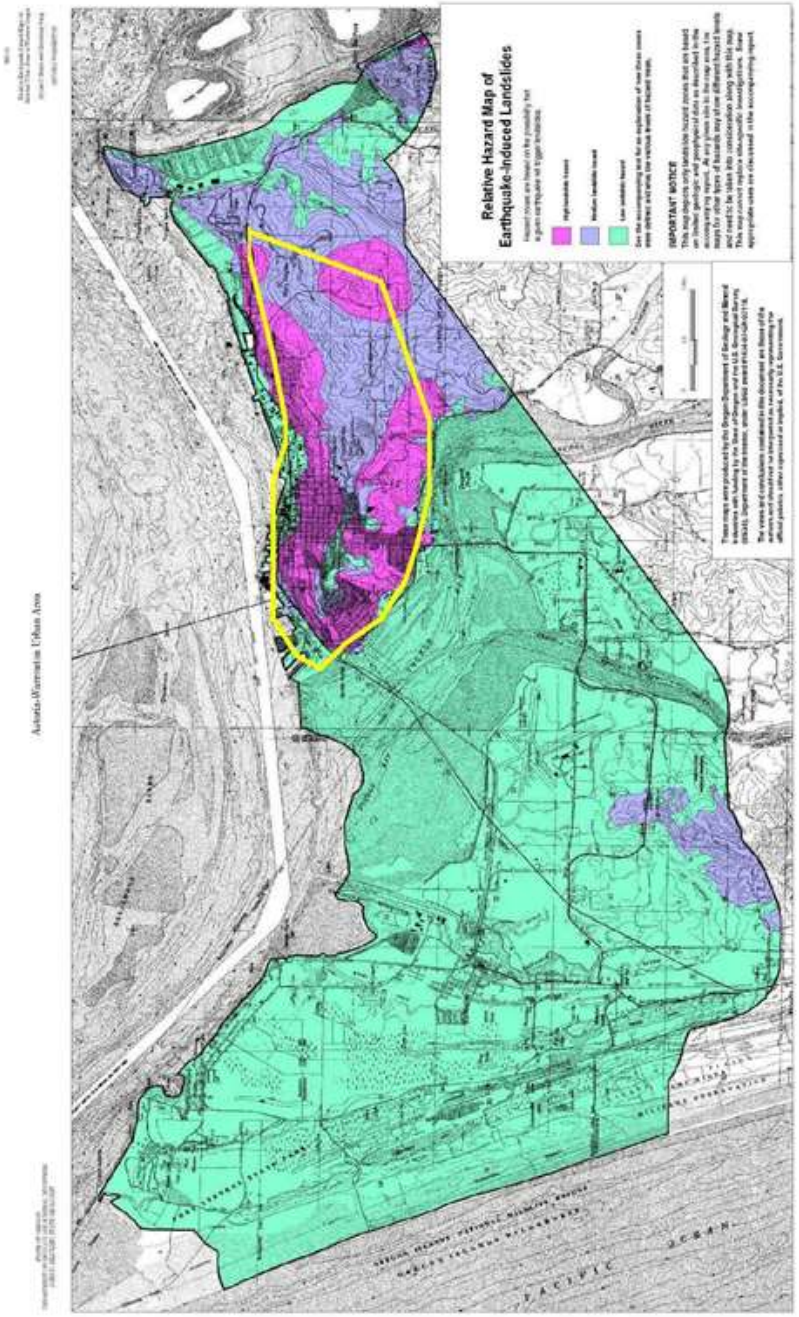
Drought is understood to pose some degree of risk to Astoria, but the City is well-prepared in terms of water supply due to a robust set of ongoing activities to manage and protect the watershed that supplies water to the City.

Earthquake

The DOGAMI Natural Hazard Risk Report for Clatsop County conducted in 2018 built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 earthquake hazard. Very high liquefaction soils are found

throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton.

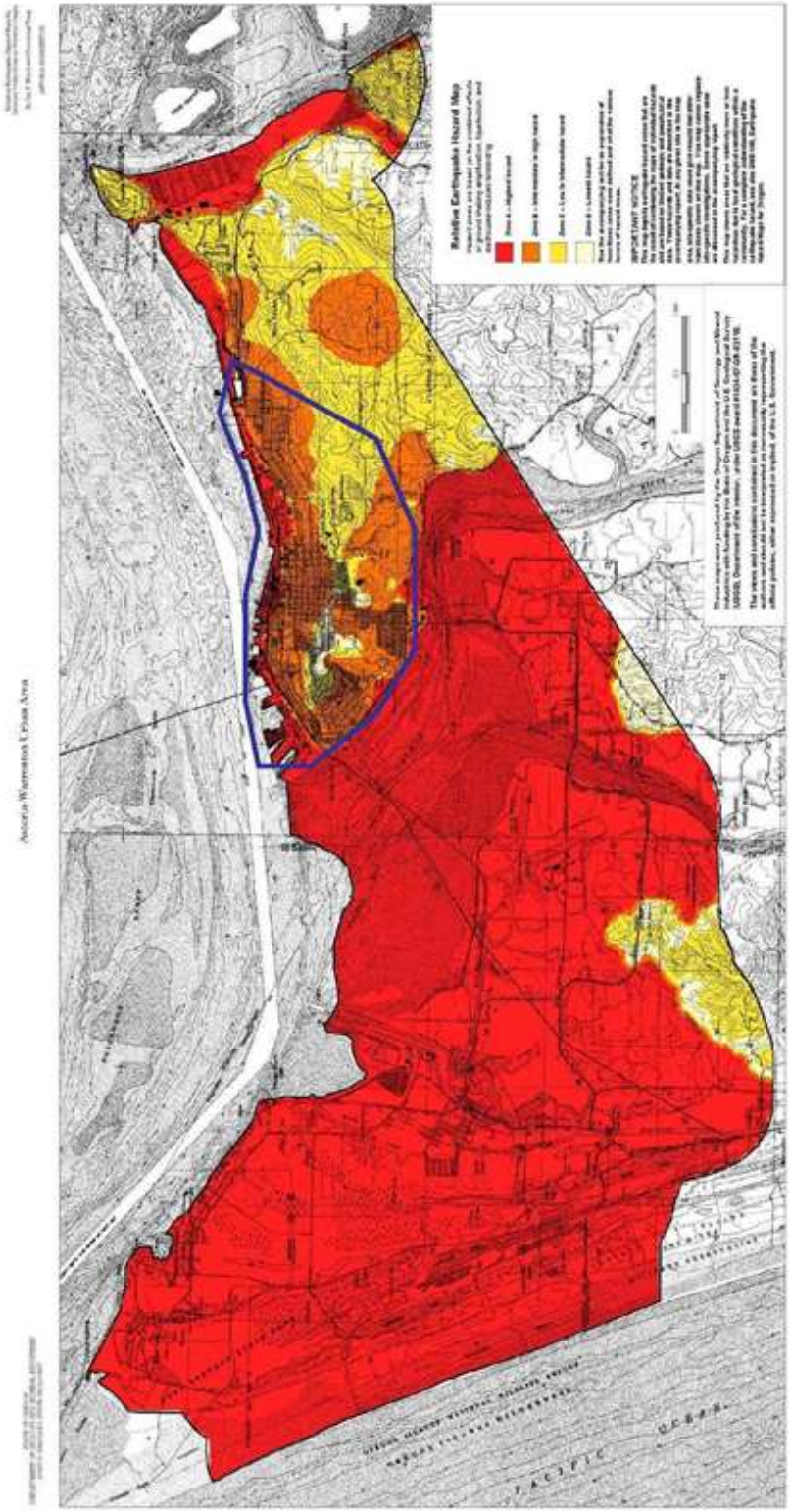
Figure II-76. Earthquake Induced Landslide hazard – Astoria-Warrenton, Oregon



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 II-77. 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.

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. Identified the importance of Bear Creek Dam as a critical facility.
- City's water distribution system pipe infrastructure 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. The majority of downtown is located on areas of high liquefaction risk. A large earthquake will have significant impacts on Astoria's economy.
- 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.
- 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.
- 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.
- Wastewater system and lift stations around town would be damaged and lead to public health emergencies following an earthquake. 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 likely 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 the Irving Avenue/19th Street Bridge in 2015. The waterfront bridges (6th Street through 11th Street) were replaced in 2019. The loss of bridges may cut off certain areas of the community.
- Vulnerability and wide-ranging hazards from gas and electric utility infrastructure.
- Effect on most road surfaces that will complicate access, evacuation, and emergency response.
- Clatsop Community College's MERTS campus is built to Earthquake Standard 3 but is subject to liquefaction and has only one road in and out
- 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

Buildings within the City of Astoria are for the City of Astoria is relatively older than other communities in Clatsop County, which implies lower seismic building design codes and thus more vulnerable to earthquake damage. When tsunami damages are disregarded, Astoria's estimated loss ratio from a CSZ earthquake alone is 46% compared to 20%-35% for the other communities in the county (Williams et al, 2020).

Flood

While Astoria does not regularly experience floods from the Columbia River due to the amount of flood control on upstream dams, storm surge and coastal erosion combine to create potential flood problems along Young's Bay.

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

- 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.
- Need for a shelter located inside City limits should roads or bridges be damaged or become impassable.
- 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, mostly just outside the City limits.
- 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.

Landslide

Landslide is the highest risk hazard for the City of Astoria. The City's historic nature is interwoven with the hillslopes it is built upon. Maintenance of Astoria's streets and stormwater system, along with regulation of development to ensure that best practices are used on slopes, constitutes a considerable amount of the City's regular workload. The extent of the landslide hazard includes most of the residential portions of the City. In 2013, the City completed a LiDAR study with the Department of Geology and Mineral Industries that identifies the location of potential landslide hazards in Astoria. This information was used by the City during the recent Geologic and Flood Hazards Ordinance update.

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

- Water and transportation infrastructure are vulnerable to the landslide hazard. The re-activation of the Bond Street slide disrupted water, sewer, storm, and transportation 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, sewer, storm lines, and transportation. This creates potential risk that could result in the inability to provide effective emergency services.
- Columbia Memorial Hospital is located at the foot of a historic slide.
- Areas near the intersection of 38th Street and Franklin Avenue are somewhat unstable.
- When the City receives multiple days of heavy rain, the excess precipitation can lead to earth movement. City staff monitors past landslide areas for signs of movement during heavy rainfall events.
- 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.
- Eastern portions of the Community College Lexington Avenue campus may be at risk from landslides.
- Astoria Middle School may be at risk to landslides.
- The Comprehensive Plan notes "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 ensure this area does not experience the same problems encountered on the north slope of the City."

The following issues have been identified in the City of Astoria's new Geologic and Flood Hazard Ordinance:

- 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.
- 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

The City of Astoria considers tsunami to be its fourth highest ranked hazard (behind landslide, earthquake, and windstorm/winter storm). While a medium risk, the downtown is now in the tsunami zone, but is still considered to be a medium risk.

Volcanic Event

The City of Astoria ranked two aspects of a potential volcanic event. Volcanic ashfall is ranked as a medium threat and a debris flow event that would come down the river system is ranked as a low threat due to the infrequency of occurrence. Ash and a lahar flow could travel down the Columbia River, but

the impact from ash would have a direct effect on more people. Astoria experienced a 2" ash fall from the 1980 Mt. St. Helens event.

Wildfire

Generally the community is at low risk from a wildfire event due to high coastal humidity, but in the intermittent dry periods with east winds from summer to late fall, wildfire risk can elevate quickly.

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

- Wildfire could impact the 3,700-acre watershed that is home to the City's water supply and located 12 miles east of the City.
- 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.
- 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 Lexington Avenue campus is located in a forested area and new and renovated buildings have been sprinkled.

Windstorm and Winter Storm

All of the community could be considered at risk from windstorms and winter storms annually. The primary impacts are interruptions in electricity, communication, and travel and the scenario considered is the 2007 event when these impacts extended for more than two weeks. The lack of access to Portland hospitals and the inability to communicate with people with medical needs or conditions were two major life safety concerns, in addition to the loss of cell service, no incoming fuel for emergency vehicles, all roads closed, limited resources, etc.

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

- 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 were not able to get to the pharmacy.
- Concerns about emergency power for critical facilities such as shelters, schools, and the community college.
- The City frequently loses power several times each winter. Concern about the resiliency of the City's power infrastructure to windstorms and winter storms. Possibly place 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 (357 12th Street) downtown survived the December 2007 windstorm as did new awnings installed at a retail downtown store (1152 Marine Drive).

- Clatsop Community College's MERTS campus (Liberty Lane) may be vulnerable during a storm 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.
- Travel along the City's steep streets becomes difficult during ice storms.
- During extended freeze situations, water service lines connected to individual homes can freeze because they are not laid very deep in the ground.
- There is a need for heated emergency shelters that are available during extended cold weather events. This is especially needed for the increasing homeless population. The City is working on adopting a Warming Center Code.

Risk Assessment Summary

Table II-71. City of Astoria Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Astoria City Hall	-	**X**	**X**	-	-	-
Astoria Fire Dept.	-	*	**X**	-	-	-
Astoria Fire Station #2	-	**X**	**X**	-	-	-
Astoria Head Start	-	**X**	-	**X**	-	-
Astoria Middle School	-	**X**	-	-	-	-
Astoria Police Dept.	-	-	**X**	-	-	-
Astoria Public Works	-	**X**	**X**	-	-	-
Astoria High School	-	X	**X**	X	-	-
Astoria Wastewater Treatment	-	**X**	**X**	-	-	-
City of Astoria Reservoir #2 & 3	-	**X**	-	-	-	-
Clatsop Community College	-	X	X	X	-	-
Clatsop County Sheriff Department	-	**X**	**X**	-	-	-
Columbia Memorial Hospital	-	X	**X**	-	-	-
John Jacob Astor Elementary	-	X	-	X	-	-
Parks Medical Limited LLC	-	X	-	X	-	-
Providence Health Clinic North Coast - Astoria	-	X	-	X	-	-
Tongue Point	X	X	X	X	-	-

Source: Williams, M. (DOGAMI) 2018. *Natural hazard risk report for Clatsop County*, unpublished. City of Astoria. Additions/Corrections in red text by the City of Astoria—they improve the accuracy of this table, but are not actual results of the DOGAMI analysis displayed by this table. *Seismic upgrade of the Astoria Fire Dept. removed an X indicating an earthquake risk. OSP listing was deleted as their office moved to outside of Astoria city limits. "Naval Air Station text deleted from Tongue Point as that use does not apply.

Hazard Profile

Table II-72. City of Astoria hazard profile.

Community Overview							
Community Name		Population	Number of Buildings		Critical Facilities[1]		Total Building Value ($)
Astoria		9,464	4,358		18		1,037,058,000
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	151	1.6%	71	1	1,302,000	0.1%
*Earthquake**	*CSZ M9.0 Deterministic*	2,501	26%	1,537	10	358,585,000	35%
Earthquake (within Tsunami Zone)		89	0.9%	242	5	118,506,000	11%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	400	4.2%	422	6	211,577,000	20%
Tsunami	Senate Bill 379 Regulatory Line	149	1.6%	183	4	121,798,000	12%
Landslide	High and Very High Susceptibility	6,356	67%	2,890	7	578,107,000	56%
Coastal Erosion	High Hazard	0	0.0%	0	0	0	0.0%
Wildfire	High Hazard	261	2.8%	151	0	41,326,000	4.0%

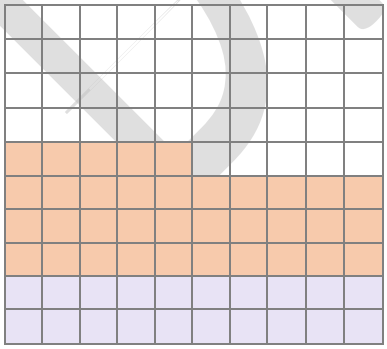
*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another. Colors correspond to colors in **Error! Reference source not found.**.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Figure II-78. City of Astoria loss ratio from Cascadia subduction zone event



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020.

Plans and Policies

Figure II-79. City of Astoria Plans and Policies

Plan/ Policy Name	Date	Author/ Owner	Description	Relation to Natural Hazard Mitigation
City of Astoria Development Code/ Zoning Ordinance	2020	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, commerce, and general welfare.	Article 14. The Flood Hazard Overlay Zone - Regulates the use of those areas subject to periodic flooding, promotes the public health, safety, and general welfare, and minimizes public and private losses due to flood conditions. Article 3. Erosion Control and Stormwater Management - The purpose of the 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 tributaries, wetland, 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	2013	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 transportation planning requirements. Transportation refinement plans were developed for the following areas of the City: Astoria Gateway TGM 7-1999, East Gateway TSP 2-2007, and Port/Uniontown TRP 2-2007	Mitigation principles and strategies can be incorporated into Transportation Systems Plan to protect key transportation infrastructure from natural hazards. Plan also identifies alternative emergency routes.

City of Astoria Comprehensive Plan		City of Astoria	To anticipate and plan for future land use within the City of Astoria.	Section CP.390 to CP.400. Geologic and Flood Hazard - Outlines limitations and regulations abided by in regard to flooding, landslides, erosion, stormwater, and development on steep slopes. The identification and prioritization of specific areas subject to each hazard can help in crafting action items.
Riverfront Vision Plan	Plan 2009; Implement. 2020.	City of Astoria	The Astoria Riverfront Vision Plan was developed to address a series of land use, transportation, and scenic, natural, and historic resource issues along the Columbia riverfront in the City. The area spans from Pier 3 in the west to Tongue Point in the east along the Columbia River.	Addresses public access to Riverfront, safe pedestrian routes, and use of native plants and removal of invasive species. Overwater residential and transient lodging development was limited in part due to the concern with tsunami.
Gateway Master Plan	1997	City of Astoria	Provides a conceptual basis for future development. Its vision is implemented through the City's Comprehensive Plan and Development Code.	Section CP.058.3 states City to maintain a set of Design Review Guidelines for the Gateway Overlay Area which address all aspects of the built environment. The guidelines are fundamental principles which are applied to specific projects.
Uniontown Reborn	2019	City of Astoria	To better integrate transportation and land use planning and develop new ways to support economic development along with safety and access enhancements to improve conditions for pedestrians, bicyclists, transit users, and motorists in Astoria's historic west gateway area known as Uniontown.	Any development in the UTO would need to address any known geologic hazards. A primary purpose of the Uniontown Reborn study is to evaluate and recommend improvements to transportation needs of US Highway 30 or West Marine Drive in terms of pedestrian, bicycle, and vehicular traffic. Overwater residential and transient lodging development was limited in part due to the concern with tsunami.
Water Supply Master Plan	1996	City of Astoria	The water supply master plan ensures 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 related to vulnerable water infrastructure. Will be combined with Water Distribution Master Plan into an Updated Water System Master Plan in 2020.
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 related to vulnerable water infrastructure. Will be combined with Water Supply Master Plan into an Updated Water System Master Plan in 2020.
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 related to vulnerable wastewater infrastructure.

Bear Creek Dam Emergency Action Plan	Updated annually	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.
Emergency Operations Plan (EOP)		City of Astoria	To prepare for, respond to, and recover from a variety of disasters, large or small.	Designed to help the City effectively resume essential functions following a disaster for up to 30 days.
Continuity of Operations Plan & Continuity of Government (COOP + COG)	2018	City of Astoria	COOP plan will serve as a supplemental tool to the EOP.	The content of the plan provides information about essential functions of City government, management structure (concept of operations (CONOPS)), procedures for notifying employees, and a chain of command for the succession of City leadership. The goal is to enable the City of Astoria to resume essential functions within 12 hours of an emergency, with or without advanced warning, and to sustain continuous operations for the entire cycle of the incident. This plan addresses emergencies from an all-hazards approach.
Parks and Recreation Master Plan		City of Astoria	Identifies Park facilities and open space with management and improvement recommendations.	Addresses the location and demographics of park users and facilities and related issues. History of each site identifies any environmental issues and hazards.

Mitigation Actions

Table II-73. City of Astoria Mitigation Actions

Hazard	City of Astoria 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard	Conduct a seismic and flood vulnerability assessment of critical City facilities and infrastructure.	H	2-5 years	Ongoing, see completed components above.	City of Astoria.
Multi-Hazard	Continue efforts to replace aged bridges with newer structures.	H	4 years	Ongoing, see completed components above.	Astoria Public Works Dept.
Multi-Hazard	Implement an all-hazards education and outreach campaign. Continue to explore ways to provide additional public education.	H	Ongoing	Ongoing, see completed components above.	Astoria Police Dept. and Astoria Fire Dept.
Multi-Hazard	Identify areas where undergrounding utilities may be appropriate	M	5-10 years	Coordinate with power companies as needed.	Astoria Public Works Dept.
Multi-Hazard	Evaluate the vulnerabilities of the water system (including the transmission main, water pipes and dam).	H	1-2 years	Ongoing, see completed components above.	Astoria Public Works Dept.
Multi-Hazard	Mitigate the vulnerabilities of the water system to ensure disaster resiliency.	H	10-50 years	Long range project	Astoria Public Works Dept.
Multi-Hazard	Maintain and enhance efforts around Community Emergency Response Teams (CERT).		On-going		Astoria Police Dept.
Multi-Hazard	Identify shelter locations and adequate equipment and supplies in town.			Shelter locations were identified on the Cascadia map in 2013	Astoria Police Dept. and Astoria Fire Dept.
Multi-Hazard	Relocate Public Work's Facilities	H	20 years	Long range project.	Astoria Public Works Dept.
Multi-Hazard	Relocate Astoria Fire Department	H	5-10 years	Ongoing; see study completed under Action Items Completed	Astoria Fire Dept.

Hazard	City of Astoria 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard	Explore the idea of hiring an Emergency Manager for the City	H	1-2 years	Consider a combined fire marshal and emergency Manager as a joint position	Astoria Police Dept. and Astoria Fire Dept.
Multi-Hazard	Ensure the safe digital retention of permanent records that could be lost in the event of flood or fire.	H	0-5 years	Ongoing; in the process of uploading Oregon Records Management System, DOD approved digital records management software to store essential data/records.	City Manager
Multi-Hazard	Conduct a Risk and Resilience Assessment (RRA) and Emergency Response Plan (ERP) of Astoria's drinking water system as required by America's Water Infrastructure Act (AWIA) of 2018.	H	0-5 years	Assess and analyze character, consequences, vulnerability, threat, risk/resilience, and risk/resilience management.	Astoria Public Works Dept.
Earthquake	Assess seismic vulnerability to hazardous materials sites.	H	Ongoing	0 to 12 months with updates every 5-10 years. To update the hazardous material emergency response plan for Clatsop County and identify hazardous material sites.	Astoria Fire Dept and County-wide Local Emergency Planning Committee.
Earthquake	Replace Irving at 33rd Street Bridge	H	0 – 5 years	Aging wood bridge to be upgraded.	Astoria Public Works
Tsunami	Re-map the tsunami inundation hazard for the City of Astoria. DOGAMI has developed new maps which are proposed for adoption in 2014-2015.			2013 DOGAMI map was not formally adopted by City but the map is utilized by City.	DOGAMI.
Flood	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.	H	Ongoing	Ongoing	Astoria Community Development / Certified Flood Manager
Flood	Determine feasibility of becoming a participant in the NFIP's Community Ratings System	M	2-5 years	City researching the CRS program and the potential benefits of participation.	Astoria Community Development / Certified Flood Manager

Hazard	City of Astoria 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Flood	Evaluate flood hazards in the Alderbrook Neighborhood	H	0-24 months		Astoria Community Development / Certified Flood Manager
Flood	Continue to work with FEMA on updated flood insurance maps acceptable to City.	H	2-5 years	City working with other jurisdictions on contesting proposed FEMA maps. Model has been updated and is being reviewed.	Astoria Community Development / Certified Flood Manager / Public Works Dept.
Landslide	Adopt a geologic hazard ordinance.	H	0-24 months		Astoria Community Development/ Public Works
Wildfire	Conduct fuel reduction in the City's watershed and urban forest. Minimize risk in the City's wildland-urban interface.	H	Ongoing		Astoria Fire Dept./ Astoria Public Works Dept.

Mitigation Action Items Completed

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.

- 17th Street Dock replaced in 2013.
- 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.
- Franklin Avenue Bride was replaced in 2012.
- All six waterfront bridges (6th to 11th Street) were replaced in 2019.
- Continue efforts to replace aged bridges with newer structures. Eight of nine bridges have been replaced. City has applied for funding for the Irving at 33rd Street Bridge.
- Evaluate the vulnerabilities of the water system at the Bear Creek 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. A seismic study was completed in June 2016. It was determined that the dam could withstand a C5 earthquake without failing.
- Conduct fuel reduction in the City's watershed and urban forest Strengthen the high-risk seismic deficiencies at Clatsop Community College's Towler Hall. Upgrades were completed in 2012.
- The Irving Avenue/19th Street Bridge was replaced in 2015.

FIRE BOAT TRIDENT

- The Port acquired the Fire Boat "Trident" The City of Astoria and the Port of Astoria entered into a Memorandum of Understanding (MOU) in June 1993 for operations of the Port's Fireboat. The City has been meeting with the Port of Astoria and are updating the MOU at this time. Anticipated MOU update adoption is September 16, 2019.
- Beginning in March 2019, Fire Boat training began and AFD has (7) firefighters that are qualified to operate the boat. All boat operators train 4 hours each month.

PUBLIC SAFETY BUILDING RELOCATION

- In April of 2019, Emergency Services Consulting International (ESCI) was contracted by the City of Astoria (AFD) to provide a fire station location study. They studied four City owned properties to determine fire department response times to see if they would meet National Fire Protection Agency (NFPA) recommendations. The report was completed in July of 2019 and three of the four locations were found to be adequate.
- In August of 2019, MACKENZIE was contracted to conduct a needs assessment for a new fire station, police department and dispatch center. Completed needs assessment in May 2020.

IDENTIFY SHELTER LOCATIONS AND ADEQUATE EQUIPMENT AND SUPPLIES IN TOWN.

- Shelter locations were identified on the Cascadia map in 2013.

IMPROVE PUBLIC COMMUNICATION INFRASTRUCTURE SO THAT IT IS LESS VULNERABLE.

- Major improvements were completed to the public safety communication infrastructure and went operational in 2019 with the reservoir site.

IMPLEMENT AN ALL-HAZARDS EDUCATION AND OUTREACH CAMPAIGN.

- Astoria along with many other agencies, participate with the “GET READY EVENT” each year. Astoria Fire Department has posted fire safety and disaster preparedness messages on Facebook. City Manager’s Office set up City Facebook pages that can be used to disseminate information from the County/Police/Fire departments and agencies.

DETERMINE NEEDS AND ISSUES RELATED TO TSUNAMI WARNING SYSTEMS. CONSIDER SIRENS/VOICE MESSAGE SYSTEMS FOR THE RIVER TRAIL FOR THE DIFFERENT TYPES OF EMERGENCIES.

- City determined that the use of warning systems in Astoria would not be effective and was not required. Tsunami signs with maps and emergency information were installed along the River Trail.

ADDRESS REPETITIVE FLOOD LOSS PROPERTIES NOT COVERED BY THE NATIONAL FLOOD INSURANCE PROGRAM.

- City determined that there were no major repetitive flood loss cases, and this was not an issue. Several homes in the Alderbrook area experience water in the basements on a regular basis but no severe damage.

COMPLETE LiDAR STUDY TO FURTHER DELINEATE LANDSLIDE HAZARDS IN ASTORIA.

- The LiDAR study was completed in 2011.

Items Completed But Not on Action Item List

The following items were not included in the Action Items in an earlier 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.
- The Police Department and dispatch center in 2019 are actively acquiring emergency supplies for staff including dry foods and cots, in order to maintain emergency operations in the case of a disaster event. Items are stored in former public restrooms at Astoria Police Department.
- Clatsop Community College's Lexington Avenue campus has completed renovations and seismic upgrades to the Student Services Center. The College completed construction of a new building that replaced Patriot and Fertig Halls in 2016. 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.

3. City of Cannon Beach

Hazard Vulnerability Analysis

On August 28, 2019 and January 27, 2020, City of Cannon Beach staff met with the DLCD project manager for risk assessment meetings. At the January meeting, staff developed the following rankings for hazards for the City.

Table II-74. City of Cannon Beach Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Volcanic Debris	Wildfire	Wind/Winter Storm
Cannon Beach	H	M	H	L	H	H	L	L	M	H

Source: City of Cannon Beach Risk Assessment meeting, Jan. 27, 2020.

Coastal Erosion

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. According to DOGAMI, large sections of Cannon Beach south of the Ecola Creek mouth, near Haystack Rock, and for residential structures at the very southern end of the city, are at risk to very high coastal erosion hazard (Williams et al, 2020). As such, the hazard is ranked high by Cannon Beach staff.

The primary areas of concern to Cannon Beach regarding coastal erosion are:

- 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 ground motion monitoring is underway. 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.

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 (Cannon Beach, 2020).

Drought

Drought is understood to pose some degree of risk to Cannon Beach, but the City is well-prepared in terms of water supply due to a robust set of ongoing activities to manage and protect the watershed that supplies water to the City.

Earthquake

The 2020 DOGAMI Natural Hazard Risk Report for Clatsop County built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 earthquake hazard. Very high liquefaction soils are found throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton (Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020).

Flood

The City of Cannon Beach considers tsunami to be its fourth highest ranked hazard (behind landslide, earthquake, and windstorm/winter storm). While Cannon Beach does not regularly experience floods from the Ecola Creek outflows the inlet and tidal surges do pose a risk. Storm surge and coastal erosion combine to create flood problems along the Ecola Creek inlet.

Landslide

Landslide is the highest risk hazard for the City of Cannon Beach. The City's historic nature is interwoven with the hillslopes it is built upon. Maintenance of Cannon Beach's streets and stormwater system, along with regulation of development to ensure that best practices are used on slopes, constitutes a considerable amount of the City's regular workload. Areas in the North side and around the S-Curves pose the highest areas of risk where current residents live.

Tsunami

The City of Cannon Beach considers Tsunami to be a High risk natural hazard.

Volcanic Event

Low risk of impact to the City.

Wildfire

Generally the community is at low risk from a wildfire event due to high coastal humidity, but in the intermittent dry periods with east winds from summer to late fall, wildfire risk can elevate quickly. A significant challenge is the lack of multiple avenues of egress out of the city and access for fire suppression to respond into challenging areas which threaten the city and the Ecola Creek Forest Reserve (ECFR). Table II-56. Wildfire Exposure on page 202 indicates that 35% of the community is at moderate risk from wildfire.

Windstorm and Winter Storm

All of the community could be considered at high risk from windstorms and winter storms annually. The primary impacts are interruptions in electricity, communication, and travel and the scenario considered is the 2007 event when these impacts extended for more than two weeks. The limited amount of access roads into Cannon Beach does isolate the area in the event of a severe prolonged windstorm.

Risk Assessment Summary

Table II-75. City of Cannon Beach Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Cannon Beach Elementary	-	X	X	-	-	-
Cannon Beach Fire and Rescue	-	-	-	-	-	-
Cannon Beach Police Dept.	-	X	X	-	-	-
Providence Health System - Oregon	-	X	X	-	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020.

Hazard Profile

Table II-76. City of Cannon Beach hazard profile.

Community Overview					
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)	
Cannon Beach	1,683	2,037	4	567,876,000	

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	1	0.0%	3	0	38,000	0.0%
*Earthquake**	*CSZ M9.0 Deterministic*	280	17%	373	0	91,424,000	16%
Earthquake (within Tsunami Zone)		121	7.2%	287	3	103,320,000	18%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	600	36%	799	3	256,840,000	45%
Tsunami	Senate Bill 379 Regulatory Line	692	41%	1,035	3	332,690,000	59%
Landslide	High and Very High Susceptibility	496	30%	417	0	106,908,000	19%
Coastal Erosion	High Hazard	56	3.3%	141	0	58,705,000	10%
Wildfire	High Hazard	3	0.2%	4	0	565,000	0.1%

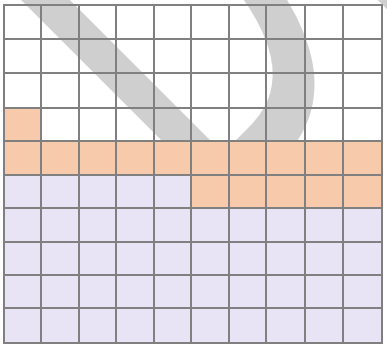
*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Figure II-80. City of Cannon Beach loss ratio from Cascadia subduction zone event



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Plans and Policies

Table II-77. Cannon Beach Plans and Policies

Plan/ Policy Name	Date	Author/ Owner	Description	Relation to Natural Hazard Mitigation
Emergency Operation Plan	October 2021	City of Cannon Beach Emergency Management	Overall comprehensive plan to identify hazards, vulnerabilities, planned response in the short term.	Provides context for long term hazard mitigation.
Emergency Operation Guidelines	July 2021	City of Cannon Beach Emergency Management	Specific guidelines for related emergencies. These guidelines provide for focused instruction and training modules delivered to the Staff, Volunteer groups, Community, and Business	The Guidelines provide context for the resources and personnel needed for emergency response which provides context for mitigation.
Cannon Beach Natural Hazard Mitigation Plan	January 2021	City of Cannon Beach Emergency Management	Overall comprehensive plan to identify natural hazards, vulnerabilities, planned response in the long term.	Provides context for long term hazard mitigation and planning, including infrastructure and budgetary.
City of Cannon Beach Comprehensive Plan	Amended March 2017	City of Cannon Beach Community Development	The purpose of the City's Comprehensive Plan is to control and promote development which is most desirable to the majority of the residents and property owners of the City. The Plan establishes a set of policies and guidelines within this context.	The Comp Plan outlines how the City addresses the statewide land use planning Goal 7, areas subject to natural hazards. Identifies how the City manages development in geologic, flood, dune, and other hazard areas.
Cannon Beach Municipal Code	Updated regularly	City of Cannon Beach Community Development	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.
Foredune Management Plan	2018	CREST/ City of Cannon Beach	Dunes can provide protection from hazards, as well as habitat, but can also impede views or access. This plan provides a framework for managing the dunes and beaches of Cannon Beach.	This plan is a tool in balancing competing needs, including hazard mitigation.
Ecola Creek Forest Reserve Stewardship Plan	February 2013	Trout Mountain Forestry / City of Cannon Beach	The City of Cannon Beach has a history of watershed protection for water supply and habitat. This document guides the management of lands acquired for these aligned purposes.	This plan is a tool in balancing competing forest needs, including hazard mitigation for drought and wildfire.

Mitigation Actions

Table II-78. Cannon Beach Action Items

Hazard	City of Cannon Beach 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard	Develop and build connecting roadways out of the city and into the lands to the East (Greenwood – ECFR) to provide access and egress in and out of the city for fire protection and emergency access	H	6-24 months	This is a longstanding community priority that needs good coordination and follow through (capacity). Seek to support a countywide effort.	City of Cannon Beach; Cannon Beach RFPD; EMS/NHMP partners.
Multi-Hazard	Build a communication system in the immediate area for a disaster response (Cell, Satellite, and Radio)	H	6-24 months	The communication shadow that affects south county radio communication is a life safety priority.	City of Cannon Beach; Cannon Beach RFPD; EMS/NHMP partners.
Multi-Hazard	Store food/ water/ shelter supplies outside of the Tsunami Inundation zone for the residential population of Cannon Beach.	H	2-5 years	This is a longstanding community priority that needs good coordination and follow through (capacity). Seek to support a countywide effort.	City of Cannon Beach; Clatsop County Emergency Management
Multi-Hazard	Secondary backup water supply to water treatment plant.	M	5-10 years	Critical infrastructure for water supply delivery To be updated – Water resiliency plan has been initiated.	City of Cannon Beach Public Works
Multi-Hazard	Advise and train the community and business on emergency procedure expectations.	M	2-5 years	This process has begun 2020 with the Emergency Operations plan approved (2021) and the development of the Emergency Operation Guidelines (EOG) for specific actions in an emergency. Training for Community and Businesses expected 2021-2023.	City of Cannon Beach Emergency Management, Cannon Beach Police
Multi-Hazard	Ecola Creek Bank Stabilization Project	M	2-5 years	An important public-private partnership to provide resiliency to erosional threats	City of Cannon Beach, Columbia River Estuary Study Taskforce
Earthquake	Retrofit Fir Street Bridge: conduct a seismic analysis and make additional retrofit improvements as needed to secure this community lifeline.	M	5-10 years	Fir Street Bridge seismic resilience is an expensive goal. This action item reflects a commitment to address the problem. A retrofit was conducted in 2013.	City of Cannon Beach; ODOT.
Earthquake	Water supply seismic connectors/ upgrades	L	5-10 years	An important goal for small earthquake events.	City of Cannon Beach

Tsunami	Fir Street Evacuation Tower or pedestrian bridge.	H	2-5 years	The potential failure of the Fir Street Bridge in an earthquake is a top priority for the community as the evacuation problem it presents is well-understood.	City of Cannon Beach; Cannon Beach Conference Center.
Tsunami	Tsunami evacuation facility plan.	H	6-24 months	The City has secured funding to update its transportation plans and seeks to move into evacuation facility planning afterwards.	City of Cannon Beach, DLCD Coastal Staff.

Completed/Ongoing Mitigation Actions

Water Resiliency

- Water Resiliency Plan to restructure water delivery from the springs to the city reserve tanks
- Seismic values added to the reserve tanks 2021-2024

Coastal Erosion

- Updated Foredune Management Plan, almost complete.
- Updating the City's Comprehensive Plan and Zoning Code.

Tsunami

- 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.
- Tsunami sirens need to be connected to a regional dispatch center for accurate testing and coordinated alerting.
- Development of a Tsunami Escape Tower and Evacuation Bridge (parking tower – or incorporated building – Over Ecola Creek) in the Downtown area critical for survival.

Earthquake

- Reinforcement of the Fir Street Bridge to withstand a significant earthquake.
- Seismic values located on the City owned water tanks (North – Mid town – Tolovana)
- Rebuild City Hall and Police Station to appropriate earthquake standards.

4. City of Gearhart

The City has included data from the DOGAMI Open-File Report 0-20-16 Table A-13 and A-14 City of Gearhart Hazard Profile. This is a risk assessment utilizing quantitative building and population data for the City of Gearhart provided by the Clatsop County Tax Assessor and the 2010 U.S. Census. For these purposes, the report is based on a population of 1,462 and a building inventory of 1,607 structures.

Hazard Vulnerability Analysis

On May 9, 2019, City of Gearhart staff met with the DLCD project manager for a risk assessment meeting where staff developed the following rankings for hazards for the City. These rankings were also reviewed by the Gearhart City Council in December 2020.

Table II-79. City of Gearhart Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Gearhart	L	L	H	L	M	H	L	L	H

Source: City of Gearhart Risk Assessment, May 2019.

Coastal Erosion

Coastal erosion occurs through a complex interaction of geologic, atmospheric and oceanic factors, including sea level rise. Beaches and dunes are highly susceptible to erosion during large storms coupled with high ocean water levels near the beach or coastal bluffs. The DOGAMI report indicates Gearhart has a low to moderate risk of coastal erosion wherein 81 buildings are exposed affecting a potential displacement of 7 residents.

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 lands are more susceptible to disease and the Clatsop plains and forests are susceptible to wild land forest fires during drought.

Earthquake

The DOGAMI Risk Report for Clatsop County conducted in 2020 built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 earthquake hazard. Very high liquefaction soils are found throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton. In the event of

a CSZ M9-0 earthquake scenario, Gearhart has the potential of 278 damaged buildings including 3 critical facilities, and 160 potentially displaced residents.

Flood

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 the Neacoxie Creek, the Neawanna Creek, and the Necanicum River Estuary. The above referenced DOGAMI report indicates a potential for 34 damaged buildings and 50 displaced residents in the event of a 100 - year flood.

Landslide

This hazard is the downslope movement of rock, soil, or other debris or the opening of sinkholes. These hazards are often associated with other incidents such as heavy rainfall, snow melt run-off, 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 is documented in the foothills on the east side of the city (DOGAMI Hazards Study 2020). Erosion can also occur on the banks of the Neacoxie Creek, and the Necanicum estuary. The DOGAMI report indicates Gearhart has 55 exposed buildings and 75 displaced residents in the event of a landslide.

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 of more than 100 feet and become a threat to life and property. The Gearhart coastline is particularly vulnerable with many residents in need of early warning. The DOGAMI report indicates a CSZ-Medium tsunami will expose 808 buildings and 775 residents. There is a potential of 1,275 exposed buildings and 1,103 displaced residents in the event of the SB 379 Regulatory line (XXL) tsunami event.

Volcanic Event

Little risk of significant impact to the City.

Wildfire

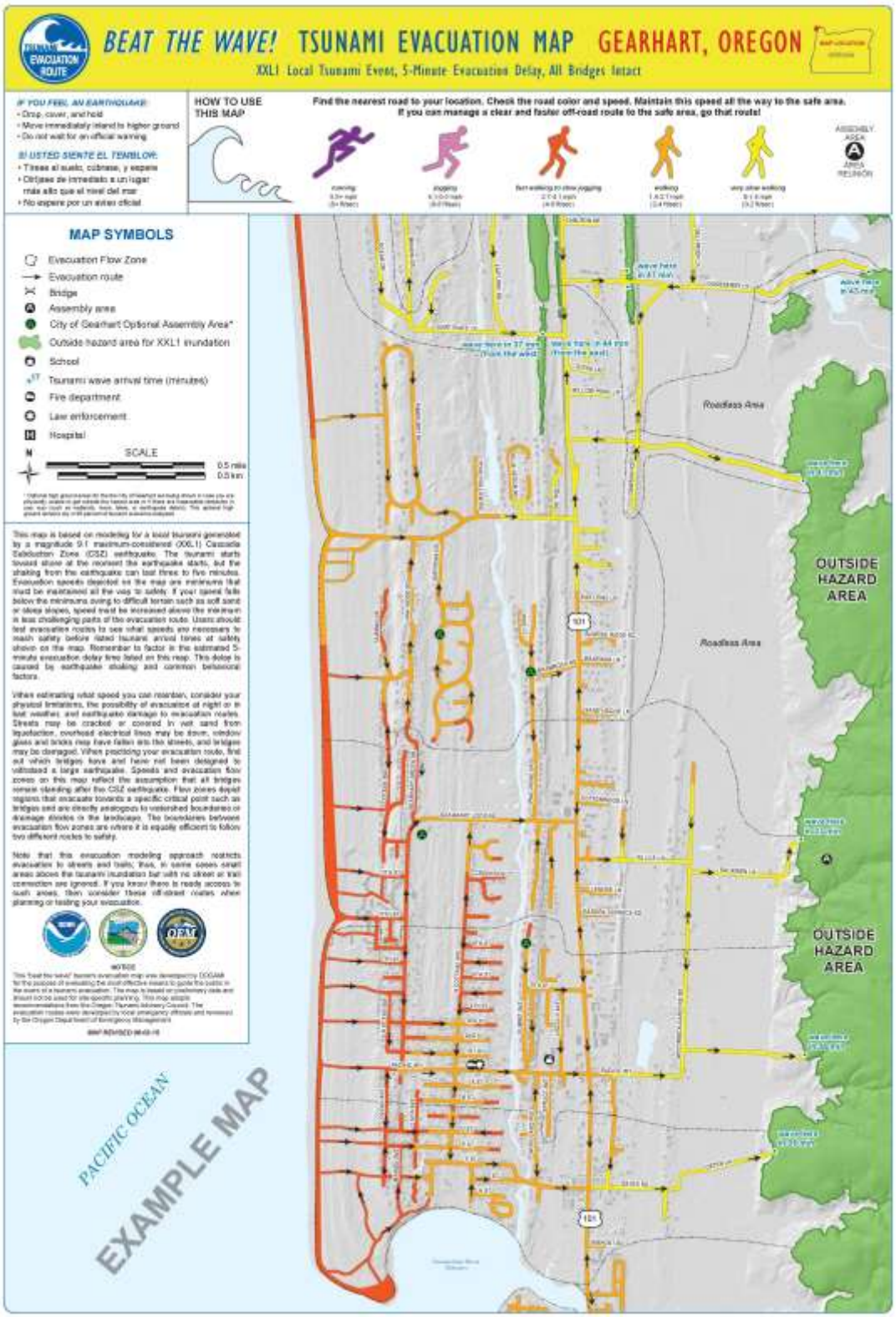
Generally, Gearhart is at low risk from a wildfire event due to high coastal humidity. However, in the intermittent dry periods with east winds from summer to late fall wildfire risk can elevate quickly. The 2020 DOGAMI Report indicates there are 2 exposed buildings and 1 potentially displaced resident in the event of a wildfire. The wildfire vulnerability risk ranking was changed to low at the February 2021 City Council meeting.

Windstorm and Winter Storm

Wind storms are common in Gearhart and usually result in localized power outages or large-scale power outages affecting all of Clatsop County. Windstorms can reach hurricane strength in 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 be a hazard by blocking

roads, affecting emergency operations, and downing power and utility lines. Strategic pruning and establishing a tree removal and maintenance program is prudent.

Figure II-81. Gearhart Beat the Wave Tsunami Evacuation Map



Source: Oregon Tsunami Clearinghouse, 2013.

Risk Assessment Summary

Table II-80. City of Gearhart Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Gearhart Elementary School*	-	X	X	-	-	-
Gearhart Police Dept.	-	X	X	-	-	-
Gearhart Volunteer Fire	-	X	X	-	-	-
Pacific Medical and Surgical Group	-	-	-	-	-	-

Source: Williams et al, 2020. *DLCD Note: *The Gearhart Elementary School is now closed and students attend Pacific Ridge Elementary School outside of the tsunami zone in Seaside. The City of Gearhart and the Seaside School District consider these facilities to be removed from the list of "at risk critical facilities", however, to be consistent, this table is presented as published in the 2020 Natural Hazard Risk Report for Clatsop County.*

Hazard Profile

Table II-81. City of Gearhart hazard profile.

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Gearhart	1,462	1,607	4	359,970,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	50	3.4%	34	0	245,000	0.1%
*Earthquake **	*CSZ M9.0 Deterministic*	156	11%	219	0	61,778,000	17%
Earthquake (within Tsunami Zone)		160	11%	278	3	50,774,000	14%

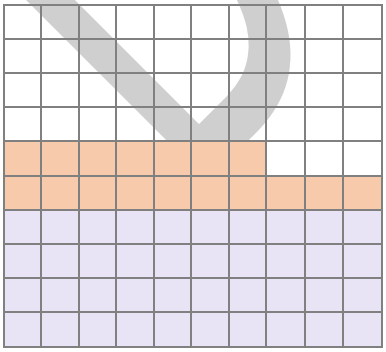
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	775	53%	808	4	144,823,000	40%
Tsunami	Senate Bill 379 Regulatory Line	1,103	76%	1,275	3	252,553,000	70%
Landslide	High and Very High Susceptibility	75	5.2%	55	0	9,783,000	2.7%
Coastal Erosion	High Hazard	7	0.5%	81	0	27,241,000	7.6%
Wildfire	High Hazard	1	0.1%	2	0	148,000	0.0%

*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Figure II-82. City of Gearhart loss ratio from Cascadia subduction zone event



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Plans and Policies

Table II-82. City of Gearhart Plans and Policies

Plan/ Policy Name	Date	Author/ Owner	Description	Relation to Natural Hazard Mitigation
City of Gearhart Comprehensive Plan	2020	City of Gearhart	The purpose of the City's Comprehensive Plan is to control and promote development which is most desirable to the majority of the residents and property owners of the City. The Plan establishes a set of policies and guidelines within this context.	The Comp Plan outlines how the City addresses the statewide land use planning Goal 7, areas subject to natural hazards. Identifies how the City manages development in geologic, tsunami, flood, dune, and other hazard areas.
City of Gearhart Zoning Ordinance	Jan. 2020	City of Gearhart	Outlines zones for use within the City and the uses within them	Contains three hazard-specific zones: flood; beaches and active dunes; and tsunami overlay zones. The purpose of the overlay zones are to increase community resiliency by establishing standards, requirements, incentives, and other measures to be applied in the review and authorization of new land use and development activities in areas subject to hazards.
Transportation System Plan Volumes I & II	2017	City of Gearhart, ODOT/ DKS Associates	The TSP outlines the transportation system, needs and necessary improvements.	A TSP allows for effective tsunami evacuation planning to be situated upon current data and existing conditions for pedestrian networks and other infrastructure.
Hazard Acknowledgement Disclosure Statement (tsunami)	2019	City of Gearhart	Discloses the tsunami risk to developers in a formal disclosure.	Ensures new development includes an understanding of tsunami risk.
City of Gearhart Water Master Plan	2018	City of Gearhart	Describes the City's water system and guides its operation.	Managing water supply is key to anticipating and preventing the impacts of drought.
City of Warrenton Water Master Plan		City of Warrenton	Describes the City's water system and guides its operation. City of Gearhart infrastructure is addressed in the Warrenton Plan.	Managing water supply is key to anticipating and preventing the impacts of drought.

Mitigation Actions

Table II-83. City of Gearhart Mitigation Actions

Hazard	City of Gearhart 2020-2025 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard, Earthquake, Tsunami	Develop and implement a community disaster education and preparedness program.	H	On-going	Cache containers available funded by SHSP program thru OEM. Short Term Rental financial incentive provides evacuation go- packs. Periodic City Blog & Website disaster preparedness announcements. Medical supplies are strategically located through the City. Tsunami hazard building permit disclaimer signature required at issuance of building permits. Need to assess social vulnerability thru CERT Map your Neighborhood program.	City of Gearhart, CERT, Great Oregon Shakeout training
Multi-Hazard	Rebuild City Hall to withstand earthquakes and aid in recovery	M	5 years	Priority is to build Fire Station, not City Hall.	City of Gearhart
Multi-Hazard, Earthquake, Tsunami	Evaluate the construction of critical facilities, structures & public utilities; retrofit, relocate or bury to withstand disaster.	H	2-5 years	Relocate the Gearhart Fire Station to a site outside of the large tsunami zone. Reconstruct /harden Neacoxie Creek crossings at G Street, Pacific Way, Gearhart Lane and Highland Road per TSP. New critical facilities and high-density dwellings are restricted in CSZ-Medium event by Tsunamis Hazard Overlay (THO) Zone	City of Gearhart
Multi-Hazard	Evaluate City ordinances and capital improvement plans regularly. Require new development and provide incentives for existing development to reduce the potential for natural hazards.	M	2-5 years	New critical facility structures are restricted by the City THO Zone. Need to develop a City CIP to include hazard mitigation projects.	City of Gearhart
Multi-Hazard	Train Certified Emergency Response Teams (CERT) for each neighborhood. Develop an emergency shelter and operations center.	H	On-going	CERT training is complete and on-going. Emergency training and operations facility to be included in a new city fire station.	City of Gearhart, CERT

Hazard	City of Gearhart 2020-2025 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Coastal Erosion	Conduct a periodic survey of vegetation on the dune and exposed sand areas. Require the maintenance of vegetation on exposed sand dune areas to increase resilience.	L	5+ years	Dune vegetation removal controlled by zone code. Invasive vegetation removal permitted. Vegetation maintenance is managed on city park land and by property owner permit.	City of Gearhart
Coastal Erosion	Continue to protect the dunes as an important buffer to coastal erosion and flooding.	L	5+ years	City updated Beaches and Active Dunes Overlay Zone in 2018. Consider a future evaluation of this code or dune conditions or coastal processes.	City of Gearhart, DLCD
Drought	Implement a water conservation plan to ensure adequate water supply.	L	5 years	City Water Master Plan identifies need. Water service fee structure encourages water conservation. Need to enhance conservation measures.	City of Gearhart
Flood	Comply with FEMA Floodplain recommendations for development within a floodplain.	L	Complete	City updated Floodplain Overlay Zone per FEMA standards in 2018. City provides periodic FIRM insurance rate announcements.	City of Gearhart
Flood	Ensure that runoff does not pollute ground water supplies.	L	None	City does not have a formal storm water collection system. Building setbacks from Neacoxie Creek are enforced.	City of Gearhart, Clatsop Co. Health/DEQ
Winter Storms	Implement winter storm preparation for high winds	L	On-going	Remove trees near power lines. Assure tie-downs for manufactured homes. Fire Dept. provides tree removal assistance.	Property owners, Building Code, Pacific Power, City of Gearhart
Landslide	Install drainage systems where necessary to prevent soil erosion.	L	On-going 2 years	Building Permit compliance required. Strengthen Land Division requirements for geotechnical analysis.	Building Code, City of Gearhart
Landslide	Require maintenance of vegetation on bare soils and site investigation/engineering in areas of slope hazard.	L	5+ years	Adopt 2020 DOGAMI landslide protections for new development	City of Gearhart
Wildfire	Ensure adequate space between structures to reduce vulnerability	L	5 years	Development permit review requires setback compliance. Identify needed urban/wildland interface setbacks.	Planning, Building code regulations

Hazard	City of Gearhart 2020-2025 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Wildfire	Construct fire access roadways and turnarounds within vulnerable neighborhoods, purchase land where right-of-way is not available.	L	2-5 years	Identify vulnerable areas and additional measures.	Building code, Fire Dept.
Wildfire	Conduct periodic fire inspections for vegetative fuels reduction and maintenance program to provide fire buffer to structures.	H	On-going	Per Fire Chief recommendations	City Fire, Planning
Wildfire	Initiate and maintain a routine fire inspection and prevention within the neighborhoods.	M	On-going	Per Fire Chief recommendations	Fire, City, Planning

Completed/Ongoing Mitigation Actions

Tsunami

Tsunami Wayfinding Signage

In 2013, the City worked with regional partners to develop new tsunami maps for the area, and a few tsunami evacuation signs were installed at that time. In 2014-15, Gearhart enhanced the wayfinding system by installing "You Are Here" signs in four key locations to specifically direct evacuees to high ground following an earthquake/tsunami. In 2018-19, the City participated with other jurisdictions in the countywide Wayfinding Assessment project, which served to identify gaps in the wayfinding system and creating a record of existing sign location to provide an easier way to maintain the system over time. Finally, in conjunction with the 2019-20 tsunami overlay project, the city was able to secure grant funding to purchase/install signs to complete the sign system for tsunami evacuation. Future steps include maintaining and exploring ongoing opportunities for improvement as well as conducting evacuation exercises.

Emergency Cache Container Program

The City launched the cache container program in spring 2019. The COVID pandemic delayed the project initially, but first access drop off date occurred in August 2020 and the second in October 2020. The program currently maintains 7 registered drums, and 9 residents are on the waiting list for the 2021 spring event.

Pre-Disaster Mitigation Reserve Fund

The city budget holds a Hazard Mitigation Fund where the fiscal year begins with $15,000 in reserves available for planning and projects that seek to protect life and property from future natural disasters. Its existence has funded projects such as the Conex bins for the soon-to-start Emergency Cache program, emergency supplies including medications and first aid, a HAM radio hut for emergency communications, and a starter supply of shelf-stable MRE's (Meals Ready to Eat).

Tsunami Hazard Overlay Zone Adoption

In August 2019, the City of Gearhart adopted Ordinance No. 924 amending the Gearhart Comprehensive Plan and Zoning Ordinance to update tsunami hazard background, policies, and development standards. These components were established via Section 3.14 of the Gearhart Zoning Code—the Tsunami Hazard Overlay Zone (THOZ). The purpose of the Tsunami Hazard Overlay Zone is to increase the resilience of the community to a local source (Cascadia Subduction Zone) tsunami by establishing standards, requirements, incentives, and other measures to be applied in the review and authorization of land use and development activities in areas subject to tsunami hazards. Significant public and private investments have been made in development in areas which are now known to be subject to tsunami hazards. These standards are not intended to require the relocation of or otherwise regulate existing development within the Tsunami Hazard Overlay Zone. These standards are intended to limit, direct and encourage the development of land uses within areas subject to tsunami hazards in a manner that will reduce loss of life,

reduce damage to private and public property, reduce social, emotional, and economic disruptions; and increase the ability of the community to respond and recover.

Tsunami Studies and Information

The City of Gearhart was a key participant and driver for technical analyses and policy development completed by the State of Oregon with federal funding. Specifically, Oregon Coastal Management Program applied for and was successful in securing two grants from the National Oceanic and Atmospheric Administration (NOAA) to address identified gaps in local land use planning for tsunami hazards, both a Project of Special Merit (which concluded in September 2019) and a Coastal Resilience Grant (to conclude in June 2021). The Oregon Department of Geology and Mineral Industries (DOGAMI) was a lead partner in these efforts to complete innovative analyses, including time/distance evacuation modeling, called "Beat the Wave," and casualty and building damage estimates for a local tsunami. These analyses covered many coastal jurisdictions, including the cities of Gearhart and Port Orford, all of Tillamook and Lincoln Counties, and the Coos Bay Estuary.

Leading up to the release of these publications were many in-person meetings, workshops, and open houses where the information was shared and revised (based on feedback) with elected officials, practitioners, emergency preparedness groups, and the public. This information has and will continue to help inform specific evacuation and mitigation improvement projects that will have the most impact in terms of lives saved. For example, many communities have utilized the Beat the Wave maps to inform where they place evacuation route signs to ensure the most efficient routes to safety are signed appropriately.

5. City of Seaside

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. 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.

Seaside is a major tourist destination. 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. Tourist and recreation facilities such as the Seaside Civic Convention Center, the downtown corridor, 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 4th of July fireworks display, the Solve Beach Cleanups, 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. The potential concentration of people in these areas is a major consideration of tsunami evacuation planning and modeling.

Hazard Vulnerability Analysis

Table II-84. City of Seaside Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Seaside	M	L	H	M	M	H	L	M	H

Source: Seaside Hazard Mitigation Committee, 2018; City of Seaside staff, 2020.

Coastal Erosion

Much of the City's frontage on the Pacific Ocean is protected by a mixture of fore dunes 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. 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.

Drought

Seaside has no record of a severe drought. Drought is averted as a result of the area's high rainfall, especially during winter months.

Earthquake

Earthquake risk was ranked for a Cascadia earthquake event scenario. Table II-35. indicates that 35% of the City of Seaside is subject to loss in a large earthquake event. Unfortunately, only 6.4% of Seaside's buildings at risk of earthquake are out of the tsunami zone. Damage from an earthquake may be more severe in the downtown area where buildings are older and sit on fill that has liquefaction potential. The 2018 DOGAMI Natural Hazard Risk Report for Clatsop County built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 earthquake hazard. Very high liquefaction soils are found throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton (Williams, M. (DOGAMI) 2018. *Natural hazard risk report for Clatsop County*, unpublished).

Flood

The City of Seaside ranked the probability of floods 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. 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.

Landslide

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. Particular areas at risk of damage in landslides are Lewis and Clark Road to the North and Highway 101 south of Beerman Creek Road, the latter of which could pose a significant hardship to Seaside residents and employees, cutting off access to and from Highway 26 and communities to the south.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario. Seaside is at very high risk from a tsunami, particularly one resulting from a local earthquake.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

Generally the community is at low risk from a wildfire event due to the maritime climate which reduces the rate at which vegetation dries during the summer months, but in the intermittent dry periods with east winds from summer to late fall, wildfire risk can elevate quickly. Table II-56. Wildfire Exposure indicates 25.6% of the community is at moderate risk from wildfire.

Wildfires are most likely to occur in wildland-urban interface areas. 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 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.

Windstorm and Winter Storm

Windstorm and winter storm risk was ranked based on the 2007 storm event that resulted in downed power and communication lines that led to closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. The lack of access to Portland hospitals and the inability to communicate with people with medical needs were two major life safety concerns.

Because coastal wind storms typically occur during winter months, they are sometimes accompanied by ice, freezing rain, flooding, and very rarely, snow. 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. More than likely, the coast's winter will just be windy, cold, and wet.

Risk Assessment Summary

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.

Table II-85. City of Seaside critical facilities

Critical Facilities by Community	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
	Exposed	>50% Prob.	Exposed	Exposed	Exposed	Exposed
Broadway Middle School*	X	X	X	-	-	-
Seaside Fire and Rescue	-	X	X	-	-	-
Seaside Head Start	-	-	X	-	-	-
Seaside Heights Elementary School*	-	X	X	X	-	-
Seaside High School*	-	X	X	-	-	-
Seaside Police Dept.	-	X	X	-	-	-
Seaside Providence Hospital	-	X	-	-	-	-
Seaside Public Works	-	X	X	-	-	-
Seaside Water Treatment	-	X	X	-	-	-

Source: Williams et al, 2020, p.65. **DLCD Note: All three Seaside School District schools listed above have been relocated to outside of the tsunami zone. The City of Seaside and Seaside School District consider these facilities to be removed from the list of "at risk critical facilities", however, to be consistent, this table is presented as published in the 2020 Natural Hazard Risk Report for Clatsop County.*

Hazard Profile

Table II-86. City of Seaside hazard profile.

Community Overview					
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)	
Seaside	6,455	4,325	9	872,504,000	

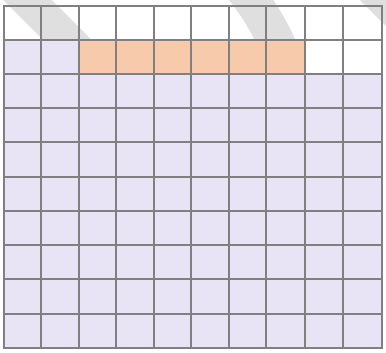
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	760	12%	186	1	1,416,000	0.2%
*Earthquake**	*CSZ M9.0 Deterministic*	343	5.3%	172	1	56,116,000	6.4%
Earthquake (within Tsunami Zone)		1,380	21%	1,402	7	252,513,000	29%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	5,226	81%	3,776	8	718,702,000	82%
Tsunami	Senate Bill 379 Regulatory Line	4,937	77%	3,657	8	703,833,000	81%
Landslide	High and Very High Susceptibility	881	14%	410	1	107,393,000	12%
Coastal Erosion	High Hazard	21	0.3%	56	0	35,067,000	4.0%
Wildfire	High Hazard	0	0.0%	2	0	347,000	0.0%

*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another. Colors correspond to colors in the table below. [1]Facilities with multiple buildings were consolidated into one building complex. [2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Figure II-83. City of Seaside loss ratio from Cascadia subduction zone event



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020, p.65.

Plans and Policies

Table II-87. City of Seaside Plans and Policies

Plan/ Policy Name	Date	Owner/ Author	Description/ Relation to Natural Hazard Mitigation	Relation to Natural Hazard Mitigation
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	City of Seaside	Inventories city open space and proposes future capital improvement projects.	

Mitigation Actions

Table II-88. City of Seaside Mitigation Actions

Hazard	City of Seaside 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard	Conduct a seismic upgrading and of water supply chains and infrastructure in the City.	H	0-24 months	Ongoing, see completed components below.	Seaside Public Works Dept.
Multi-Hazard	Continue efforts to replace aged bridges with newer structures.	H	0-24 months	Ongoing, see completed components below.	Seaside Public Works Dept.
Multi-Hazard	Implement an all-hazards education and outreach campaign. Continue to explore ways to provide additional public education.	H	0-24 months	Ongoing, see completed components below.	Seaside Planning Department
Multi-Hazard	Identify areas where undergrounding utilities may be appropriate	M	2-5 years	Coordinate with power companies as needed.	Astoria Public Works Dept.
Multi-Hazard	Evaluate the vulnerabilities of the water system (including the transmission main, water pipes and dam) and mitigate to ensure disaster resiliency.	H	0-24 months	Ongoing, see completed components below.	Seaside Public Works Dept.
Multi-Hazard	Maintain and enhance efforts around Community Emergency Response Teams (CERT).	H	On-going	CERT team reorganized and training	Seaside Planning Department
Multi-Hazard	Improve shelter locations and provide adequate equipment and supplies	H	On-going	Shelter locations being identified as new structures are being established outside CZ.	Seaside Planning Department
Multi-Hazard	Relocate EOC	H	2-5 years	Location identified; building shell in place.	Multiple departments

The City of Seaside has a robust mitigation program with both current and recommended projects summarized in the section below. The City has a number of departments that take a leadership role, as well as a cadre of community organizations and volunteers of all ages. The primary source of funding is local tax revenue, fees, levies, and bonds. State funds are utilized when available. Federal dollars, both Building Resilient Infrastructure and Communities (BRIC) and Hazard Mitigation Grant Program Funds are under consideration for the next steps for the various projects as staff time and capacity allows. Partnerships are common both within the city and across the county, as well as with universities and State researchers like DOGAMI. The projects listed below are intended to be initiated or conducted during the period of the plan update (2021-2026) unless otherwise noted.

Figure II-84. New Water Resource and Emergency Operations Center (EOC) Site

Source: City of Seaside, 2020.

Mitigation Actions Completed and Recommended

Coastal Erosion

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.

Drought

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. A new 2 million gallon water tank has recently been completed adjacent to the High School/Middle School. The tank supplies

water for the school's fire suppression system and can be used as a fully functioning water supply. This affords the City with additional fire protection and an abundant City water supply.

Earthquake

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.

Flood

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 as a means to further reduce the risks from flood damage while reducing flood insurance rates.

Landslide

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.

Tsunami

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. In 2020 the Seaside Middle School and High School was relocated outside the inundation zone and combined 3 schools. In addition, the elementary school, on the adjacent property was seismically upgraded and new modular structures were added to accommodate students who come from neighboring Cannon Beach and Gearhart locations. Broadway Middle School, Seaside Heights Elementary School, Seaside High School, and Seaside Providence Hospital were all removed from the critical facility mitigation list by the City of Seaside after this successful tsunami relocation.

The City Planning Department has hired an Emergency Preparedness and Planning Assistant to conduct natural hazard public education and outreach.

In 2013 the City collaborated with the Tsunami Advisory Group (TAG) 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. During 2020 the City restocked the barrels with fresh supplies that will last a minimum of 5 years. It was also a time to reconnect with the barrel keepers to reeducate them on their volunteer responsibility and familiarize them with the contents of the barrel especially since many of the homes had new homeowners that were not fully aware of their importance to the project.

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 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 its Earthquake and Tsunami Awareness activities. A program is being initiated to provide local businesses, especially those in the hospitality industry, with resources to being their planning, to educate their employees and inform visitors.

Figure II-85. New Tsunami Evacuation Signage in Seaside

Source: City of Seaside, 2020.

The City has installed 62 "this way" tsunami markers on roadways along the evacuation routes and 11 "leaving tsunami zone" markers on roadways at the edge of the inundation zone. The City just received 25 more to put down in spring 2021. They are also replacing or updating 25 round pole signs.

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, AmeriCorps, Grad Student Intern; private contractor; or some other form of employee or partnership with another agency like Oregon Sea Grant.

- Adopt an event scenario that can be used to help plan for events and identify needed mitigation measures.
- Advocate for State and Federal funding and activities that will promote emergency preparedness, hazard mitigation, and community resiliency within the City and the Coastal Region.
- Continue 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. For example, the Seaside City Hall and the Seaside Convention Center would be proposed for future analysis as both are considered priority critical facilities at risk to tsunami and earthquake risk.

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 tsunami evacuation routes. Additionally, tree removal is ongoing to improve visibility. Sidewalks are being added to outlying streets along the evacuation routes to alleviate tripping and stumbling hazards. 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 making the new school facilities 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 the deployment and use of the trailers for mass care events. 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.

Wildfire

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.

Windstorms and Winter Storms

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.

Multi-Hazards

Current Mitigation Activities

New Water Resource and EOC: The City has just completed a new 2 million gallon water tank above the new Seaside High School/Middle School at 372 feet above sea level, well outside of the tsunami inundation zone. The tank supplies water to the new school at 1,650 gallons daily. It also feeds the neighboring Spruce Drive and Cooper Drive sub divisions. Because of the elevation, the pumps allow a flow of 3,500 per minute for fire protection to the school and neighbors. It has been fitted with a seismic valve that will shut off water flow in the event of an earthquake. The pumps can be controlled from either the pump house or remotely via the internet. There are two access points to the tank site. The main paved road weaves up Spruce Drive and passes the Pacific Ridge Elementary School and the High School/Middle School. The East Hills Water Tank site is 3.31 acres and the adjacent land has been cleared, leveled and surfaced to accommodate a modular building. A 1,280 square foot modular building will house the City's EOC, satellite offices for the city, and fire and police departments are also planned. A future pole building will be constructed to house emergency equipment (fire trucks/earth movers) and there is room at the school football field for a helicopter pad.

Red Cross trailers: Two will be stored at each of the water tanks. A recently acquired towable trailer is being relocated from Elsie/Vine Maple fire department to the East Hills Water Tank site. In each of the trailers are shelter materials for disaster victims. An additional trailer is located at the Royal View Water Tank site off Lewis & Clark road. It also has shelter and medical supplies. The city has supplemented the trailer with a generator, Ham radio system, and three supply cache barrels that hold medical, sanitation, and shelter for 20 people. Three days of food for 20 people are also in each of the barrels.

Radio Communication: The City is in the process of updating its communication system. The equipment at the repeater sites has become dated and has since prohibited clear reception between radio users. A new transmitter has been erected at the new East Hills reservoir site adjacent to the new High School/Middle School. This site will soon become the City's EOC location.

Other repeaters throughout the county have also been updated to improve City communication among other agencies.

- Tolovana (just south of Cannon Beach)—This is an existing site. Old equipment is being upgraded from voter to repeater type radio equipment. It is outside of the tsunami inundation zone.
- Tillamook Head—Replaced old aging equipment. Outside inundation zone.
- Humbug—Completely new site. Repeater type radio equipment. Outside inundation zone.
- Seaside Police Department—Update to switch apparatus, which is part of interoperability to Astoria dispatch.

A new 2 million gallon water tank has recently been completed adjacent to the High School/Middle School. The tank supplies water for the school's fire suppression system and can be used as a fully functioning water supply. This affords the City with additional fire protection and an abundant City water supply.

Replacement of Storm Drain and Culvert: New culverts are replacing aged equipment. Fish friendly storm drain piping will increase the flow to the Necanicum River to prevent flooding due culvert failure. One culvert ready for replacement is on Wahanna Road by the Hospital.

Bridge upgrade: Two bridges and three culverts are replacing existing dilapidated equipment in an effort to restore the Necanicum River's original width and watercourse. This will decrease the turbidity of the flow, as the river will no longer be squeezed through a smaller channel. The additional flow will allow reservoir tanks to be filled at a faster rate. This is further up the watershed 4 miles outside of town on Hwy 26.

Seismic earthquake valves: Both Royal View and Peterson Point water tanks are being retrofitted with seismic valves that prevent flow when disrupted. The seismic valves will shut the outflow and the water is captured. Timeline to complete 5 years.

Storm drainage. All storm water piping is being replaced so roads don't sink in the event of an earthquake. We are also separating storm water from sewer water so we don't treat clean water. This saves energy from having to re-pump clean water to the treatment plant.

Tsunami evacuation routes are being cleared of overhanging trees and debris. Trucks and buses can get through easier, siite visibility is improved. Sidewalks improvements (reconditioning) and new sidewalks are being added to improve evacuation pathways patterns.

Holladay Drive improvement project. New water and sewer lines being installed. Old clay pipe would dislodge and crack it in an earthquake. The old 18 inch pipe leaks through joints. Installation of PVC pipe that is gasketed and interlocked is being completed so it can't come apart during an earthquake and instead would flex and stay together.

Replacing fire hydrants. Old hydrants installed in the 1960s and 1970s are being replaced with new ones to comply with new fire codes. As a result they produce more water per minute (800 to 1500 gpm). In an earthquake the old hydrants would break the water main.

Water meter replacement. The City of Seaside now has better management of water supply and are not wasting water with leaky old meters. We monitor the customer flow so when they have a high bill they replace broken equipment.

Working to conserve water. With the water meter replacement the water consumption and meter the sites that are not being monitored so we lose less water to leaky systems.

Fire Department – A new ladder truck purchased in 2020 will allow the fire department to reach higher buildings like the new school, etc.

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.

The Seaside Planning Department continues to support the Seaside CERT team with training and supplies. Support the 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.

New EOC with a micro grid or generator with a renewable energy supply.

Seaside is working on mass care planning and coordination.

6. City of Warrenton

Hazard Vulnerability Analysis

On August 27, 2019, City of Warrenton staff met with the DLCD Project Manager to assess the hazards that pose a risk to the City. The primary hazards affecting Warrenton are wind/winter storm, tsunami, and flood—the ranking for these and other six hazards are listed below.

Table II-89. City of Warrenton Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Warrenton	L	M	M	H	-	H	M	L	H

Source: City of Warrenton Risk Assessment, 2019.

Coastal Erosion

The City of Warrenton ranks the vulnerability and probability of coastal erosion as low as erosion caused by the tidal and wave actions is primarily only occurring at Hammond Marina. The vulnerability of coastal erosion in previous plan versions was ranked as high due to the large amount of coastal land area and the amount of dwellings in or near erosion zones. However, City staff have found these findings were driven by the preponderance of data on the Clatsop Plains, not actual impact.

Drought

Warrenton's water comes from small dams on the hills east of Seaside. While the City has the supply it generally needs, drought is an issue. The City does not manage its watershed. The watershed is owned by Green Mountain. While there is no history of water conservation orders, Pacific Seafood and other industries are heavy users and would experience economic challenges if water supply became an issue.

Earthquake

A crustal earthquake was considered for this hazard vulnerability analysis. There are many new homes and many wood structures in the City of Warrenton, and minimal concrete and unreinforced masonry structures, making existing structures potentially resilient to a smaller earthquake event.

The 2018 DOGAMI Natural Hazard Risk Report for Clatsop County built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 earthquake hazard. Very high liquefaction soils are found throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton (Williams et al, 2020).

Flood

The City of Warrenton is protected by 12' levees with 2' of freeboard. Public Works conducts consistent and diligent maintenance and repair on the flood control structures in the City. They have never had a breach of any sort and never had a flood. A stormwater fund assists with some of the repair costs.

Landslide

Warrenton is flat. There are no landslide areas in Warrenton. Therefore the vulnerability and probability of a landslide in Warrenton is low.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario. Warrenton is at an extremely high risk due to the prevalence of liquefiable soils, its reliance upon levees for normal elevation flood protection, and its limited access to evacuation areas.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

Generally the community is at low risk from a wildfire event due to high coastal humidity, but in the intermittent dry periods with east winds from summer to late fall, wildfire risk can elevate quickly. Table II-56. Wildfire Exposure indicates that 29% of Warrenton is at high risk from wildfire and 18% is at moderate risk.

Windstorm and Winter Storm

Windstorm and winter storm risk was ranked based on the 2007 storm event that resulted in downed power and communication lines that led to closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. The lack of access to Portland hospitals and the inability to communicate with people with medical needs were two major life safety concerns.

Risk Assessment Summary

Warrenton has three bodies of water along its borders: the Pacific Ocean, the Columbia River and Young's Bay. The eleven miles of dikes (which have not been breached), dispersal of catch basins, and type of soil alleviate the impacts of flooding. When flooding occurs, the sewer pump stations may fail if power outages occur. The levee system with culverts and tidegates is a major section of the infrastructure that protects the City from flood waters. These tidegates and culverts are the most likely locations for a failure in the levee system. Most of the stormwater conveyance system has little or no slope, resulting in ponding and localized flooding.

Flooding of bridges in Warrenton is a major concern; these bridges are critical links in the transportation system of the city. Young's Bay Bridge on Highway 101 is a major route for the North Coast and is subject to flooding. Evacuation of people or deliveries of supplies will be a problem if the Young's Bay Bridge is not operational. Other bridges in Warrenton, the Skipanon Bridge, and Alder Bridge, if flooded, could preclude access of people and supplies as well.

Table II-90. City of Warrenton Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
CMH Medical Group Urgent Care	-	-	-	-	-	-
Port of Astoria	X	X	X	-	-	-
Providence Medical Clinic - Warrenton	X	-	X	-	X	-
South Jetty High School	-	X	-	-	-	-
U.S. Coast Guard - Air Station Astoria	X	X	X	-	-	-
Warrenton Fire Dept.	X	-	X	-	-	-
Warrenton Grade School	X	X	-	-	X	-
Warrenton High School	X	X	X	-	X	-
Warrenton Police Dept.	X	X	X	-	-	-
Warrenton Public Works	X	X	X	-	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020.

Hazard Profile

Table II-91. City of Warrenton hazard profile.

Community Overview					
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)	
Warrenton	4,987	2,826	10	493,680,000	

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	2,335	47%	1,168	8	22,240,000	4.5%
*Earthquake**	CSZ M9.0 Deterministic	452	9.1%	397	1	77,676,000	16%
Earthquake *(within Tsunami Zone)*		1,137	23%	857	6	116,662,000	24%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	3,231	65%	1,803	8	263,619,000	53%
Tsunami	Senate Bill 379 Regulatory Line	2,718	55%	1,544	7	236,453,000	48%
Landslide	High and Very High Susceptibility	100	2.0%	61	0	9,955,000	2.0%
Coastal Erosion	High Hazard	0	0.0%	1	0	23,000	0.0%
Wildfire	High Hazard	1,410	28%	860	3	142,943,000	29%

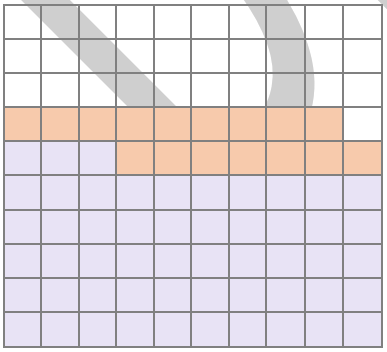
*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Figure II-86. City of Warrenton loss ratio from Cascadia subduction zone event



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Plans and Policies

Table II-92. City of Warrenton Plans and Policies

Plan/ Policy Name	Date	Author/ Owner	Description	Relation to Natural Hazard Mitigation
City of Warrenton Comprehensive Plan	Jan. 2011	City of Warrenton	The purpose of the City's Comprehensive Plan is to control and promote development which is most desirable to the majority of the residents and property owners of the City. The Plan establishes a set of policies and guidelines within this context.	The Comp Plan outlines how the City addresses the statewide land use planning Goal 7, areas subject to natural hazards. Identifies how the City manages development in geologic, flood, dune, and other hazard areas.
Housing Needs Assessment & Development Code Update	Jan. 2019	Clatsop County	This Comprehensive Housing Study analyzed countywide housing supply, and included proposals that may improve housing choice and affordability.	This Plan outlines a countywide approach to statewide land use planning Goal 10, housing and population. This plan identifies areas suitable for development which generally have fewer environmental impacts and generally avoid hazard areas.
Warrenton Urban Renewal Area Substantial Amendment	Aug. 2007	City of Warrenton	The City of Warrenton Urban Renewal Plan encourages infill, rehabilitation and redevelopment that is consistent with the Comprehensive Plan and Zoning Regulations. Through implementation of the Plan, economic development will be stimulated by the elimination of blighting conditions, provision of supporting public facilities, and general improvements in the overall appearance, condition, and function of the downtown, marina and the District in its entirety.	The City of Warrenton uses this plan as a guide to improve and maintain the structures and the quality of buildings of the downtown corridor and making sure they hold up to natural hazards. The Urban Renewal Committee is the City Commission and this document aligns the priorities of the elected officials and the residents and stakeholders interested in downtown redevelopment.
Emergency Operations Plan	July 2010	City of Warrenton	The Emergency Operations Plan (EOP) provides a framework for coordinated response and recovery activities during any type or size of emergency.	The EOP outlines preparation plans for the City in the event of a Natural Hazard or other major emergency or disaster. The Plan assures that key personnel are ready to respond in a timely efficient manner.
Storm Water Master Plan	Feb. 2008	City of Warrenton	The Stormwater Master Plan helps understand the stormwater management system, and develop Capital Improvement projects for the City to implement in anticipation of continued growth.	The SWMP is primarily focused on conveyance and flooding issues. The plan has recommended projects to mitigate impacts from flooding and prevent future losses due to flood and hazard impacts.
Transportation System Plan		City of Warrenton	The TSP sets the vision for the community's transportation system for the next 20 years.	The TSP establishes a coordinated transportation project list to meet multiple objectives including "coordinated planning for lifeline and evacuation routes with local, State, and private entities."
Wastewater Facilities Plan		City of Warrenton	This plan analyses current and projected wastewater flows and treatment for the City of Warrenton.	The plan highlights existing system challenges as well as needed improvements in order to maintain functionality during regular usage as well as storm or emergency events.
Water Master Plan		City of Warrenton	The Water Master Plan (WMP) documents key water system information and provides analysis and recommendations that inform infrastructure development and operational decisions by City staff.	The plan identifies existing facilities as well as upgrades to maintain current water quality. In addition, this plan addresses needs in the system to mitigate seismic impacts and potential system failures due to natural hazards.

Mitigation Actions

Table II-93. City of Warrenton Mitigation Actions

Hazard	City of Warrenton 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Flood	Continue regular maintenance of levees.	H	2-5 yrs.	The City relies on flood control levees and maintains this infrastructure with a rigorous schedule and approach.	
Flood	Levee recertification	H	2-5 yrs.	The City is currently working with the State to determine levee requirements for certification.	Stormwater funds; FEMA BRIC/FMA program
Flood	Coordinate with FEMA on issues surrounding recently proposed revisions to the Flood Insurance Rate Maps.	M	2-5 yrs.	The City works with FEMA on proposed revisions to flood maps. The City has determined critical wetland areas beyond the scope of FEMA flood guidance to better direct development outside of environmentally sensitive areas.	FEMA Cooperating Technical Partners (CTP)
Multi-Hazard	Emergency Operations Plan (EOP) review and maintenance	M	1-5 yrs.	The City's EOP was adopted in 2010 and needs to be updated. This is in review across multiple Warrenton City Departments	
Multi-Hazard	Coordinate transportation planning for lifeline and evacuation routes with local, State, and private entities.	M	5-10 yrs.	The TSP was adopted in 2019, and the City continues to consider grants and other funding sources to maintain and improve the transportation system.	ODOT, Clatsop County
Multi-Hazard	Capital Facilities Water improvements to address fire flow deficiencies	H	2-5 yrs.	Overall the City's water system provides high quality water to its customers. Some areas of the City have deficient fire flows. These should be addressed to maintain life safety and structure preservation within Warrenton City.	

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.

Drought

Develop a water conservation plan to be used during a drought event.

Coastal Erosion

The South Jetty is being repaired. This repair will continue for several more years before completion.

Earthquake

Prior to 2004, all buildings were constructed to seismic classifications I-V. A brochure on Tsunami evacuation includes information on what to do when an earthquake occurs. This brochure is available to citizens at the City of Warrenton Fire Department and the City of Warrenton Planning and Building Department. S.T.E.P. has distributed this brochure as part of an emergency disaster packet to approximately 1,200 houses.

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, the construction plans must be engineered or designed by a professional because of periodic high water table flooding conditions.

The levee system with culverts and tide gates protects the City from flood waters.

A Wetland Ordinance has been adopted that protects wetlands and riparian corridors.

In the early 1960s, the 8th Street Dam was built across the Skipanon River to alleviate flooding upstream during high tide.

In the early 1970s, two pump stations were built in downtown Warrenton to facilitate drainage of the City during tailwater conditions in the Skipanon and Columbia Rivers.

Removal or fill of 50 cubic yards in waters of the state requires a permit from the Department of State Lands.

Repaired West Hammond Marina tidegate.

Tsunami

A Tsunami Evacuation brochure with a map and an explanation on what to know and what to do has been developed by the Oregon Department of Geology and Mineral Industries (DOGAMI), the City of Warrenton, the State of Oregon and Clatsop County. It represents a worst-case scenario for a tsunami caused by an undersea earthquake. This brochure is available to citizens at the City of Warrenton Fire Department and the City of Warrenton Planning and Building Department. S.T.E.P. has distributed this brochure as part of an emergency disaster packet to approximately 1,200 houses

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 and Winter Storm

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 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, floor, earthquake, and snow.

A Red Cross trailer with supplies is located in the Public Works yard.

Established a volunteer citizen’s emergency preparedness.

Contracted with the Oregon Emergency-Preparedness Outreach and hired an Outreach Coordinator.

7. Port of Astoria

Hazard Vulnerability Analysis

The Port of Astoria Risk Assessment consisted of four meetings with Port of Astoria leadership staff: an interview with Sue Transue on June 21, 2019 and another with Gary Kobes, Airport Manager on August 27, 2019. A discussion with former Director Jim Knight and Sue Transue occurred June 4, 2019. A zoom meeting occurred on May 27, 2020 with Sue Transue and Gary Kobes to review mitigation actions.

Table II-94. Port of Astoria Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Port of Astoria	-	-	H	H	M	H	M	L	H

Source: Port of Astoria, 2019

Port of Astoria hazard risks, vulnerabilities, and history shadow those of the City of Astoria as outlined in the Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan with a few exceptions as noted below.

Coastal Erosion

Being that much of the Port's infrastructure borders the Columbia River, erosion is a constant risk.

Drought

Same as City of Astoria.

Earthquake

Same as City of Astoria.

Flood

The Port of Astoria Airport is vulnerable to flooding but is not an owner of the flood control structures that protect it—the same levees that protect Warrenton that have a suite of ownership, but are primarily well-maintained by the City, drainage districts, and federal advisors like USACE. However, the Airport is very low-lying and is subject to ponding from precipitation as well as a levee breach.

Maritime operations could be subject to impacts from debris like logs.

Landslide

Same as City of Astoria, but no direct impacts to structures but potential impacts to site access.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario. Majority of port property is located within the Tsunami Inundation Zone making the Port at high risk from a tsunami event.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked. Risk of ash fall would be the same as the City of Astoria. Volcanic lahar flow is of some concern. Mitigation would be business resilience and dredging capability.

Wildfire

A bit less than the City of Astoria's due to the Port's location at the water's edge.

Windstorm/Winter Storm

Windstorm and winter storm risk was ranked based on the 2007 storm event that resulted in downed power and communication lines that led to closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. The Port is more susceptible than City of Astoria due to the Port's direct northern exposure. The Port sustained damage in most of the historical events.

Risk Assessment Summary

Port of Astoria hazard risks, vulnerabilities, and history shadow those of the City of Astoria as outlined in the Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan with a few exceptions. For the Port, flood, winter storm, and a CSZ earthquake and tsunami event are the hazards of most concern. Landslide is not a priority as it is for Astoria. The Port's capacity position dictates a long-term focus with attention to low-severity, high-frequency events like winter storms. The mitigation strategy focuses on an incremental approach to operational resiliency.

Table II-95. Port of Astoria Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Port of Astoria-Maritime Operations	**X**	**X**	**X**	**-**	**-**	**-**
Port of Astoria Regional Airport	**X**	**X**	**X**	**-**	**-**	**-**
U.S. Coast Guard - Air Station Astoria	X	X	X	-	-	-
Warrenton Fire Dept.	X	-	X	-	-	-
Warrenton Police Dept.	X	X	X	-	-	-
Warrenton Public Works	X	X	X	-	-	-
Astoria Fire Dept.	-	X	X	-	-	-
Astoria Fire Station #2	-	X	-	-	-	-
Clatsop County Sheriff Department	-	-	-	-	-	-
Oregon State Police	-	X	X	-	-	-
Tongue Point Naval Air Station	X	X	X	X	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020.

Port of Astoria Regional Airport Revenue Sources:

- Lease hangars
- Sell fuel to both general aviation and outside military aircraft, CG from Sac.
- Lease land/buildings to Lektro/ UPS/ Recology
- Minor revenue from fees—landing, overnight.

Plans and Policies

Table II-96. Port of Astoria Plans and Policies

Plan/ Policy Name	Date	Owner/ Author	Description	Relation to Natural Hazard Mitigation
Airport Master Plan	2007	Port of Astoria Airport	An official FAA document that guides funding priorities. It is scheduled to be updated 2022	
Airport Overlay, Warrenton Comp Plan	2005?	City of Warrenton	Guides development at the airport and the impact on surrounding land. Sets the airport out as an industrial zone, also a commercial area.	
Strategic Master Plan	2019-2024	Port of Astoria	On October 1, 2019, the Port of Astoria Commission approved the Strategic Business Plan Update (2019-2024). The Mission Statement is as follows. The Port of Astoria seeks to generate economic growth and prosperity in a safe and environmentally responsible manner for its citizens through creation of family wage jobs and prudent management of its assets. For the next 2 to 4 years, the Port will be focusing on restoring financial sustainability, addressing the rehabilitation needs of its aging infrastructure and fostering public trust.	

Mitigation Actions

Table II-97. Port of Astoria Mitigation Actions

Hazard	Port of Astoria 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard	Evaluate the reliability of the Port of Astoria systems (electric, fuel, water, etc.) for variations in business use and low-severity events; move into seismic evaluation of systems and structures as a second step (Assess Port of Astoria facilities and retrofit.)	M	2-5 years	The Port is focused on improving economic stability and prioritizing low-cost improvements is timely.	
Multi-Hazard	Develop secondary back-up power, communications, and lighting for the Port of Astoria airport.	H	1-2 years	Ongoing/Underway	Port of Astoria; Clatsop County
Flood	Evaluate the vulnerability of the Warrenton-Astoria Airport to chronic flooding; Elevate key infrastructure out of flood risk areas.	H	2.-5 years	The airport is vulnerable to flooding on a long time frame. Budget limitations make targeted, cost-effective solutions a priority.	Port of Astoria, cities, County, Coast Guard, others.
Flood	Support efforts to maintain levees and protect flood-prone lands surrounding the Warrenton-Astoria Airport (AST).	H	Ongoing	AST is subject to flooding from sources outside of its control.	City of Warrenton, FEMA, diking districts.
Wind/ Winter Storm	Conduct annual monitoring of the Port's maritime infrastructure; Draft an infrastructure monitoring plan and seek funding to ensure the staff time to maintain the datasets necessary to secure FEMA funding in future disaster events.	H	Annually; 1-2 years.	Annual monitoring is ongoing and a monitoring plan is in place but additional technical resources and capacity is needed.	Port of Astoria operations staff;
Wind/ Winter Storm	Improve the storm resilience of Pier 2 and the West Mooring Basin.	H	2-5 years	These two structures were impacted by the 2015 storm and partially restored.	

8. Sunset Empire Transportation District

See Transit: Sunset Empire Transportation District (SETD) page 84 for a description of SETD operations.

Hazard Vulnerability Analysis

Risk assessment meetings with Sunset Empire Transportation District (SETD) staff on May 16th and June 20th, 2019 resulted in the following hazard vulnerability rankings for the jurisdiction.

Table II-98. Sunset Empire Transit District Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Sunset Empire Transit District	-	L	H	H	M	H	L	L	H

Source: SETD, 2019.

The primary hazards affecting Sunset Empire Transportation District (SETD or District) are wind/winter storm, tsunami, earthquake, and flood. SETD will operate if the roads are open and fuel is available. If some roads are closed, routes are adapted as necessary. The District now has a generator so it can operate if the power is out. The primary hazard the District seeks to mitigate for is tsunami—SETD seeks to relocate its bus barn and operations to outside of the tsunami zone. SETD is a team-player when it comes to disaster planning, response, and mitigation (Lewicki, May 2019).

Earthquake

The greatest existential hazard risks posed to the District are from earthquake and tsunami scenarios. Both sites that SETD operates out of are located on soils that can liquefy in an earthquake and neither has a hazard-free evacuation route to high ground. In fact, evacuation routes are nearly non-existent for a Cascadia subduction earthquake event.

Flood

Flood risk is slowly increasing for SETD at both the Warrenton Bus Barn and Astoria Transit Center locations.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario. Both SETD sites are located on liquefiable soils. Follow a CSZ earthquake prior to tsunami inundation, the facility (remnants) can be expected to be below sea level.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Windstorm/ Winter Storm

Windstorm and winter storm risk was ranked based on the 2007 storm event that resulted in downed power and communication lines that led to closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks.

High wind and winter storm events affect SETD when roads are impassable due to downed power lines, ice, or snow. This hazard is high risk for the entire county and the SETD Director was a leader in responding to the 2007 winter storm event. As manager of the local Costco store, he ensured that fuel was made available and coordinated with authorities that perishable supplies were dispersed and made useful in a timely way, and that store facilities were available to the community in a variety of ways.

Risk Assessment Summary

The following summaries of populations, facilities, and assets constitute those that are likely at risk from the hazards described.

Operations

Astoria Transit Center at 900 Marine Drive is open 8am-6pm and is home to SETD administrative offices, a parking lot with park-and-ride spaces, and SETD's primary transfer location in which includes a ticket window and indoor waiting area. This is also a connection point for Pacific Transit System, NW Connector routes (to four other Oregon counties), and NW Point ODOT service that connects to Portland.

Warrenton Operations Center 465 NE Skipanon Road is open 5am-10pm and is home to SETD Bus Yard, the Human Resources office, and this is the location where most employees report to work. Fixed routes depart from this location and para transit service is based here.

Seaside Transit Office SETD recently upgraded their customer service facility in Seaside by relocating their kiosk in the Seaside Factory Outlet Center to a new location that provides ticket sales and customer information to support growth in the area and strong ridership on Route 101 (SETD, 2016.) This leased facility at 39 N. Holladay Street hosts one employee and is open 9am-6pm, 7 days a week (Lewicki, P., 2019).

Bus Stops and Shelters: SETD is a flag stop system, people can flag the bus to stop where it is safe along the route. Daily boarding at most shelters ranges from 10-25 riders, while enhanced shelters are constructed in locations with more than 25 daily boardings. SETD's Long Range Comprehensive Transit Plan (Sept. 2016) has guidance for when construction or improvements are made to the system. For hazards, shelters are currently the lowest level of concern for the transit agency. However, they could be used to disseminate tsunami information and evacuation maps.

Staff

SETD is organized into six divisions, all of which are overseen by an Executive Director and the Board of Commissioners. SETD employs 41 people, 38 total FTE. The Operations Division is the largest division, with 32 employees—23 of whom are bus operators. As of July 2015, SETD has been hiring additional administrative and operations staff. SETD has undertaken a wage study to determine if pay levels meet cost of living and skills required metrics, and recently began providing most operators with official lunch breaks. SETD is overseen by a 7-member Board who represent of all parts of the County as all registered voters in Clatsop County can qualify to serve. The Board sets policies for the Transportation District, selects and evaluates the Executive Director, and ensures District operations are managed in compliance with District policies (NW Oregon Transit, 2019).

Transit Customers

Sunset Empire Transportation District (SETD) serves all of Clatsop County and aims to reach all potential riders via specific accessibility programs. The population of Clatsop County is 35% rural, and like all rural places, transit service often carries a large share of persons who are "transit-dependent", or have no personal transportation options. Transit provides this population with a crucial lifeline to jobs, services, family and friends, and medical providers. Transit-dependent people are often older adults (65+), youth under 17, people with low incomes, people with disabilities, people with limited English proficiency, and households without a vehicle. The SETD Long Range Comprehensive Transit Plan, Sept. 2016, has great maps and explanation for how SETD works to best-serve the Clatsop Community with transit options.

SETD has a Title VI program that reflects their commitment to non-discrimination which includes a public engagement plan, a language assistance plan, training guidelines, and amenity standards. The program objectives acknowledge the challenges to public participation and utilization of public services by community members with barriers to their capacity (language, financial, physical, etc.) and the program guidance identifies strategic actions to address these challenges (NW Oregon Transit, 2019).

Plans & Policies

Table II-99. Sunset Empire Transportation District Plans and Policies

Plan/ Policy Name	Date	Owner/Author	Description/How Plan Relates to Hazard Mitigation
Long Range Comprehensive Transit Plan Vol. I & II	Sept. 2016	Sunset Empire Transportation District	Frames the position of the organization and the path to growth and change.
Coordinated Human Services Public Transportation Plan (Coordinated Plan)	Jan. 2015	SETD/ODOT	Identifies improvements to transportation services for individuals with disabilities, individuals who are senior, and individuals with lower incomes by providing strategies to guide financial investments.
Sunset Empire Strategic Prioritization Plan	Updated 2015	SETD	This plan identifies key organizational priorities and indicates that a feasibility study for relocating the Warrenton Bus Barn out of the tsunami zone is priority level two.
Sunset Empire Comprehensive Transportation Plan	2001	SETD	Outlines key components of SETD's transportation system and guides how improvements intersect with policies and infrastructure.
Clatsop County Transportation System Plan	2015	Clatsop County	Outlines key components of the County's transportation system and guides how improvements intersect with policies and infrastructure.
City of Astoria Transportation System Plan	2013	Astoria	Outlines key components of the County's transportation system and guides how improvements intersect with policies and infrastructure.
Transportation Planning Rule (OAR 660-012)	1991 with updates	Oregon Land Conservation & Development	Guides the development of transportation plans; Rule overseen by LCD Commission and implemented by the Department.

Mitigation Actions

Table II-100. Sunset Empire Transportation District Mitigation Actions

#	Hazard	Sunset Empire Transportation District 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
SETD #1	Tsunami	Relocate the SETD Buses and Operations Facility in Warrenton to a site outside of the tsunami zone.	H - Highest priority	2-5 yrs.	New action/plan holder for the 2021 Plan Update.	SETD/ Clatsop NHMP Steering Committee
SETD #2	Tsunami	Identify locations out of the tsunami zone to move buses to on short notice.	H	1-2 yrs.	New action/plan holder for the 2021 Plan Update.	SETD/ Clatsop NHMP Steering Committee
SETD #3	Tsunami	Review the evacuation recommendations for the Warrenton site from the Nanoos Tsunami Evacuation Zones App; provide employee evacuation guidance as suitable. http://nvs.nanoos.org/TsunamiEvac	H	1-2 yrs.	New action/plan holder for the 2021 Plan Update.	SETD/ Clatsop NHMP Steering Committee
SETD #4	Multi-Hazard	Ensure SETD communications are sufficient to receive evacuation notices and instructions for use in a disaster event.	H	1-2 yrs.	New action/plan holder for the 2021 Plan Update.	SETD/ Clatsop NHMP Steering Committee
SETD #5	Multi-Hazard	Hardening/resilience of Astoria site: Identify ways to ensure resilience of the Astoria Bus Depot for use during evacuation events.	M - Important	5-10 yrs.	New action/plan holder for the 2021 Plan Update.	SETD/ Clatsop NHMP Steering Committee
SETD #6	Multi-Hazard	Develop caches of emergency supplies (food, water, shelter, operations) as part of employee resilience and preparedness.	M	2-5 yrs.	New action/plan holder for the 2021 Plan Update.	SETD/ Clatsop NHMP Steering Committee
SETD #7	Tsunami	Work with partners to improve the seismic and flood resilience of bridges in Warrenton and across Young's Bay. Develop emergency plans to address the separation of administration from operations in a CSZ event.	n/a - no authority	1-2 yrs.	New action/plan holder for the 2021 Plan Update.	ODOT, County, Cities/ Clatsop NHMP Steering Committee

SETD Capabilities

In context of hazards, Sunset Empire Transportation District (SETD) operations would serve the community differently in a disaster.

Operations: In a major disaster, SETD would stop running the transit routes, and instead would allocate our buses, facilities, and staff to move people out of harm's way or to where they needed to go based on direction of the Emergency Operations Center or other authority. As with winter storms and landslides, SETD continues to operate the rest of its system if one part is down—alternate routes are implemented to avoid hazard areas.

Staff: Like all businesses, there is a question of how to ensure that staff are available during or after a disaster. Developing employee loyalty is based on an employee being able to meet their family obligations and how much employer loyalty they feel is extended to them. Incentivizing staff to report to work after a severe disaster event is a potential mitigation action.

Assets: As stated previously, SETD facilities, buses, and equipment would be completely out of service at both current locations in a Cascadia Subduction Zone earthquake event. This is a contributing factor to moving the bus barn out of a tsunami and liquefaction zone, as it is imperative to have a facility to report to before worrying about if staff will report.

Regular Maintenance of Infrastructure

Repair capabilities for the District are focused on the bus fleet. The Warrenton location is where bus repairs and maintenance occur. SETD's regular maintenance of their bus fleet allows for its use for evacuations at any time.

Ongoing: SETD Programs

- SETD has an established Memorandum of Understanding (MOU) with Clatsop County Emergency Management indicating that buses and bus drivers with CDLs will be available for emergency response as needed.
- SETD has Evacuation Agreements established with two local senior centers (Clatsop Care Health District and Astor Health) that are activated based on the need to evacuate and the District's ability to assist.
- The Clatsop County Sheriff's office has two projects with SETD. In partnership with Clatsop Community Action and the State Department of Human Services (DHS), blocks of tickets or passes are purchased to provide to customers in need. The County coordinated with SETD on a new bus pullout and shelter on 19th Street by Sheriff's office. The project aims to provide service to people on probation who predominantly use buses for transport.
- Specific populations may also receive support via bus passes and other services or projects.
- Multi-seasonal routes for tourists are expanding across the service territory:
    - Cruise ships necessitate six additional buses for Route 11 (downtown Astoria and Port docks) for tourists and Route 12 (to Warrenton) for ship staff.
    - Adding service to Hammond/Fort Stevens to help serve campgrounds.
    - Seasonal routes in Seaside and Cannon Beach for tourists, including a Seaside Streetcar in future years.
- Regional transit partnerships could be activated to support evacuation needs.

9. Clatsop Community College

Hosting thousands of people on campus each year, including 1,350 full-time students, CCC administration is acutely aware of their position as a community leader that needs to be prepared to support its student population and the larger community in the event of a natural disaster. As such, CCC staff are working closely with Clatsop County Emergency Management and Columbia Memorial Hospital staff to understand when and if the college would become an evacuation site or mass care facility.

Hazard Vulnerability Analysis

On June 5, 2019, three staff from the Clatsop Community College administration met with the DLCD Project Manager to assess the risk from the hazards that may affect the college and to rank them in terms of history, vulnerability, threat, and probability. The following rankings indicate the level of risk facing the Clatsop College campuses from natural hazards. Descriptions by hazard explain the logic of the rankings.

Table II-101. Clatsop Community College Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Clatsop Community College	-	L	M	H	M	M	M	L	H

Source: CCC, 2019.

Coastal Erosion

This hazard does not affect the college.

Drought

Same as City of Astoria as they are the water provider; only if there is a conservation order and then it would likely only limit irrigation and other “non-essential” activities.

Earthquake

Liquefaction is a concern, especially for the Merts Campus. Earthquake risk is ranked medium as the history of earthquake occurrence is higher for southern areas of the county.

Flood

Being located on the Columbia River, the Merts Campus encounters coastal flooding during extreme high tide events.

Landslide

Medium risk as risk is just a subset of that for the City of Astoria. Potential areas at risk on the Lexington Campus include the library and parking lot behind library. Facilities could be impacted by a stand-alone landslide event or as a secondary impact from an earthquake.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario. Resilience planning being added to studies; new Merts buildings are going to be built to safety standards

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked. Same risk as City of Astoria; some degree of concern about the potential air quality/ health impacts.

Wildfires

Low to no risk at any campus locations.

Windstorm/Winter Storm

Windstorm and winter storm risk was ranked based on the 2007 storm event that resulted in downed power and communication lines that led to closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. Most recent events and damage include downed trees, some fencing, and other impacts.

Risk Assessment Summary

The following summaries of populations, facilities, and assets constitute those that are likely at risk from the hazards described.

Clatsop Community College (CCC) has approximately 115 full-time and 70 part-time employees in all positions: faculty, administration, and classified staff. The college has an annual enrollment of 5,500 students, 1,350 of which are full-time.

Educational Facilities: The community college has two campuses (Lexington and Mertz) in addition to the Seaside Center which has auxiliary functions that support students but is not a full campus.

Lexington Campus: 2009-2010 Towler Hall was rebuilt and is Patriot Hall is new in 2017.

CCC's campus has undergone major renovations and features a new 43,000 sq. ft. building that houses science and allied health departments, classrooms, student government, bookstore, and Clatsop Cafe.

Alder Hall: needs seismic upgrades.

Library: Assembly area at the back of the library. Patriot Hall was discussed to be a shelter; was not built to be one but folks know.

Columbia Hall: This is where people could congregate; some built-in protections because on bedrock.

Mertz Campus: Industrial buildings and there is a new facility that is going to be new. a lg number of career technical programs, most are housed at Mertz, Fire Science, Historic Preservation, Maritime Science (only cc program).

Students in Residential Areas: In the event of a disaster, the College anticipates becoming a resource for the neighboring community. Students may gravitate towards campus both to seek and provide assistance to their peers and College staff.

Table II-102. Clatsop Community College and City of Astoria Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Astoria City Hall	-	X	-	-	-	-
Astoria Fire Dept.	-	X	X	-	-	-
Astoria Fire Station #2	-	X	-	-	-	-
Astoria Head Start	-	X	-	X	-	-
Astoria Middle School	-	X	-	-	-	-
Astoria Police Dept.	-	-	X	-	-	-
Astoria Public Works	-	X	X	-	-	-
Astoria Senior High School	-	X	-	X	-	-
Astoria Wastewater Treatment	-	X	-	-	-	-
City of Astoria Reservoir #2	-	-	-	-	-	-
Clatsop Community College	**-**	**X**	**X**	**X**	**-**	**-**
Clatsop County Sheriff Department	-	-	-	-	-	-
Columbia Memorial Hospital	-	X	-	-	-	-
John Jacob Astor Elementary	-	X	-	X	-	-
Oregon State Police	-	X	X	-	-	-
Parks Medical Limited LLC	-	X	-	X	-	-
Providence Heart Clinic North Coast - Astoria	-	X	-	X	-	-
Tongue Point Naval Air Station	X	X	X	X	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020.

Plans & Policies

Table II-103. Clatsop Community College Plans and Policies

Plan/ Policy Name	Date	Owner/ Author	Description	Relation to Natural Hazard Mitigatiion
		Clatsop Community College		

Mitigation Actions

Table II-104. Clatsop Community College Mitigation Actions

Hazard	Clatsop Community College 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard	Participate in and provide support for community mitigation planning with a focus on coordination with Columbia Memorial Hospital on evacuation routes, assembly areas, and mass care partnerships.	H	2-5 yrs.	The College seeks to understand if there are expectations of the College or needs to prepare for.	CCC, Columbia Memorial Hospital, Clatsop County, Astoria.
Multi-Hazard	Provide support for CCC students, faculty, admin, and classified staff understanding natural hazards and becoming '3-weeks ready'.	H	0-36 months	The College will seek new opportunities to expand understanding and action.	CCC, Clatsop County
Earthquake	Improve the seismic resilience of Clatsop Community College buildings, equipment, and infrastructure.	H	0-36 months	Seismic resilience ranges from new building design to retrofitting power and power connectors..	CCC
Earthquake	Ensure that all facilities and operations have backup power; add back up power to Patriot Hall and Towler Hall	H	0-36 months	Ensuring backup power is a CCC priority.	CCC
Earthquake	Ensure that all facilities have backup water and emergency supplies.	H	0-36 months	The ability to provide a supply of water in a disaster is a CCC priority.	CCC
Landslide	Install rock slide protections to prevent landslides from impacting buildings; evaluate the landslide risk to campus and develop a plan to implement protective strategies.	H	0-36 months	Rocks have hit the Art Building and indicate that further consideration may be needed.	CCC, DOGAMI

10. Seaside School District

For twenty-five years, the community of Seaside has considered the risk of a Cascadian Subduction Zone earthquake and tsunami event. The completion of a school district-wide facility relocation project in 2020 will ensure students will be free of this catastrophic hazard risk while on-site at school facilities. For a project description, see the Seaside Schools Tsunami Relocation Project on page 317. See page 64 for a description of Seaside School District's operations.

Hazard Vulnerability Analysis

The SSD Risk Assessment was held May 7, 2019 and consisted of an interview with Chuck Loesch, SSD Facilities Manager. Mr. Loesch met with the DLCD Project Manager on behalf of the SSD Administration who were provided risk assessment materials in advance of the meeting and were able to provide follow up information.

Table II-105. Seaside School District Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Seaside School District	-	L	H	M	M	H	L	M	H

Source: Loesch, C., 2019.

Coastal Erosion

There are no SSD buildings impacted by coastal erosion; this hazard does not affect the District.

Drought

The risk of drought on SSD is same as City of Seaside generally. If there is a conservation order, then irrigation and bus washing would be reduced accordingly. In a worst-case scenario of "no water", there would be no school.

Earthquake

Seismic risk for the School District is the same as for the City of Seaside; liquefaction is a major concern.

Flood

The District Administration building is owned by the City of Seaside, it receives ground water flooding. The Bus Transportation Dept. at 1985 N Roosevelt, Seaside, OR Bus Depot receives king tide flooding where the offices and bus storage parking lot are currently threatened regularly from Neawanna Creek at high tide. For risk assessment purposes, flood scenarios were discussed in order to put the risks in context. Scenario 1 was if the Bus Depot experienced a high tide combined with heavy rains. Scenario 2 considered if ground water flooding occurred in the District Administration Building in a combined high tide/heavy rain event.

Landslide

The only landslide risk for SSD is that of bussing students to campus. An Arch Cape-area landslide blocked Highway 101 for a half day in the past.

Tsunami

The tsunami hazard was ranked for a Cascadia earthquake event scenario. Tsunami risk presents a very high risk across the entire community of Seaside. The risk of a tsunami event resulting from a Cascadia Subduction event is the reason for the major school relocation project.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked. Risk of volcanic ash fall is the same for SSD as for the City of Seaside; generally very low risk except for days with east winds.

Wildfires

SSD is extremely well prepared for fires with a low wildfire risk for the City of Seaside. In addition, SSD buildings are mostly constructed with fire-resistant materials (CMU concrete block and steel) and District staff follow Firewise fire risk reduction protocols.

Every building is sprinklered at a robust level and have gas line shut off valves that would address a fire from gas line. SSD gas lines are above the standards and tested regularly.

SSD has an integrated pest management (IPM) program that deals with vegetation and debris management throughout Seaside School District. For example, shrubbery is limited to 18” above the ground and 18” away from each building.

Windstorm/Winter Storm

Windstorm and winter storm risk was ranked based on the 2007 storm event that resulted in downed power and communication lines that led to closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. The Seaside School District had several buildings impacted by tree blow-down in the 2007 windstorm event.

Risk Assessment Summary

Table II-106. City of Seaside Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Broadway Middle School*	X	X	X	-	-	-
Seaside Fire and Rescue	-	X	X	-	-	-
Seaside Head Start	-	-	X	-	-	-
Seaside Heights Elementary School*	-	X	X	X	-	-
Seaside High School*	-	X	X	-	-	-
Seaside Police Dept.	-	X	X	-	-	-
Seaside Providence Hospital	-	X	-	-	-	-
Seaside Public Works	-	X	X	-	-	-
Seaside Water Treatment	-	X	X	-	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020. **DLCD Note: All three Seaside School District schools listed above have been relocated to outside of the tsunami zone. The City of Seaside and Seaside School District consider these facilities to be removed from the list of "at risk critical facilities", however, to be consistent, this table is presented as published in the 2020 Natural Hazard Risk Report for Clatsop County.*

Plans and Policies

Table II-107. Seaside School District Plans and Policies

Plan/ Policy Name	Date	Author/ Owner	Description	Relation to Natural Hazard Mitigation
Seaside School District Comprehensive Plan and Zoning Map and Text Amendment Request	June 2017	Seaside School District, Westbrook Planning.	SSD followed a lengthy process to secure the ability to construct the new school complex out of the tsunami zone. This Comp Plan text and map amendment was part of that challenge.	These documents and amendments were required in order to secure permission to construct the new school building outside of the tsunami zone.
Seaside School District Strategic Plan	2018	Seaside School District	SSD's priorities for managing the campus and education of students in the District.	Indicates how the District priorities relate to education about and protection from risk of tsunamis.
City of Seaside Emergency Operations Plan	Adopted 2010	City of Seaside	Coordinates the City's response to incidents using an Incident Command System	

Mitigation Actions

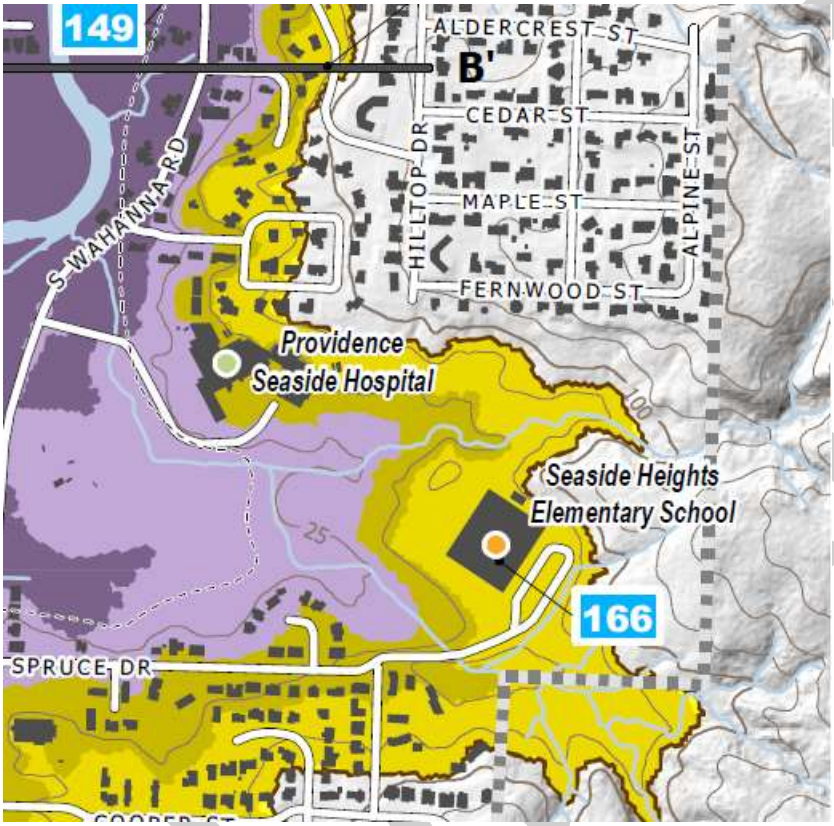
Table II-108. Seaside School District Mitigation Actions

Hazard	Seaside School District 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Tsunami	Seaside Schools Relocation Project, see description below.	H	2015-2020	The Seaside School District is nearing completion on a $100 million tsunami relocation project of three schools located in the inundation zone.	SSD, GO Bond, Seaside, Weyco, others.
Earthquake	Seismic Retrofit of Seaside Heights Elementary School	H	2015-2020	As part of the tsunami relocation project, the site chosen had a pre-existing school that needed to be upgraded.	Seismic School Rehabilitation Fund
Multi-Hazards	Student preparedness and education.	H	0-36 months	The SSD will continue to prepare students, staff, and facilities for the risk of disaster through education and supplies.	SSD general fund, other sources

Seaside Schools Tsunami Relocation Project

The Seaside School District is nearing completion on a $100 million tsunami school relocation project. The new site is situated at an elevation (80'-100') that is modeled to be above the largest possible tsunami—a size termed XXL in the evacuation models. Broadway Middle School and Seaside High School are moving to this new site. In addition, an existing school site above the "large" tsunami zone, is adjacent to the relocation site and is being renovated to accommodate the incorporation of Gearhart Elementary into Seaside Heights Elementary, forming a new school called Pacific Ridge Elementary.

Figure II-87. Location of the Seaside elementary school in relation to the tsunami zone



Source: DOGAMI, 2013. *Tsunami Inundation Maps for Gearhart-Seaside, Clatsop County, Oregon*.

The goals for the project were to provide a suitable site for a new school campus that were (1) outside of the tsunami inundation zone, or where tsunami evacuation was feasible, and (2) located on relatively flat and stable ground with access to public streets and utilities. The District needed a site of about 50 acres in addition to the existing property.

The project required a comprehensive plan and zoning ordinance amendment because the District was forced to look outside the Seaside Urban Growth Boundary (UGB) to find a suitable site because there were no suitable sites within the UGB or within nearby rural exception areas. This project pioneered the regulatory pathway for facility relocation in Oregon.

Based on the District's analysis over two decades, land owned by Weyerhaeuser (Tax Lot 2102 east of Seaside Heights Elementary) was determined to best meet school campus siting requirements included in the Seaside Comprehensive Plan. In 2016, Weyerhaeuser generously donated 80 acres of commercial forest land to the District. It was determined that approximately 49 acres of the 80-acre site is developable and needed for the new school campus.

Seaside School District Tsunami Relocation Project was funded with a $99.7 million general obligation bond. It was funded in 2016, after a four year effort to convince voters. The bond came three years after a failed $128.8 million dollar bond approval effort. The approved bond equates to about $1.35 per thousand, a 37.5% total reduction in cost from the previous bond. A home with an assessed value of $200,000 would see a tax hike of about $270 and a $400,000 home about $540. A $2.5 million grant from the Business Oregon Seismic Rehabilitation Grant program supported the project in April 2019. C-pods, storage containers for food and other emergency supplies, are being developed as part of the new school site. Preparedness was built into the plan to relocate the schools and C-pod storage and supplies are planned, funded, and under implementation.

Planning for an evacuation assembly area is underway for the new high school. For facilities staffed primarily by classified staff, the school administration is moving to the new site leaving the Bus Barn as the only facility still in the hazard zone. There is a spot on the hill where it will possibly move. Seismic upgrades for the elementary school location are being completed with Oregon Seismic Rehabilitation Grant program funds.

11. Cannon Beach Rural Fire Protection District

Cannon Beach RFPD is the fire department for the City of Cannon Beach and the surrounding rural areas. It has two stations, one in Cannon Beach and one in the unincorporated community to the south of Arch Cape. Eighty percent of the District's calls are medical (80%), about 10% motor vehicle accident/fire, 5% fire, fire alarm, and fire prevention, and the final 5% are either surf or high-angle rescues on the cliffs of Ecola State Park.

Hazard Vulnerability Analysis

A risk assessment meeting with three staff from Cannon Beach Rural Fire Protection District (Cannon Beach RFPD) on May 8th, 2019 resulted in the following hazard vulnerability rankings for the jurisdiction. Windstorms/ winter storms, landslide, and wildfire ranked as the top three risks the district faces. The HVA reflects the loss exposure table—Cannon Beach RFPD itself has minimum exposure for its buildings. The hazard descriptions below include the hazards they perceive or address in the community primarily.

Table II-109. Cannon Beach RFPD Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Cannon Beach RPFD	L	-	M	L	H	H	M	H	H

Source: CBRFPD, 2019.

Earthquake

Earthquake hazard was ranked for a Cascadia earthquake event scenario but is set at a medium ranking because from a jurisdictional mitigation standpoint, Cannon Beach Fire District has little it can do.

Landslide

During windstorm/winter storm events, landslides are the primary mechanism for isolating the community. This is particularly a concern for providing service to customers in the southern reaches of the county or providing reciprocity to Nehalem Fire and Rescue further south.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario. However, concerns at the District include evacuation protocols for a distant tsunami.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

Generally the community is at low risk from a wildfire event due to high coastal humidity, but in the intermittent dry periods with east winds from summer to late fall, wildfire risk can elevate quickly. Table II-56. Wildfire Exposure indicates 35% of the community is at moderate risk from wildfire. The Countywide mutual aid provides good local coordination; the District would like to see better regional coordination.

Windstorm/Winter Storm

The scenario used to rank this hazard is the 2007 Wind Storm Event that resulted in downed power and communication lines that resulted in closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. For Cannon Beach, the impacts extend to storm waves going over the embankments and affecting local hospitality hotspots like Tolvana, Stephanie, Ocean Lodge, Waves and Webs, and Mo's.

Risk Assessment Summary

The Cannon Beach RFPD's Insurance Services Office (ISO) rating is a Class 3. The following information is relevant for estimating the potential losses facing the District in the event of a disaster.

Table II-110. Cannon Beach Rural Fire Protection District Critical Facility Loss Exposure

	Flood 1% Annual Chance	Earthquake Moderate to Complete Damage	Tsunami CSZ M9.0 – Medium	Landslide High and Very High Susceptibility	Wildfire High Hazard	Coastal Erosion High Hazard
Critical Facilities by Community	**Exposed**	**>50% Prob.**	**Exposed**	**Exposed**	**Exposed**	**Exposed**
Cannon Beach Fire and Rescue	-	-	-	-	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, p.61. DLCD Note: This data is excerpted from the City of Cannon Beach critical facilities table.

Plans and Policies

Table II-111. Cannon Beach RFPD Plans and Policies

Plan/ Policy Name	Date	Owner/Author	Description	Relation to Natural Hazard Mitigation
Clatsop County Community Wildfire Protection Plan	2013	Oregon Dept. of Forestry	Describes priority fire protection areas and actions.	Implementation of the CWPP helps to prevent conflagrations and coordinate resources.

Mitigation Actions

Table II-112. Cannon Beach Fire District Mitigation Actions

Hazard	Cannon Beach Fire District 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Wildfire	Coordinated wildfire prevention effort along the Oregon Coast.	H	2-5 yrs.	See potential for a larger regional effort.	ODF, OPRD, Tillamook and Clatsop counties.
Winter Storm/ Tsunami	Prepare tourist facilities at risk of winter storm or distant tsunami flooding	H	2-5 yrs.	See need for a coordinated local effort.	CB Fire, Cannon Beach
Multi-Hazard	Ensure uninterrupted emergency communications to the south coast: install fiber to both CBFD stations to foster installation of a repeater.	H	2-5 yrs.	Cost estimate for fiber to Arch Cape ~$16k.	CB Fire, Cannon Beach
Multi-Hazard	Ensure uninterrupted emergency communications to the south coast: ensure system is as efficient and effective as possible.	H	2-5 yrs.	The dual PSAP system adds complexity as dispatch is a separate channel not on repeaters	CB Fire, Astoria and Seaside PSAPs, other fire agencies.

12. Knappa-Svensen-Burnside Rural Fire Protection District

Knappa Fire provides services to a large area with somewhat unique characteristics when compared to the other population centers of Clatsop County. While the Knappa area does include low-lying areas along the Columbia River that are subject to inundation from high tides and to a small degree tsunami, the Knappa District is integral to the Highway 30 lifeline—the northern travel corridor in and out of Clatsop County. Resilience in the area is drawn from the fishing and logging community, as well as the construction and paper industries—the majority of the residents have very practical skills.

Hazard Vulnerability Analysis

Risk assessment meetings with Knappa Fire District (Knappa Fire) staff on occurred in April 2019 with former Fire Chief Paul Olheiser and on June 20, 2019 with both Chief Olheiser and new Fire Chief Kurt Donaldson. These meetings resulted in the following hazard vulnerability rankings for the jurisdiction.

Table II-113. Knappa Fire Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Knappa Fire District	-	L	H	M	M	L	L	M	H

Drought

While the risk of drought is low, declining water levels in the various systems accessed by the Fire District for fire response does pose a concern to the District.

Earthquake

Earthquake risk was ranked for a Cascadia earthquake event scenario. Knappa Fire would be the primary or sole responding agency for the Northwest area of the County in the event of a catastrophic event.

Flood

Flood risk is ranked for the risk of a dam breach which is low probability as well as for the risk of a levee failure along a section of the Columbia River. For example, the entire community of Brownsmead is at risk of a levee failure. The ranking is only medium as the community would have ample notice of any potential risk.

Landslide

Landslide risk is moderate for Knappa Fire—it is based on a scenario of a landslide that impacts a bridge. In most scenarios, this would only impact one direction of traffic—a logistical concern but not a life safety one.

Tsunami

Tsunami risk was ranked for either a Cascadia earthquake or distant tsunami event scenario. The Knappa Fire District is uniquely safe from tsunami in the event of a major earthquake locally or in distant locales.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

The 2013 Arch Cape 300 acre fire is the scenario used to rank the risk of this hazard. High risk fire times are primarily November through February when slash pile burns are at risk of getting out of control from east winds and fire resources are not deployed.

Windstorm/Winter Storm

The scenario used to rank this hazard is the 2007 Wind Storm Event that resulted in downed power and communication lines that resulted in closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks.

Risk Assessment Summary

Knappa Fire District's Insurance Services Office (ISO) rating is a Class 4.

Table II-114. Knappa Fire Critical Facilities

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Clatsop County Public Works	-	X	-	-	-	-
Clatsop County Sheriff	-	X	-	-	-	-
Hilda Lahti Elementary School	-	X	-	-	-	-
Knappa High School	-	X	-	-	-	-
Knappa Svensen RFPD	-	X	-	-	-	-
Knappa Water Association	-	X	-	X	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, p.55. DLCD Note: Brownsmead RFPD is operated by Knappa Fire is subject to a 1% annual flood event and earthquake damage. John Day—Fern Hill Fire Station is also operated by Knappa Fire and is subject to earthquake and landslide risk (Clatsop County critical facilities table, p.51).

Table II-115. Unincorporated community of Svensen-Knappa hazard profile.

Community Overview					
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)	
Svensen-Knappa	3,013	1,652	6	178,049,000	

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	17	0.6%	6	0	44,000	0.0%
*Earthquake**	*CSZ M9.0 Deterministic*	782	26%	523	6	37,280,000	21%
Earthquake (within Tsunami Zone)		0	0.0%	0	0	0	0.0%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	0	0.0%	0	0	0	0.0%
Tsunami	Senate Bill 379 Regulatory Line	10	0.3%	8	0	660,000	0.4%
Landslide	High and Very High Susceptibility	1,129	38%	719	1	68,858,000	39%
Wildfire	High Hazard	112	3.7%	58	0	5,607,000	3.1%

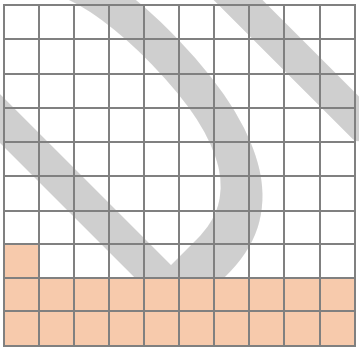
*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Table II-116. Unincorporated community of Svensen-Knappa loss ratio from Cascadia event



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Plans and Policies

Table II-117. Knappa Fire Plans and Policies

Plan/ Policy Name	Date	Owner/Author	Description	Relation to Natural Hazard Mitigation
Clatsop County Community Wildfire Protection Plan	2013	Oregon Dept. of Forestry	Describes priority fire protection areas and actions.	Implementation of the CWPP helps to prevent conflagrations and coordinate resources.

Mitigation Actions

Table II-118. Knappa Fire District Mitigation Actions

Hazard	Knappa Fire District 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Earthquake	Seismic upgrade of Knappa Fire Station.	H			Knappa Fire
Multi-Hazard	Support the seismic improvement of area lifelines such as bridges including: John Day Bridge, Mill Creek, Ferris, Bear, Mary's, and the two bridges between Knappa and Bradwood.	H		Knappa Fire does not have jurisdiction or authority over area bridges.	Oregon Dept. of Transportation, Clatsop County, Others.
Multi-Hazard	Support utility upgrades that reduce the risk of fire in hazard events: e.g. utility shutoff valves, undergrounding powerlines, etc.	H		Knappa Fire does not have jurisdiction or authority over area utilities.	Pacific Power, Dept of Energy

13. Lewis and Clark Rural Fire Protection District

Lewis and Clark Fire Mitigation Goal: Protect the 3,000 people of Jeffers Garden & Miles Crossing. The priority hazards for the District are consistent with many other jurisdictions in ranking windstorm and winter storm as the most frequent event, together with a Cascadia earthquake event as the most potentially catastrophic. However, Lewis & Clark Fire District's service territory is also at risk of flooding linked to its location on an estuary behind a levee—both chronic flooding and potentially catastrophic.

Hazard Vulnerability Analysis

A risk assessment meeting with Lewis & Clark Fire District staff occurred on May 1st, 2019 and included Jeff Golightly, Flint Helligso, and Pam Reber. The meeting resulted in the following hazard vulnerability rankings for the jurisdiction.

Table II-119. Lewis & Clark RFPD Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Lewis & Clark Fire District	-	-	H	H	M	H	L	M	H

Source: LCRFPD, 2019.

Earthquake

Earthquake risk was ranked for a Cascadia earthquake event scenario.

Flood

Flood risk was ranked based on two scenarios. The first is an annual event with groundwater and precipitation-driven flooding behind levees. The second is a levee breach in one or more locations every 1.5 years.

Landslide

Landslide risk was considered for a temporary or permanent road closure.

Tsunami

Tsunami risk was ranked for a Cascadia earthquake event scenario.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

Generally the community is at low risk from a wildfire event due to high coastal humidity, but in the intermittent dry periods with east winds from summer to late fall, wildfire risk can elevate quickly. The Wildfire Exposure table on page 204 indicates that 11% of Clatsop County is subject to high wildfire risk and 44% is subject to moderate risk and that 29% of Warrenton is at high risk from wildfire and 18% is at moderate risk.

Fires in the County are addressed through mutual aid. Clatsop County has been lucky in the summer as small fires have been caught quickly, but the risk is high due to the frequent high winds. Fire risk keeps getting worse as the region is getting much less coastal precipitation. A few days of east wind and it is dry. For example, on April 30, 2019, the humidity was 26%. High risk fire times are primarily November through February when slash pile burns are at risk of getting out of control from east winds and fire resources are not deployed. In the District, high risk areas include Fort Clatsop which is all heavy timber with large facilities, not the beach grass like near the cities of Gearhart and Warrenton.

Windstorm/Winter Storm

The scenario used to rank this hazard is the 2007 Wind Storm Event that resulted in downed power and communication lines that resulted in closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks. The frequency assumed was a 15-20 year interval.

Risk Assessment Summary

Lewis and Clark Fire District's Insurance Services Office (ISO) rating improved from a Class 8-10 to a Class 3-4.

Table II-120. Lewis and Clark Fire District critical facilities

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Lewis & Clark Elementary	-	X	-	X	X	-
Lewis & Clark RFPD	X	X	X	-	X	-
Miles Crossing Sanitary Sewer District	X	-	X	-	X	-
Youngs River-Lewis & Clark Water	X	X	X	X	-	-

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020. DLCD Note: This table was adapted from the Unincorporated Clatsop County critical facilities table.

Plans and Policies

Table II-121. Lewis and Clark Fire Plans and Policies

Plan/ Policy Name	Date	Owner/Author	Description	Relation to Natural Hazard Mitigation
Clatsop County Community Wildfire Protection Plan	2013	Oregon Dept. of Forestry	Describes priority fire protection areas and actions.	Implementation of the CWPP helps to prevent conflagrations and coordinate resources.

Mitigation Actions

Table II-122. Lewis and Clark Fire District Mitigation Actions

#	Hazard	Lewis and Clark Fire District 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
#1	Tsunami	Relocate of primary Fire Station facility	High	2-5 yrs.	Fire Station is integral to the proper evacuation of the large, low-lying area vulnerable to tsunami. Relocation to higher ground has a secondary benefit of improving response times to most of the District.	Lewis and Clark Fire District
#2	Tsunami	Updates to upper Fire Station facility (bath, office, bays, etc.)	High	2-5 yrs.	The upper Fire Station facility is integral to District operations if the primary facility is destroyed in a tsunami event.	Lewis and Clark Fire District
#3	Tsunami	Install Conex container cache sites in the Fire District; secure funds for regular maintenance, training.	High	2-5 yrs.	Lewis and Clark Fire Chief has extensive experience with caches and is willing to coordinate to install and maintain caches in the county.	Lewis and Clark Fire District
#4	Flood	Elevation and certification of dikes necessary to protect Miles Crossing and Jeffers Gardens.	High	2-5 yrs.	The levees and dikes maintained by the City are integral to the safety of the Fire District's residents.	City of Warrenton
#5	Earthquake	Elevate and reinforce the roads in Jeffers Gardens	High	10-20 yrs.	The roads through Jeffers Gardens are lifelines when Highway 101 is down; they need to be resilient to hazards for the safety of the entirety of Northwest Clatsop County.	Clatsop County, Oregon Dept. of Transportation

14. Arch Cape Domestic Water Supply District

Arch Cape Domestic Water Supply District is managed by an independent Board of Directors, but shares operations staff with Arch Cape Sanitary District. The community risk profile sections differ in that one reflects risks to the domestic water supply system (this chapter) and the other reflects risks to the sanitary system (Chapter 15 Arch Cape Sanitary District).

Hazard Vulnerability Analysis

Arch Cape Water representatives met with the DLCD Project Manager on June 3, 2019 to conduct the risk assessment for the District. A preliminary call occurred in April 2019 and a follow up meeting occurred August 28th, 2019 with individual board members. Board input was received on January 15th, 2021 and resulted in an increase in the wildfire vulnerability ranking.

Table II-123. Arch Cape Water District Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Arch Cape Domestic Water Supply District	-	H	M	L	H	M	-	H	H

Source: Arch Cape Risk Assessment meetings, 2019.

Earthquake

Earthquake risk was ranked for a Cascadia earthquake event scenario.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

A wildfire could threaten water and sanitary district infrastructure. ACWD retains a base pool for firefighting per statute.

Windstorm and Winter Storm

The scenario used to rank this hazard is the 2007 Wind Storm Event that resulted in downed power and communication lines that resulted in closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks.

Risk Assessment Summary

Table II-124. Arch Cape Water District Hazard Vulnerability Table

WATER DISTRICT RISK	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm	MITIGATION
Damage to Water Tower	-		H				-		H	Make seismic upgrades; manage vegetation and slope adjacent to tower.
Breakage/Inundation of Water Lines	-		H		M		-			No way to mitigate except flexible connectors in a couple of locations.
Damage to Pumping Station (Asbury Creek)	-		H	H		H	-	M	M	Make seismic upgrades to building.
Electrical Outage of Pumping Station (no generator)	-		H	H		L	-		H	Purchase and install a standby generator Upgrade electrical system for a connection to a standby generator.
Damage to Water Plant Buildings	-		H			M	-	L		Make seismic upgrades to building.
No power to operate Water Plant Inoperable Generators for Plant / Stations Cannot obtain sufficient fuel for generator due to transportation blockage.	-		H		H	H	-		L	• Upgrade facility to house standby generator • Purchase standby generator • Purchase larger fuel storage tank • Outfit building with solar power capability
Depletion of Water Supply Water supply can be depleted in 3 ways 1) drought so there isn't sufficient water from our current supply, 2) slide so that current water supply become rerouted and doesn't get where it needs to be, 3) current water supply continues but becomes unusable due to contamination.	-	M			H	M	L	L		• Purchase watershed • Find location and dig well, connect as a water source • Build second Water Reservoir, connect as a water source.

Source: Phil Chick and Bill Campbell, 2020.

The following information is relevant for estimating the potential losses facing the District in the event of a disaster.

Table II-125. Arch Cape Domestic Water Supply District Critical Facility Exposure

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Arch Cape Dom Water Supply	-	X	-	X	-	-
Arch Cape Sanitary District	-	X	-	-	-	-

Source: Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020. DLCD Note: This table was adapted from the Unincorporated Clatsop County critical facilities table.

Arch Cape Hazard Profile

Table II-126. Unincorporated community of Arch Cape hazard profile.

Community Overview				
Community Name	Population	Number of Buildings	Critical Facilities[1]	Total Building Value ($)
Arch Cape	183	462	4	113,684,000

Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate ($)	Loss Ratio
Flood[2]	1% Annual Chance	9	5.1%	15	0	1,113,000	1.0%
*Earthquake**	*CSZ M9.0 Deterministic*	20	11%	76	2	16,694,000	15%
Earthquake (within Tsunami Zone)		6	3.5%	32	1	7,126,000	6.3%

Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value ($)	Percent of Exposure
Tsunami	*CSZ M9.0 – Medium*	59	32%	162	1	43,350,000	38%
Tsunami	Senate Bill 379 Regulatory Line	88	48%	253	1	63,972,000	56%
Landslide	High and Very High Susceptibility	57	31%	135	1	31,372,000	28%
Coastal Erosion	High Hazard	16	8.9%	50	0	12,270,000	11%
Wildfire	High Hazard	1	0.7%	3	0	838,000	0.7%

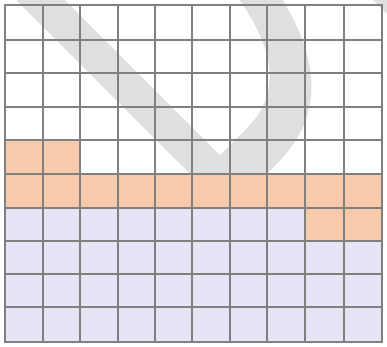
*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.

[1]Facilities with multiple buildings were consolidated into one building complex.

[2]No damage is estimated for exposed structures with "First floor height" above the level of flooding (base flood elevation).

Figure II-88. Unincorporated community of Arch Cape loss ratio from Cascadia event



Each cell represents 1% of building value, so the grid represents 100% of total building value. The magnitude 9.0 CSZ event is predicted to simultaneously produce a damaging earthquake and tsunami. Hazus-MH modeling for loss ratio is available only for earthquake. Buildings with exposure to the tsunami inundation zone are assumed to be completely damaged, which would be 100% loss ratio. To avoid double counting of buildings, the earthquake loss ratio was calculated only for buildings outside of the tsunami zone.

†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020, p.52.

Plans & Policies

Table II-127. Arch Cape Water District Plans and Policies

Plan/ Policy Name	Date	Owner/Author	Description	Relation to Natural Hazard Mitigation
ACWD Water System Master Plan	April 2005	Arch Cape Water District	A comprehensive analysis of the Arch Cape water distribution system. Makes recommendations for facility improvements based on current deficiencies and future needs.	ACWD uses the Master Plan to prioritize mitigation actions.
Water Management and Conservation Plan	Dec. 2015	Arch Cape Water District	The plan details the water sources and water supply future for the Water District.	The plan identifies hazards to the system and various actions required to manage those hazards including earthquake, tsunami, drought, etc.

Mitigation Actions

Table II-128. Arch Cape Water District Mitigation Actions

#	Hazard	Arch Cape Domestic Water Supply District 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
1	Multi-Hazard	Protect water supply and prevent its depletion via drought, slide, or contamination by protecting current source and/or developing a second water source: 1) Purchase watershed; 2) Find location and dig well, then connect well as a water source; 3) Build a second Water Reservoir, connect as a water source.	H - Highest priority	1-3 years	Have submitted application for Federal Grant to purchase watershed.	ACDWSD/ Clatsop County/ ODF/USDA/ Sustainable NW /North Coast Land Conservancy
2	Multi-Hazard	Reduce or prevent damage to the Water Tower from a hazard event: 1) Make seismic upgrades to Water Tower; 2) Manage slope adjacent to tower and vegetation	H - High priority	1-3 years	Dependent on 1) engineering assessment of viability/feasibility 2) Funding	ACDWSD/FEMA HMGP or BRIC
3	Multi-Hazard	Reduce or prevent damage to the Water Plant Buildings from a hazard event: 1) Make seismic upgrades the Water Plant building; 2) install flexible connectors that prevent breakage of Water Lines.	H - High priority	1-3 years	Dependent on 1) engineering assessment of viability/feasibility 2) Funding	ACDWSD/FEMA HMGP or BRIC
4	Wildfire	Keeping roads graded, maintained, and clear of brush to allow access of emergency vehicles; including the management of water runoff.	H - High priority	3-5 years	Pending implementation of Forest Management Plan (Sept. 2021).	State and federal funding: ODF, USFS, NRCS, HMGP
5	Wildfire	Forest management treatments that reduce the risk of wildfire.	H - High priority	3-5 years	Pending implementation of Forest Management Plan (Sept. 2021).	State and federal funding: ODF, USFS, NRCS, HMGP
6	Multi-Hazard	Increase timeframe that Water Plant can be operated when area's transportation infrastructure is damaged by 1) Purchase larger fuel cell, 2) Upgrade facility to house a standby generator and purchase standby generator	M - Important	3-5 years	Dependent on Funding	ACDWSD/FEMA BRIC or HMGP

15. Arch Cape Sanitary District

Hazard Vulnerability Analysis

Arch Cape Water representatives met with the DLCD Project Manager on June 3, 2019 to conduct the risk assessment for the District. A preliminary call occurred in April 2019 and a follow up meeting occurred August 28th, 2019 with individual board members. Board input was received on January 15th, 2021 and resulted in an increase in the wildfire vulnerability ranking.

Table II-129. Arch Cape Sanitary District Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Arch Cape Sanitary District	-	H	M	L	H	M	-	H	H

Source: Chick,P., Schiffman, R. and B.Campbell, 2019.

Earthquake

Earthquake risk was ranked for a Cascadia earthquake event scenario.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

A wildfire could threaten water and sanitary district infrastructure. ACWD retains a base pool for firefighting per statute.

Windstorm and Winter Storm

The scenario used to rank this hazard is the 2007 Wind Storm Event that resulted in downed power and communication lines that resulted in closed roads, loss of power, and loss of telecommunications across the County for nearly two weeks.

Risk Assessment Summary

Table II-130. Arch Cape Sanitary District Hazard Vulnerability Table

SANITARY DISTRICT RISK	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm	MITIGATION
Breakage/Inundation of Sewer Lines (sewage backing up onto streets and into homes).	-		H		M	H	-			No way to mitigate.
Damage to Pumping Stations			H	H		H				• Make seismic upgrades (earthquake) • Elevate two of the pumping station (rising water)
Damage to Treatment Plant, including equipment, tanks, electrical, and inflow-outflow.	-	-	H	L		H	-	M		Make seismic upgrades. Conduct wildfire mitigation in forest including road maintenance for emergency vehicle access.
Damage to Treatment Plant Buildings	-		H				-			Make seismic upgrades.
Insufficient on-site fuel resources for generator due to regional transportation blockages from downed trees, washed out roads, etc. • Treatment Plant and Pump Stations Generators are inoperable without power; • If sufficient fuel cannot be brought in, on-site resources must be fortified.	-		H	L	H	H	-	L	H	Purchase larger fuel storage tank. Outfit buildings with solar power capability.

Source: Phil Chick and Bill Campbell, 2020.

The following information is relevant for estimating the potential losses facing the District in the event of a disaster.

Table II-131. Arch Cape Sanitary District Critical Facility Exposure

Critical Facilities by Community	Flood 1% Annual Chance Exposed	Earthquake Moderate to Complete Damage >50% Prob.	Tsunami CSZ M9.0 – Medium Exposed	Landslide High and Very High Susceptibility Exposed	Wildfire High Hazard Exposed	Coastal Erosion High Hazard Exposed
Arch Cape Dom Water Supply	-	X	-	X	-	-
Arch Cape Sanitary District	-	X	-	-	-	-

Source: Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020. DLCD Note: This table was adapted from the Unincorporated Clatsop County critical facilities table.

Plans & Policies

Table II-132. Arch Cape Sanitary District Plans and Policies

Plan/ Policy Name	Date	Owner/Author	Description	Relation to Natural Hazard Mitigation
Wastewater Facility Master Plan	2006	Arch Cape Sanitary District	A comprehensive analysis of the Arch Cape sanitary system. Makes recommendations for facility improvements based on current deficiencies and future needs.	ACWD uses the Master Plan to prioritize mitigation actions.

Mitigation Actions

Table II-133. Arch Cape Sanitary District Mitigation Actions

#	Hazard	Arch Cape Sanitary District 2020-2025 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
#1	Earthquake	Reduce or prevent damage to the Treatment Plant by making seismic upgrades to the buildings.	H - Highest priority	1-3 years	Dependent on 1) engineering assessment of viability/feasibility 2) Funding	ACDWSD/Funding Source
#2	Widlfire	Keeping roads graded, maintained, and clear of brush to allow access of emergency vehicles; including the management of water runoff.	H - High priority	3-5 years	Pending implementation of Forest Management Plan (Sept. 2021).	State and federal funding: ODF, USFS, NRCS, HMGP.
#3	Wildfire	Forest management treatments that reduce the risk of wildfire	H - High priority	3-5 years	Pending implementation of Forest Management Plan (Sept. 2021).	State and federal funding: ODF, USFS, NRCS, HMGP.
#4	Multi-Hazard	Increase timeframe that Sanitation Plant can be operated when area's transportation infrastructure is damaged by 1) Purchase larger fuel cell, 2) Upgrade facility to house a standby generator and purchase standby generator	M - Important	3-5 years	Dependent on Funding	ACDWSD/Funding Source
#5	Multi-Hazard	Reduce or prevent damage to the Pumping Stations from rising water of a flood or tsunami event by elevating two of the pumping stations.	M - Important	3-5 years	Dependent on Funding	ACDWSD/Funding Source

16. Falcon Cove Beach Water District

The FCBWD Board considers the odds of having a natural disaster to be high, and thus seek to adopt the best practices for preparation and mitigation, including the ability to access federal mitigation funding.

Hazard Vulnerability Analysis

The District's current position on its top hazards is described below; Charles Dice and Pam Reber met for a risk assessment meeting on June 19, 2019. Risk for the Arch Cape/Falcon Cove areas is also discussed in the coastal erosion hazard chapter.

Table II-134. Falcon Cove Beach Water District Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Falcon Cove Beach Water	H	H	H	M	M	H	L	H	H

Source: Dice, C., 2019.

Coastal erosion:

Falcon Cove lost four homes to coastal erosion over the past 40 years; it will likely lose 2 more in the next 5 years. There is no mitigation as this area is located on a coastal escarpment. FCBWD does not have the authority to regulate development. The water district does have some water distribution lines at risk, but their concrete reservoirs are at 250' elevation so they are relatively secure.

Drought

FCBWD faces supply challenges due to drought. There have been five years of consecutive drought since 2014, resulting in a drop in production each year in late summer—August/September. The possibility of these drier conditions continuing into the future due to climate change poses a major risk to water supply for the current population.

The current water supply situation has resulted in a moratorium on the development of additional lots in the community. The moratorium/ ongoing drought has two main mitigation solutions—conservation and additional water source development. The development of a new well is identified in the Capital Improvement Plan. Water conservation kits provided by Energy Trust were distributed to the local community. Implementation of a water conservation and curtailment plan has 3 levels: 1) irrigation reduced: no washing boats and cars; 2) no irrigation or hose use; 3) restrict water use altogether down to certain levels to be set by current storage and statutory requirements. The long-term strategy of watershed protection is also supported by FCBWD but largely beyond the scope of the District; land ownership is limited to the 20-30 acres immediately adjacent to the spring. In 2019, the North Coast

Land Conservancy was pursuing the purchase of approximately 5,000 acres of timberland in the south county. That effort would secure 80% of drinking water supply watershed for FCBWD.

Earthquake

Earthquake hazard was ranked for a Cascadia earthquake event scenario. FCBWD has plans to install seismic valves on the output distribution line for the two primary reservoirs (105K + 80K).

Flood

Some individual homes in Falcon Cove are located in VE flood zones, but FCBWD does not have infrastructure in these flood-prone areas. King tides are much more of a concern due to their capacity to exacerbate coastal erosion.

Tsunami

Tsunami hazard was ranked for a Cascadia earthquake event scenario. About half of community would be affected by a distant tsunami, but this is not critical to the water system other than the distribution pipe to the affected homes. Distribution pipes are 24-36” below ground.

Volcanic Event

An event similar to the eruption of Mount St. Helens that delivered less than a half inch of ash to the area is the scenario ranked.

Wildfire

The North Spring pump house is surrounded by forest and is the most prone asset at risk from fire. A severe conflagration in the south county could wipe out the Falcon Cove area if the fire was severe. However, being situated on only the west side of Highway 101 and adjacent to lands that have minimal human access, the risk is lower than many areas. The forest management regime has likely suppressed wildfire historically, but State Parks works with regional partners to use best practices for land management and species conservation.

Wind and Winter Storm

FCBWD was affected by the winter storm in 2007; the event used to rank this hazard. A lot of trees went down in the community, which was not unusual as every winter we have windstorms that knock out power and close roads. The main risk of the wind/winter storm hazard to FCBWD is of the trees that could fall on spring and pump house or a very large tree that could damage the concrete reservoir. All connections rely on gravity-fed water, so power outages do not impact that supply flow. A pump is needed to get water to the reservoir, so resupplying storage is limited without electricity. For power outages resulting from wind/winter storms FCBWD has 1-2 weeks of water capacity. After that, supply is replenished via a generator, but FCBWD fuel supply is limited to the 50 gallons of diesel on hand which would provide another 3 days of supply.

Risk Assessment Summary

The following information is relevant for estimating the potential losses facing the District in the event of a disaster.

FCBWD Assets include:

- North Spring
- North Spring Equipment/Inventory
- North Spring Water Rights Permit
- South Spring
- South Spring Equipment/Inventory
- South Spring Water Rights Permit
- Acreage around springs
- 20K Reservoir
- 80K Reservoir
- 105K Reservoir
- Equipment: pressure tank, booster pump, air valves
- Fire hydrants-14

Table II-135. Replacement Cost of Existing Assets

FALCON COVE BEACH DOMESTIC WATER SUPPLY DISTRICT
WATER SYSTEM DEVELOPMENT CHARGE
REPLACEMENT COST OF EXISTING ASSETS
AUGUST 2018 ENR CCI 11,124

	Capital Asset	*Replacement Cost 2018*
1	**Distribution System Improvements**	
1.1	$463,189 pre-2003, ENR 6694; less $137,290 contributions	$632,430
1.2	Waring St. Pipeline, $13,900 in 2005, ENR 7446	20,700
1.3	Tide Avenue, $49,540 in 2005, ENR 7446	74,000
1.4	Ray Brown Rd. $10,700 in 2006, ENR 7751	15,300
2	**North Springs Source**	
2.1	Spring House, 24'6" x 18' CMU	36,000
2.2	Pump House, 22'6" x 8', Duplex PS, Disinfection	60,000
2.3	Office, 10' x 10'	18,000
3	**South Springs Source**	
3.1	Collection Basin $70,000, less Outstanding Debt $25,800, less Forgivable Loan $38,790	6,300
3.2	20,000 g Storage Tank	32,000
3.3	Simplex Pump Station & Controls	40,000
4	**Storage Systems:**	
4.1	79,400 g ~~Concrete Reservoir, $110,000~~ in 1990, ENR 4732, less $83,800 outstanding Debt	174,800
4.2	105,000 g Concrete Reservoir, 2010 ENR 8799	340,000
5	**SCADA & Telemetry Improvements**	44,000
	TOTAL ASSET VALUE	**$1,493,530**

No debt on BOK,

Source: Curran-McLeod, 2018.

Plans and Policies

Table II-136. Falcon Cove Beach Water District Plans and Policies

Plan/ Policy Name	Date	Owner/Author	Description	Relation to Natural Hazard Mitigation
Operations & Maintenance Manual	Revised 2018	Falcon Cove Beach Domestic Water Supply District (FCBWD)	This document will outline how Falcon Cove Beach Water District (FCBWD) is operated on a day to day basis to ensure public health, safety, and compliance with all applicable regulations.	
Water System Development Charge Update and Capital Improvement Plan	Updated Sept 2018	Curran-McLeod, Inc. Consulting Engineers; FCBWD	The purpose of this document is to authorize, plan, and establish the basis for funding water system development charges and capital improvements.	
South Spring Improvement Plan	2016	FCBWD	Drafted in order to apply for Oregon IFA Safe Drinking Water Revolving Loan Fund Grant	
Water Conservation and Curtailment Plan		FCBWD, IFA		
Coliform Sampling Plan		FCBWD		
Backflow/Cross Connect Ordinance		Clatsop County		

Mitigation Actions

Table II-137. Falcon Cove Beach Water District Mitigation Actions

#	Hazard	Falcon Cove Beach Water District 2021-2026 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
#1	Wind/ Winter storm	Cutting the trees at the reservoir site that put tank at risk; Clearing around pump and springhouses.	H	1-2 yrs.	Less than $10k; important action will show progress while larger projects develop.	FCBWD
#2	Earthquake	Install seismic valves on the output of the two reservoirs to retain storage post-event.	H	2-5 yrs.	Project cost estimate $30-40k	FCBWD
#3	Drought	Put in another well.	H	2-5 yrs.	Project cost estimate $60k	FCBWD
#4	Drought	Automate the intertie between the north and south spring systems. The south spring dries every summer so it needs to be tied in manually, but plan to automate.	M	2-5 yrs.		FCBWD
#5	Multi-Hazard	Build capacity; secure funding for staffing.	H	1-2 yrs.		FCBWD

According to Curran-McLeod in 2018, developing sufficient water source to meet peak day demands is the most pressing issue for the District. "The North and South Springs are both susceptible to diminished flows depending upon the weather. Securing additional source is difficult and costly, but necessary. Options may include additional spring source development (or) well construction or implementation of an Aquifer Storage and Recovery (ASR) Facility... Operationally, the District may be required to truck water during critical time periods."

Capital Improvements that can improve operations:

Tide Avenue Pump Station should be replaced with a connection between the Tide Avenue line and the 20,000 gallon tank to address the lack of reliability and avoid the confined space permit needed. Curran-McLeod engineers also determined that the pump station has a "substantial amount of safety and operational deficiencies and should be abandoned." (Curran-McLeod, 2018)

Regular Maintenance of Infrastructure

The Falcon Cove Beach Water District conducts regular maintenance and system upgrades consistent with best practices and State drinking water regulations. The following projects occurred in the past five years—other records are available upon request (C.Dice, 2018).

2018 - Make repairs to Tide Ave Booster Pump vault to stop leaks; Replace WellMate WM4 Pressure tank at Tide Ave Booster Pump.

2017 – Install rebuilt LMI Pump and clean 50gal solution tank at South Spring; Install new Mercoid Switch at Tide Ave. Booster Pump.

2016 – Oregon IFA Safe Drinking Water Revolving Loan Fund Grant/Loan Project to Improve the South Spring site, including: Installation of new Spring Collection Vault (Concrete 72"ID, 8foot tall vault); Installation of new 4" PVC collection pipe into underground Spring Source; Installation of new 4" PVC overflow pipe; and Installation of Telemetry for SCADA system at North Spring for monitoring.

2015 - Service connection from Ray Brown 8 inch to North Spring Pump House. "South Spring Improvement Plan" approved by IFA.2005 – June/July 2005 - Tide Ave replace 4" Transite waterline with 8" C900 PVC waterline from Columbia & Tide to Tide Ave Booster Pump with 8" C900 PVC water line continuing on to Fire Hydrant at Tide & Falcon Lane. Install new Fire Hydrant, move old FH to Tillamook & Ray Brown.

D. Risk Assessment Findings

The following pages present information from the three key sources of data that informed the 2021 Clatsop County plan update and then calls out the key takeaways of hazard vulnerability concern and the specific areas in which all sixteen jurisdictions share joint mitigation priorities.

- Natural Hazard Risk Report for Clatsop County
- Future Climate Projections – Clatsop County
- Hazard Vulnerability Analysis
- Risk Assessment Summary

Natural Hazard Risk Report for Clatsop County

The selected countywide results and conclusions of the DOGAMI *Natural Hazard Risk Report for Clatsop County, Oregon, Including the Cities of Astoria, Cannon Beach, Gearhart, Seaside, and Warrenton and the Unincorporated Communities of Arch Cape, Svensen-Knappa, and Westport (*Open-File Report O-20-16). https://www.oregongeology.org/pubs/ofr/p-O-20-16.htm are below.

Figure II-89. DOGAMI Risk Report Countywide Results

Selected Countywide Results
Total buildings: 25,829
Total estimated building value: $5 billion

Cascadia Subduction Zone Magnitude 9.0 Earthquake[a]
Red-tagged buildings[b]: 5,045
Yellow-tagged buildings[c]: 1,314
Loss estimate: $1.2 billion

Cascadia Subduction Zone Tsunami Inundation
Number of buildings exposed: 8,810
Exposed building value: $1.7 billion

100-year Flood Scenario
Number of buildings damaged: 2,529
Loss estimate: $41 million

Landslide Exposure (High and Very High Susceptibility)
Number of buildings exposed: 7,335
Exposed building value: $1.2 billion

Coastal Erosion Exposure (Moderate Hazard)
Number of buildings exposed: 349
Exposed building value: $135 million

Wildfire Exposure (High Hazard)
Number of buildings exposed: 2,467
Exposed building value: $340 million

[a]Results reflect damages caused by earthquake to buildings outside of the tsunami zone. Earthquake and tsunami results combined estimate the total damages from a CSZ M9.0 event.
[b]Red-tagged buildings are considered to be uninhabitable due to complete damage.
[c]Yellow-tagged buildings are considered to be of limited habitability due to extensive damage.

Source: Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020, p.2.

Conclusions

- Extensive overall damage and losses are expected from a Cascadia M9 earthquake and tsunami.
- Retrofitting buildings to modern seismic building codes can reduce damages and losses from earthquake
- Flooding is a threat for some of the communities in Clatsop County
- Elevating structures in the flood zone can reduce vulnerability
- New landslide mapping would increase the accuracy of future risk assessments
- Exposure analysis shows that most communities along the open coast are at risk to coastal erosion hazard
- Wildfire hazard is high for areas near Warrenton, Youngs Bay, and along the Columbia River.
- Most of the study area's critical facilities are at high risk to a CSZ earthquake and tsunami
- The two biggest causes of displacement to population are a CSZ event (earthquake and tsunami) and landslide.
- The results allow communities the ability to compare across hazards and prioritize their needs.

Future Climate Projections – Clatsop County

This report presents future climate projections for Clatsop County relevant to specific natural hazards for the 2020s (2010–2039 average) and 2050s (2040–2069 average) compared to the 1971–2000 average historical baseline. The projections were analyzed for a lower greenhouse gas emissions scenario as well as a higher greenhouse gas emissions scenario, using multiple global climate models.

This summary lists only the projections for the 2050s under the higher emissions scenario. Projections for both time periods and both emissions scenarios can be found within relevant sections of the main report.

Heat Waves

Extreme heat events are expected to increase in frequency, duration, and intensity due to continued warming temperatures. In Clatsop County, the frequency of hot days with temperatures at or above 90°F is projected to increase on average by 3 days (with a range of 0 to 7 days) by the 2050s under the higher emissions scenario compared to the historical baseline. In Clatsop County, the temperature of the hottest day of the year is projected to increase by about 6°F (with a range of about 1 to 9°F) by the 2050s under the higher emissions scenario compared to the historical baseline.

Cold Waves

Cold extremes are still expected to occur from time to time, but with less frequency and intensity as the climate warms. In Clatsop County, the frequency of days at or below freezing is projected to decline by about one day on average by the 2050s under the higher emissions scenario compared to the historical baseline. In Clatsop County, the temperature of the coldest night of the year is projected to increase by about 6°F (with a range of about 0 to 10°F) by the 2050s under the higher emissions scenario compared to the historical baseline.

Heavy Rains

The intensity of extreme precipitation events is expected to increase slightly in the future as the atmosphere warms and is able to hold more water vapor. In Clastop County, the magnitude of precipitation on the wettest day and wettest consecutive five days per year is projected to increase on average by about 16% (with a range of 2% to 32%) and 11% (with a range of ---2% to 24%), respectively, by the 2050s under the higher emissions scenario compared to the historical baseline. In Clatsop County, the frequency of days with at least ¾” of precipitation and the frequency of days exceeding a threshold for landslide risk is not projected to change substantially.

River Flooding

Coastal rain---dominated watersheds, such as the Nehalem River, may experience an increase in winter flood risk due to projected greater winter precipitation and warmer winter temperatures causing precipitation to fall more as rain and less as snow, in addition to increases in the frequency and intensity of flood---producing atmospheric river events.

Drought

Drought conditions, as represented by low summer soil moisture, low spring snowpack, low summer runoff, low summer precipitation, and high summer evaporation are projected to become more frequent in Clatsop County by the 2050s.

Wildfire

Wildfire risk, as expressed through the frequency of very high fire danger days, is projected to increase under future climate change. In Clatsop County, the frequency of very high fire danger days per year is projected to increase on average by about 27% (with a range of ---9 to +76%) by the 2050s under the higher emissions scenario compared to the historical baseline.

Air Quality

Under future climate change, the risk of wildfire smoke exposure is projected to increase in Clatsop County. The number days with high concentrations of wildfire---specific particulate matter is projected to increase by 32% while the intensity of particulate matter concentrations is projected to increase by 63% by 2046–2051 under a medium emissions scenario compared with 2004–2009.

Coastal Erosion & Flooding

The risk of coastal erosion and flooding hazards on the Oregon coast is expected to increase with climate change due to sea level rise and changing wave dynamics. In Clatsop County, local sea level is projected to rise by 0.8 to 4.8 feet by 2100. At these levels, the multi-year likelihood of a flood event reaching four feet above mean high tide is virtually certain to occur by 2100.

Ocean Temperature & Chemistry

Ocean warming, ocean acidification, and decreasing dissolved oxygen levels are leading to alterations in marine ecosystems affecting coastal communities.

Windstorms

Limited research suggests very little, if any, change in the frequency and intensity of windstorms in the Pacific Northwest as a result of climate change.

Increased Invasive Species & Pests

Warming temperatures, altered precipitation patterns, and increasing atmospheric carbon dioxide levels increase the risk for invasive species establishment, insect and plant pests and disease for forests and cropping systems. Warming ocean waters have altered marine species composition with greater prevalence of warm-water species expected during marine heat waves.

Hazard Vulnerability Analysis

The sixteen jurisdictions who participated in this planning process all convened staff together with the DLCD project manager to conduct the OEM Hazard Vulnerability Analysis (HVA) process. While this exercise provides a subjective analysis of relative risk, it puts the hazards in perspective for the participating individuals and subject matter experts, and allows the jurisdictions to draw a more clear line around the intersection of their risk and their responsibilities.

Table II-138. Hazard Vulnerability Analysis Rankings: 16 Jurisdictions

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Event*	Wildfire	Wind/Winter Storm
Unincorporated Clatsop County (rural)	M	H	H	H	L	H	L	L	H
Astoria	H	M	H	H	H	M	M/L	H	H
Cannon Beach	M	M	H	L	M	H	L/L	M	H
Gearhart	L	L	H	L	M	H	L	L	H
Seaside	-	-	H	H	M	H	L	M	H
Warrenton	L	M	M	H	-	H	M	L	H
Port of Astoria	-	-	H	H	M	H	M	L	H
Sunset Empire Transit District	-	L	H	H	M	H	L	L	H
Clatsop Community College	-	L	M	H	M	M	M	L	H
Seaside School District	-	L	H	M	M	H	L	M	H
Cannon Beach RPFD	L	-	M	L	H	H	M	H	H
Knappa Fire District	-	L	H	M	M	L	L	M	H
Lewis & Clark Fire District	-	-	H	H	M	H	L	M	H
Arch Cape Water District	-	H	M	L	H	M	-	H	H
Arch Cape Sanitary District	-	H	M	L	H	M	-	H	H
Falcon Cove Beach Water	H	H	H	M	M	H	L	H	H

Source: Clatsop County Multi-Jurisdictional NHMP Update Steering Committee, April-Oct., 2019. *The volcanic event considered most likely is ashfall, but two communities also ranked volcanic debris flow as a hazard which is the second ranking.

The United Nations Office for Disaster Risk Reduction (UNDRR) describes vulnerability as the conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. The positive factors which increase the ability of people to cope with hazards are “capacity” and “coping capacity” (UNDRR, 2020).

Physical Vulnerability may be determined by aspects such as population density of a community or the site, design and materials used for critical infrastructure and for housing. Example: Wooden homes are less likely to collapse in an earthquake, but are more vulnerable to fire (ATSDR, 2016).

Social Vulnerability refers to the inability of people, organizations and societies to withstand adverse impacts to hazards due to characteristics inherent in social interactions, institutions and systems of cultural values. It is linked to the level of well-being of individuals, communities and society. It includes aspects related to levels of literacy and education, safety and security, access to basic human rights, systems of good governance, and social equity. Example: When flooding occurs some citizens, such as children, elderly and differently-able, may be unable to protect themselves or evacuate if necessary (ATSDR, 2016).

Economic Vulnerability. The level of vulnerability is highly dependent upon the economic status of individuals, communities and nations. The poor are usually more vulnerable to disasters because they lack the resources to protect themselves from being negatively impacted. Example: The high cost of housing has resulted in a homeless crisis; being unable to escape the impacts of extreme weather makes it nearly impossible for someone to be healthy or functional in society (ATSDR, 2016).

Environmental Vulnerability. Natural resource depletion and resource degradation are key aspects of environmental vulnerability (ATSDR, 2016). Example: Forests support the retention of moisture, lands that have been harvested may have a lower capacity to retain water and are thus less drought-resilient (ODPM 2020).

Risk Assessment Summary

Clatsop County is at considerable risk from two existential threats—a Cascadia Subduction Zone earthquake and tsunami and future climate projections (climate change). County jurisdictions have received extensive data, had dialogue, and made significant progress on addressing the risk these threats pose, but without external funding and political leadership, this information is not readily transformed into policies and mitigation actions.

Isolation in natural disaster events is a common concern across Clatsop County jurisdictions. Isolation is a risk associated with seven of nine hazards affecting the County, but it is primarily associated with wind/winter storms, tsunami, earthquake, and flood events. Isolation which can be defined as a combination of the absence or loss of some or all of the following: communication, residential power, infrastructure power (water supply, traffic lights, etc.), regional supply routes for food and medicine, travel by vehicle beyond a limited range, and local climatic conditions that pose a life safety risk to vulnerable populations. Community lifelines address isolation. Lifelines are the way resources, information, and people reach a community from the outside or interact with the community on the inside. Besides loss of life and life-threatening structure damage, damage to community lifelines is the single biggest risk to the County jurisdictions because community lifelines are at the core of both survival and a high-quality life.

In addition to the burden of charting new territory for risk reduction with limited funding, each summer the major population hubs of Clatsop County swell in size nearly 10-fold from the influx of tourists. Services and infrastructure are put to the test without the requisite funding to meet the needs posed by these visitors. Property owners who hail from large cities like Portland and Seattle weigh in on local political decisions in complex ways that are very difficult to control or plan around. As a result of this complex and politicized context, the simplest and lowest-risk path forward is a step-by-step approach that works outward from current jurisdiction operations and capital projects. Building consensus and partnerships for bigger projects will take time and capacity. The sixteen jurisdictions participating in this planning effort are committed to this work but understand it is a long term project.

Mitigation Priorities

The Clatsop County MJNHMP Steering Committee has identified the following mitigation priorities:

Tsunami evacuation planning that has enough technical resources, route information, signage, outreach to local and visitor populations, support for vulnerable populations with limited physical and mental abilities, outreach materials for all language groups, funding, and coordination to effectively protect the lives of everyone in the County during a distant or local earthquake event. To accomplish the level of tsunami evacuation planning envisioned by the group, a countywide plan could be warranted that outlines the gaps and needs in the current evacuation planning efforts. Additional technical analysis, designs may include:

- New evacuation routes
- New signage locations
- New signage types (and in additional languages and formats)
- Tsunami evacuation bridges, trails, lanes, and other retrofits of current infrastructure
- Tsunami evacuation towers where the evacuation times are insufficient for the transit time of the target population.
- Evacuation training modules and materials for various sectors (hospitality, etc.)
- Evacuation exercise modules and materials for various sectors (emergency mgmt., etc.)
- Reduce or eliminate damage to critical facilities, services, and equipment from a seismic event.

III. MITIGATION STRATEGY

A. Introduction

Mission

"To create a disaster resilient Clatsop County."

Strategic Vision

Mitigation goals are adaptively managed and mitigation actions are collaboratively implemented using the best available policy, technology, and implementation resources available.

The key components of the vision for the Clatsop County mitigation strategy are:

- Pragmatic Governance: Use an efficient, step-by-step approach, working outward from current jurisdictional operations to implement this plan.
- Community Lifelines: Fortify critical infrastructure and emergency services. Ensure that when community lifelines such as water and power are impacted by natural disaster that local community is resilient enough to address their own essential services for 2 weeks to 3 months.
- Resilient Communities: Support community organizations, CERT teams, ham radio operators, and individuals helping others as people are at the heart of the community and its ability to bounce back.

Pragmatic Governance

An efficient, step-by-step, collaborative approach will be used to implement the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan (MJNHMP), working outward from current jurisdictional operations to implement this plan.

In order to accomplish this, the Clatsop County MJNHMP Steering Committee will:

- Prioritize 1-3 mitigation strategies to collaboratively implement in the next 5 years (2021-2026).
- Meet at least annually to report on progress and provide detailed documentation on how the mitigation actions are being implemented, in addition to identifying the successes and lessons learned.
- Identify key mitigation actions and community risks to address in policies and planning efforts.
- Share materials, successes, and lessons learned for communicating hazard priorities and actions to decision bodies and constituents.

Community Lifelines

As outlined in the Community Lifelines Implementation Toolkit Version 2.0, Community Lifelines enable the continuous operation of critical government and business functions and is essential to human health and safety or economic security (FEMA, Nov. 2019).

- Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function;
- Lifelines are the integrated network of assets, services, and capabilities that are used day-to-day to support the recurring needs of the community;
- When disrupted, decisive intervention (e.g., rapid service re-establishment or employment of contingency response solutions) is required to stabilize the incident.

The following lifeline mitigation actions are priorities for the 2021-2025 Clatsop County MJNHMP:

- Ensure effective tsunami evacuation infrastructure is developed and the relevant plans, policies, routes, signage, and structures are implemented/constructed.
- Support Clatsop County's two hospitals in adapting to the seismic risk of a Cascadia Subduction Zone earthquake event. Targets include zero patient evacuations and no loss of power or water supply.
- Reduce or eliminate damage to critical facilities, services, and equipment. The DOGAMI Natural Hazard Risk Report for Clatsop County (Williams, M. C., Anthony L. H., & O'Brien, F. E., 2020) "estimated that 88% (69) of Clatsop County's 78 critical facilities will be non-functioning after a CSZ event, with 30 of those located within the medium tsunami zone." Mitigate the tsunami and earthquake risk facing the highest risk facilities via retrofit, retreat, or relocation.

Resilient Communities

Resilience is the ability to weather the storm, to bounce back to the original condition or to an even stronger state. When we look to address complex problems like the isolation that results from a winter storm or an earthquake event, people are the key to addressing the isolation that exists before help arrives and systems are restored. Resilient communities are the innate partner of lifelines—they are self-reliance by the whole community, where giving and receiving help is inherent. From stockpiling firewood and preparing for a winter storm to ensuring that water is supplied to local hospitals in the event of an earthquake, the more resilient individual parts of the community is, the stronger the whole is. Thus, the community can become resilient by **building the human networks that foster preparedness and support for reducing risk from hazards locally**. The following strategies support resilient communities:

Support community organizations such as the Red Cross and groups of active individuals like those on a CERT (Community Emergency Response Team) with information/communication, funding, and capacity. A key part of resilience is people helping themselves by planning ahead and helping others to keep the entire community lifted up. Local nonprofits are experts in this work, engage them to support this work being integrated across all sectors and areas of the County.

- Implement the Clatsop MJNHMP Public Engagement Plan to communicate hazard risks, mitigation priorities, and create political momentum to support plan implementation.
- Support Clatsop County Emergency Management's mission of community preparedness.

B. Goals and Objectives

Mitigation Goals

The plan goals guide the mitigation activities of the multi-jurisdictional group. Their aim is to reduce risk and prevent loss of life and assets, and increase community resilience from natural hazards. Seven goals were identified in the 2008 Clatsop County NHMP and reaffirmed in 2015, including:

- 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

The previous seven goals have been revised into the 2021-2026 Clatsop County NHMP Goals. The Goals are not in order of priority:

1. **Reduce or prevent the risk of injury or death from natural hazards.**
2. **Reduce or eliminate damage to critical facilities, services, and equipment from a natural hazard event.**
3. **Reduce or prevent damage to public and private services, buildings, and infrastructure; protect natural and cultural resources as a part of these efforts.**
4. **Increase cooperation and collaboration among mitigation partners to protect the economic engines of Clatsop County.**
5. **Raise awareness about the risks of natural hazards and the strategies to mitigate them.**

Mitigation Objectives

The Mitigation Strategy establishes a framework for reducing risk from natural hazards over the long term. The focus of this plan is to protect people and assets from natural disasters as identified in the risk assessment.

1. **Reduce or prevent the risk of injury or death from natural hazards**
    a. By expanding tsunami evacuation infrastructure, plans (evacuation, mass care, recovery, etc.), trainings, and exercises to provide timely and safe evacuation of all persons out of hazard zones during a hazard event.
    b. Through the coordination of planning for all-hazards mass care facilities across the County with ample food, water, and shelter supplies in place, or the networks available to supply care facility needs for all types of events.
    c. Through the timely and clear distribution of information necessary to protect the community from the impacts of natural hazards.

2. **Reduce or prevent damage to critical facilities, services, and equipment from a natural hazard event.**
    a. Identify the jurisdictions seeking relocation and assess their needs via a planning or design process.
    b. Support the jurisdictions seeking relocation by raising awareness about tsunami risk and the importance of this strategy for the Clatsop NHMP Steering Committee.
    c. Convene a Relocation Committee to share information about best practices and develop collaborations for tsunami relocation.
3. **Reduce or eliminate damage to public and private buildings and infrastructure; protect natural and cultural resources as a part of these efforts.**
    a. Mitigate natural hazards by building and reinforcing community lifelines across Clatsop County.
        i. Develop system-specific priorities for the following sectors:
        ii. Utilities: Work with communications, electric, domestic water, sanitary treatment, natural gas, and other utility providers to harden, elevate, bury, and otherwise protect critical systems from failure or significant delays during disaster events.
        iii. ODOT Transportation Lifelines—identify local priorities that align local priorities with State seismic retrofit plans;
            1. Update local transportation plans to reflect seismic needs, evacuation routes, and other current planning efforts;
        iv. Identify and prepare for delays in food and fuel normally resupplied via the transportation system.
        v. Levees and tidegates: Protect the structures that provide safety and service to the community. Structure mitigation takes three forms: retrofit, retreat, or relocation.
    b. Mitigate natural hazards by developing disaster-resilient communities across Clatsop County.
        i. Develop community stockpiles or alternative service provision on an “island” basis.
        ii. Provide education and planning support to small and rural parts of the County unlikely or unable to receive services.
        iii. Develop a community planning document—Use the planning areas for the County Comp Plan update, identify the islands that would result from bridge failure in a Cascadia and/or landslide event. Overlay other scenarios, such as winter storm power outages and road closures to prioritize mitigation actions.
    c. Require and enforce building codes, National Flood Insurance Program standards, and other regulatory frameworks that reduce risk from natural hazards to human infrastructure.
    d. Identify and develop strategies to protect natural and cultural resources.
        i. Historical sites: consider hardening or elevating protective structures.
        ii. Watersheds/wetlands: consider purchase or other conservation measures.
        iii. Cultural sites/museums: consider plans that address relocation of artifacts and collections in an event.

4. **Increase cooperation and collaboration among County partners to protect the economic engines in the County.**
    a. Develop sector-specific priorities, plans, and implementation strategies.
        i. Tourism—collaborate on tsunami education training for the hospitality industry, the distribution of tsunami evacuation maps, etc.
        ii. Forestry—collaborate on the implementation of vegetation management practices that reduce fuel loads and enhance natural habitats to be more fire resilient.
        iii. Fisheries - collaborate with fishing industry on resiliency/stability of industry with impacts from climate change
    b. Reduce secondary damage from loss of infrastructure, staff, capabilities:
        i. Manage for the loss of continuity of operations of the private and commercial systems that support the economy.
        ii. Manage for the loss of continuity of operations of the public systems that support the economy.
        iii. Establish local management plans with chain of command and two or three deep training on all critical positions.
        iv. Establish a Multi-jurisdictional Mutual Aid Plan and Agreement to guide the sharing of staff resources in the event of a catastrophic disaster (or other situations as appropriate). .
5. **Raise awareness about the risks of natural hazards and the strategies to mitigate them.**
    a. Develop informational materials to inform the community about how to protect themselves and their assets from natural hazards.
    b. Prepare civic officials/ community decision makers with information about natural hazards and how they can be mitigated.
    c. Prioritize Clatsop County hazards for expanding awareness of risk and the strategies the NHMP Steering Committee plans to use to address them. Develop an outreach strategy to identify audience, objectives, and tools. Consider focusing on tsunami and wind/ winter storm awareness for the 2021-2026 plan update.

C. Funding Sources

There are numerous local, state, and federal funding sources available to support natural hazard mitigation projects and planning. The following section includes an abbreviated list of the most common funding sources utilized by local jurisdictions in Oregon. Because grant programs often change, it is important to periodically review available funding sources for current guidelines, program descriptions, and updated deadlines.

Local Funding

Local funding depends on the funding mechanisms your jurisdiction has authority to use. A few common types of funding for hazard mitigation projects include:

Capital Improvement Project (CIP):

Many jurisdictions put together a set of their big ticket items into a budget package called a CIP budget or 'Capital Projects' budget. These projects usually have been on the organizational 'to do' list for some time or have gained priority status through another mechanism such as a planning, design, or strategic planning process. Once a project moves into this status, an array of budget tools are deployed.

General Obligation Bond:

A general obligation bond (GO bond) is a municipal bond backed solely by the credit and taxing power of the issuing jurisdiction rather than the revenue from a given project. General obligation bonds are issued with the belief that a municipality will be able to repay its debt obligation through taxation or revenue from projects. No assets are used as collateral. In Oregon Revised Statutes, it appears that the rules for issuing GO Bonds is regulated by type of entity. For example, sanitary and water districts have a discrete set of rules specific to their authorities in 2020 ORS, Vol. 12, Chapter 450: https://www.oregonlaws.org/ors/chapter/450

Road Fund:

A "county road fund" means a separate fund in the county treasury designated to receive deposit of revenues that are dedicated to roads or road improvements. The county road fund must be used in establishing, laying out, opening, surveying, altering, improving, constructing, maintaining and repairing county roads and bridges on county roads (with exceptions).

See 2020 ORS, Vol. 10, Ch.238, Section 238.705: https://www.oregonlaws.org/ors/368.705

Special Tax District:

Some districts, like Ports, may have authority to create special tax levies, such as a "bond sinking fund", that is "a special tax upon all taxable real and personal property situated within the port, Such annual levy shall not exceed one-tenth of one percent."

See 2020 ORS, Vol. 19, Ch. 777, Section 777.520. https://www.oregonlaws.org/ors/777.520)

Deferred and Lifetime Maintenance Funding

Other considerations about how to use lines of funding essentially amount to either a future line of funding or a deficit (such as an unfunded mandate or deferred maintenance). Lifetime Maintenance funding is a component of a project that can be included in a CIP or other project budget. This includes the expected operations and maintenance (O&M) costs of the project and it rolls those costs into the upfront costs so there is a budget available for them. The alternative to this is a piece of equipment or other asset that does not receive the maintenance it needs due to budget cuts, which then has a shorter life and thus a higher annual cost to the jurisdiction and its customers.

Foundation Funding

Meyer Memorial Trust

https://mmt.org/

Since 1982, Meyer has awarded grants and program-related investments totaling more than $814 million to more than 3,380 organizations around the Pacific Northwest. Today, Meyer focuses on work in Oregon in four areas Oregonians have identified as crucial to making the state better for all its residents: housing, education, the environment and building stronger communities.

Oregon Community Foundation

https://oregoncf.org/

OCF provides grants and scholarships across Oregon. As a statewide community foundation they work alongside donors, stewarding their priorities into strategic giving to support diverse communities across Oregon, creating lasting, transformative change. They have five offices and professional advisors to assist donors in setting up advised funds to serve seven areas of impact.

State Funding

State Interagency Hazard Mitigation Team (IHMT) website

http://www.oregon.gov/oem/Councils-and-Committees/Pages/IHMT.aspx

Find IHMT meeting dates and locations, agendas, minutes and meeting materials. The State IHMT is comprised of about 18 state agencies involved with natural hazards. The State IHMT meets quarterly to understand losses arising from natural hazards, coordinate recommended strategies to mitigate loss of life, property, and natural resources, and maintain the *Oregon Natural Hazards Mitigation Plan*.

State Preparedness and Incident Response Equipment (SPIRE)

https://www.oregon.gov/oem/emresources/Grants/Pages/Spire.aspx

Oregon House Bill 2687 became effective in August 2017. It established a grant program to distribute emergency preparedness equipment to local governments and other recipients to be used to decrease risk of life and property resulting from an emergency. Items purchased must qualify as capital assets, meaning individual items must cost at least $5,000. A total of $5,000,000 is available to procure emergency preparedness equipment to help Oregon communities prepare, respond, and recover from emergencies. The upcoming deadline for this grant program, as listed on the OEM website as of May13, 2020, is March 1, 2019. The website has not been updated for the next round of applications. The contact for the SPIRE program is Jim Jungling, jim.jungling@state.or.us.

Seismic Rehabilitation Grant Program

http://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/

The Seismic Rehabilitation Grant Program (SRGP) provides state funds to strengthen public schools and emergency services buildings so they will be less damaged during an earthquake. Reducing property damage, injuries, and casualties caused by earthquakes is the goal of the SRGP.

Oregon Watershed Enhancement Board

http://www.oregon.gov/OWEB/Pages/index.aspx

While OWEB's primary responsibilities are implementing projects addressing coastal salmon restoration and improving water quality statewide, these projects can sometimes also benefit efforts to reduce flood and landslide hazards. In addition, OWEB conducts watershed workshops for landowners, watershed councils, educators, and others, and conducts a biennial conference highlighting watershed efforts statewide. Funding for OWEB programs comes from the general fund, state lottery, timber tax revenues, license plate revenues, angling license fees, and other sources. OWEB awards approximately $20 million in funding annually.

Federal Funding: Pre-/Post-Disaster

Hazard Mitigation Assistance (HMA)

https://www.fema.gov/media-library-data/1424983165449-38f5dfc69c0bd4ea8a161e8bb7b79553/HMA_Guidance_022715_508.pdf

Detailed program and application information for federal post-disaster and pre-disaster programs can be found in the Hazard Mitigation Assistance Guidance, dated February 27, 2015, note that guidance regularly changes. Verify that you have the most recent edition. Flood mitigation assistance is usually offered annually; applications are submitted online. Applicants need a user profile approved by the State Hazard Mitigation Officer (SHMO), which should be garnered well before the application period opens.

For Oregon Military Department, Office of Emergency Management (OEM) grant guidance on Federal Hazard Mitigation Assistance, visit:
https://www.oregon.gov/OEM/emresources/Grants/Pages/HMA.aspx

Contact: Amie Bashant, State Hazard Mitigation Officer (SHMO), amie.bashant@state.or.us

Hazard Mitigation Grant Program

http://www.fema.gov/hazard-mitigation-grant-program

The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP involves a paper application which is first offered to the counties with presidentially declared disasters within the past year, then becomes available statewide if funding is still available. The grant is administered by FEMA.

Building Resilient Infrastructure and Communities (BRIC) Grant Program

http://www.fema.gov/pre-disaster-mitigation-grant-program

The Building Resilient Infrastructure and Communities (BRIC) Grant Program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. BRIC grants are available on an annual basis. Applicants need to submit a letter of interest to the State Hazard Mitigation Officer, annually in September. The grant is administered by FEMA.

Flood Mitigation Assistance Program

http://www.fema.gov/flood-mitigation-assistance-program

The overall goal of the Flood Mitigation Assistance (FMA) Program is to fund cost-effective measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other National Flood Insurance Program (NFIP) insurable structures. This specifically includes:

- Reducing the number of repetitively or substantially damaged structures and the associated flood insurance claims;
- Encouraging long-term, comprehensive hazard mitigation planning;
- Responding to the needs of communities participating in the NFIP to expand their mitigation activities beyond floodplain development activities; and
- Complementing other federal and state mitigation programs with similar, long-term mitigation goals.

Disaster Loan Assistance

http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans

There are four types of loans available from the U.S. Small Business Administration (SBA): home and personal property loans; business physical disaster loans; economic injury loans; and military reservist injury loans. When physical disaster loans are made to homeowners and businesses following disaster declarations by the SBA, up to 20% of the loan amount can go towards specific measures taken to protect against recurring damage in similar future disasters.

Public Assistance Grant Program, FEMA

http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit

The objective of the Federal Emergency Management Agency's (FEMA) Public Assistance (PA) Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President.

Emergency Management Performance Grants, FEMA

https://www.fema.gov/emergency-management-performance-grant-program

EMPG grants help state and local governments to sustain and enhance their all-hazards emergency management programs.

HUD Disaster Resources

https://www.hud.gov/info/disasterresources

HUD provides a variety of disaster resources listed below. We also partner with Federal and state agencies to help implement disaster recovery assistance. Under the National Response Framework the Federal Emergency Management Agency (FEMA) and the Small Business Administration (SBA) offer initial recovery assistance.

Community Development Block Grant (CDBG) Program

http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs

The Community Development Block Development Grant Program is administered by the U.S. Department of Housing and Urban Development. The Community Development Block Grant Program promotes viable communities by providing: 1) decent housing; 2) quality living environments; and 3) economic opportunities, especially for low and moderate income persons. Eligible activities most relevant to natural hazards mitigation include: acquisition of property for public purposes; construction/reconstruction of public infrastructure; community planning activities. Under special circumstances, CDBG funds also can be used to meet urgent community development needs arising in the last 18 months which pose immediate threats to health and welfare. Grants are awarded based on specific projects as they are identified.

Rural Development Assistance – Utilities, USDA

https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service

Direct and guaranteed rural economic loans and business enterprise grants to address utility issues and development needs.

Rural Development Assistance – Housing, USDA

https://www.rd.usda.gov/programs-services

The RDA program provides grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster is necessary.

HOME Investments Partnerships Program, HUD

https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/

The HOME IPP provides grants to states, local government and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.

Federal Funding: Fire Resources

Assistance to Firefighters Grant Program

https://www.fema.gov/welcome-assistance-firefighters-grant-program

FEMA and the U.S. Fire Administration are the administrators of the grant. The purpose of the grant is to provide equipment, protective gear, emergency vehicles, training, and other resources needed to protect the public and emergency personnel from fire and related hazards. The funds are available to fire departments, non-affiliated emergency medical services organizations, and state fire training academies. The funds enhance operations efficiencies, foster interoperability, and support community resilience. Grants are awarded on specific projects as they are identified.

National Fire Plan (DOI – USDA)

http://www.forestsandrangelands.gov/

The NFP provides technical, financial, and resource guidance and support for wildland fire management across the United States. This plan addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.

Assistance to Firefighters Grant Program, FEMA

http://www.fema.gov/welcome-assistance-firefighters-grant-program

FEMA AFGM grants are awarded to fire departments to enhance their ability to protect the public and fire service personnel from fire and related hazards. Three types of grants are available: Assistance to Firefighters Grant (AFG), Fire Prevention and Safety (FP&S), and Staffing for Adequate Fire and Emergency Response (SAFER).

Federal Funding—Hazard Mapping and Technical Support

National Flood Insurance Program, FEMA

http://www.fema.gov/national-flood-insurance-program

The NFIP makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements.

National Flood Insurance Program: Flood Mapping; FEMA

http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping

Flood insurance rate maps and floodplain management maps for all NFIP communities.

Cooperating Technical Partners

https://www.fema.gov/flood-maps/guidance-partners/cooperating-technical-partners

The purpose of the CTP Program is to provide, through a Cooperative Agreement, funds to ensure that partners can perform program management and technical mapping-related activities.

Coastal Zone Management Program, NOAA.

https://coast.noaa.gov/czm/

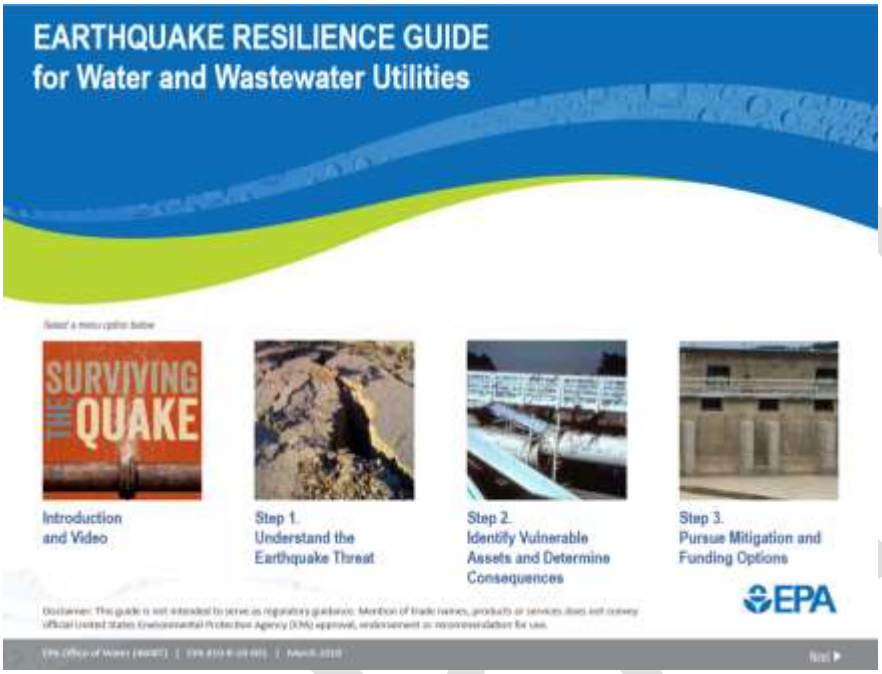
Provides grants for planning and implementation of non-structural coastal flood and hurricane hazard mitigation projects and coastal wetlands restoration.

EPA Recommendations for Seismic Resilience for Water Systems

https://www.epa.gov/sites/production/files/2018-02/documents/180112-earthquakeresilienceguide.pdf

There are three steps in this guide: Step 1 - Understand the Earthquake Threat. Step 2 - Identify Vulnerable Assets and Determine Consequences. Step 3 - Pursue Mitigation and Funding Options.

Figure III-1. Earthquake Resilience Guide



Federal Funding for Water and Wastewater Utilities in National Disasters (Fed FUNDS)

https://www.epa.gov/fedfunds

This website gives utilities information about federal disaster funding programs. Although Fed FUNDS focuses on major disasters, you can use the information for any incident that disrupts water or wastewater services or damages critical infrastructure.

National Earthquake Hazard Reduction Program (NEHRP), National Science Foundation

http://www.nehrp.gov/

Through broad based participation, the NEHRP attempts to mitigate the effects of earthquakes. Member agencies in NEHRP are the US Geological Survey (USGS), the National Science Foundation (NSF), the Federal Emergency Management Agency (FEMA), and the National Institute for Standards and Technology (NIST). The agencies focus on research and development in areas such as the science of earthquakes, earthquake performance of buildings and other structures, societal impacts, and emergency response and recovery.

Decision, Risk, and Management Science Program, National Science Foundation

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423

Supports scientific research directed at increasing the understanding and effectiveness of decision making by individuals, groups, organizations, and society. Disciplinary and interdisciplinary research, doctoral dissertation research, and workshops are funded in the areas of judgment and decision making; decision analysis and decision aids; risk analysis, perception, and communication; societal and public policy decision making; management science and organizational design. The program also supports small grants for exploratory research of a time-critical or high-risk, potentially transformative nature.

Clean Water State Revolving Fund

https://www.epa.gov/cwsrf/learn-about-clean-water-state-revolving-fund-cwsrf

The U.S. Environmental Protection Agency (EPA) administers this fund. The purpose is to fund water quality projects, including all types of nonpoint source projects, watershed protection or restoration projects, estuary management projects, and more traditional municipal wastewater treatment projects. Grant awards are based on specific projects as they are identified.

Community Action for a Renewed Environment (CARE)

https://www.epa.gov/international-cooperation/community-action-renewed-environment-care-roadmap-10-step-plan-improve

The administrator of this funding source is the EPA. The purpose is to fund the removal or reduction of toxic pollution. The grant award is based on specific projects as they are identified.

Emergency Watershed Protection Program, USDA-NRCS

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp

Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by severe natural hazard events.

Partners for Fish and Wildlife, DOI – FWS

http://www.fws.gov/partners/

The PFW program provides financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.

North American Wetland Conservation Fund, DOI-FWS

https://www.grants-gov.net/cfda.php?CFDANumber=15.623

NAWC fund provides cost-share grants to stimulate public/private partnerships for the protection, restoration, and management of wetland habitats. The grant funds projects for wetlands conservation in the United States, Canada, and Mexico.

Federal Land Transfer / Federal Land to Parks Program, DOI-NPS

http://www.nps.gov/ncrc/programs/flp/index.htm

Identifies, assesses, and transfers available federal real property for acquisition for state and local parks and recreation, such as open space.

Wetlands Reserve program, USDA-NCRS

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/wetlands

The WR program provides financial and technical assistance to protect and restore wetlands through easements and restoration agreements.

Secure Rural Schools and Community Self-Determination Act of 2000, US Forest Service

http://www.fs.usda.gov/pts/

Reauthorized for FY2012, it was originally enacted in 2000 to provide five years of transitional assistance to rural counties affected by the decline in revenue from timber harvests on federal lands. Funds have been used for improvements to public schools, roads, and stewardship projects. Money is also available for maintaining infrastructure, improving the health of watersheds and ecosystems, protecting communities, and strengthening local economies.

USGS Natural Hazards

http://www.usgs.gov/natural_hazards/y

The USGS Natural Hazards Mission Area includes six science programs: Coastal & Marine Geology, Earthquake Hazards, Geomagnetism, Global Seismographic Network, Landslide Hazards, and Volcano Hazards. Through these programs, the USGS provides alerts and warnings of geologic hazards and interactive maps and data.

D. Integration

To achieve risk reduction, it is necessary to consider natural hazards mitigation in jurisdictional planning processes, from land use to infrastructure to emergency response.

Existing Plans & Policies

Communities often have existing plans and policies that guide and influence land use, land development, and population growth such as comprehensive plans, zoning ordinances, and technical reports or studies. Adopted plans and established policies 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. See the specific relevant plans and policies listed in the Community Risk Profile for each jurisdiction.

The Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan (MJNHMP) 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 to 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.

Integration

Jurisdictions have a wide array of authorities that can be effective in reducing risk from hazards. In order to put these to work, it is necessary to articulate how the authority can, should, and will be used to address natural hazards. Considering natural hazards mitigation in jurisdictional planning processes, from land use to infrastructure to emergency response are all effective practices for reducing risk. Every advance in mitigation reduces impact, decreasing the need for response and recovery and increasing resilience.

Each jurisdiction engages in comprehensive planning and other processes (budget, capital facilities, public works and engineering, open space and recreation, environmental planning, etc.) within which mitigation can be considered and accomplished. However, it is not yet generally embedded in the context of these conversations. For most jurisdictions this will constitute a type of awareness campaign and require a change in organizational culture or political opinion in order to secure approval from the boards, councils, and commissions that guide them. Steering Committee members will be responsible for communicating the importance and necessity of integrating mitigation goals, objectives, and actions into the everyday business of the jurisdiction to those within their individual organizational structures responsible for developing and implementing the various planning and operations documents and processes. Steering Committee members will also engage in those planning and operations processes to the extent necessary and appropriate to ensure that mitigation goals, objectives, and actions are duly considered and incorporated as applicable and feasible.

Table III-1. Plans and Codes for Potential Integration identifies by jurisdiction the types of plans and implementing codes into which natural hazard mitigation goals, objectives, and actions may be integrated.

Table III-1. Plans and Codes for Potential Integration

	Strategic Plan	Comprehensive Plan	Capital Improvements Plan	Economic Development Plan	Emergency Operations Plan	Post-Disaster Recovery Plan	Building Code	Zoning Code	Subdivision Code	Special Purpose Codes	Post-Disaster Recovery Code	Real Estate Disclosure Requirements	Comments
Clatsop County	X	X	X	---	X	---	X	X	---	---	---	---	
Astoria	X	X	---	X	X	X	X	X	X	---	---	---	Advance Astoria: 5-Year Economic Development Strategy; Astor-East Urban Renewal Plan, Astor-West Urban Renewal Plan, Uniontown Reborn Economic Development Plan, Waterfront Development overlay zones, Gateway overlay zone; Emergency Operations Plan; Continuity of Operations Plan (COOP), Continuity of Government Plan (COG); Subdivision code is part of zoning code (development code).
Cannon Beach	X	X	X	---	---	---	X	X	---	---	---	---	CIP is part of the City of Cannon Beach Capital Asset Management Policy.
Gearhart		X	---	---	X	---	X	X	X	---	---	X	Transportation System Plan includes evacuation route locations. THO zone restricts certain development and densities in tsunami CSZ M scenario and requires hazard disclosure signature.
Seaside	X	X	---	---	---	---	X	X	---	---	---	---	
Warrenton	X	X	X	X	X	---	X	X	X	X	---	---	Economic Development Plan update in progress, anticipated completion Q1, 2021. Special purpose code is City-adopted locally significant wetlands map (1994) regulating development through the Warrenton municipal code.
Port of Astoria	X	X	---	---	---	---	---	---	---	---	---	---	
Sunset Empire Transit District	X	X	---	---	---	---	---	---	---	---	---	---	
Clatsop Community College	---	---	---	---	---	---	---	---	---	---	---	---	
Seaside School District	---	---	---	---	---	---	---	---	---	---	---	---	
Cannon Beach Fire	X	---	X	---	---	---	---	---	---	---	---	---	
Knappa Fire	---	---	---	---	---	---	---	---	---	---	---	---	
Lewis and Clark Fire	---	---	---	---	---	---	---	---	---	---	---	---	
Arch Cape Water													Subject to Clatsop County codes.
Arch Cape Sanitary													
Falcon Cove Water													

E. Tools and Assets

Beyond the planning and other processes available for integration, each jurisdiction has a variety of tools and assets available for implementing natural hazards mitigation. Many are the same or similar among the jurisdictions. A few are unique. Table III 2 Tools and Assets Supporting Mitigation identifies both.

The Cities of Cannon Beach and Seaside have specifically hired emergency management staff to provide support on natural hazards mitigation and preparation activities. The Cities of Astoria and Gearhart have leadership staff with emergency management and mitigation expertise that they deploy in the course of their duties.

In general, the jurisdictions are small, understaffed, and dealing with difficult financial circumstances. Even so, their long experience with natural disasters elevates their individual and collective commitment to mitigation. Their mitigation strategies ground their visions aspirations, demonstrating that they will use and leverage their tools and assets as fully as possible to advance mitigation, focusing on improving communication, supporting their first responders, and reducing risk to people, businesses, property, and the environment.

Table III-2. Tools and Assets Supporting Mitigation

	Land Use Planner or Engineer	Public Works or Construction Engineer	Building Inspector or Fire Marshal	Floodplain Manager	Surveyor	Vulnerability Assessment Expertise	GIS or Hazus Expertise	Scientists with local Hazards Expertise	Emergency Manager	Grant Writing Expertise	Capital Improvement Plan (CIP) Funding	Authority to Levy Taxes	Water, Sewer, Electric, Gas Fees	System Development Charges	Withhold Spending in Hazard Areas	Comments
Clatsop County	X	X	X	X	X	X	X	X	X	X	X	X	---	X	---	Clatsop County handles electrical inspections for the whole county. Water, sewer, electric provided by utility districts.
Astoria	X	X	X	X	---	---	X	X	---	X	X	X	X	X	X	In 2020, Astoria hired a building inspector; varies from City employee to contract with other communities over the years. Fire Marshal duties are handled by the Fire Chief. Astoria is part of regional team with a revolving CDBG loan funds program for low income home owner renovations. Astoria has two urban renewal districts. Withhold spending - City has Comprehensive Plan policy to not sell property identified in a known landslide area. Contracted services include: surveyor, landslide expert.
Cannon Beach	X	X	---	X	---	X	---	---	X	X	X	X	X	X	---	
Gearhart	X	X	X	X	---	X	X	---	---	X	---	X	X	---	---	Gearhart has a part-time building inspector.
Seaside	X	X	X	X	---	X	---	X	X	X	X	X	X	X	---	
Warrenton	X	X	X	X	---	X	X	---	X	X	X	X	X	X	---	Planner on staff, Engineering provided through contract; PW Director on staff; Building Official and Residential Inspector on staff. City's EOP identifies the City Manager as the Emergency Manager. Water and Sewer EDU, Connection Fee, Monthly Service Fees.
Port of Astoria	---	---	---	---	---	---	---	---	---	X	---	---	---	---	---	
Sunset Empire Transit District	---	---	---	---	---	---	---	---	---	X	---	---	---	---	---	
Clatsop Community College	---	---	---	---	---	---	---	---	X	X	---	---	---	---	---	
Seaside School District	---	---	---	---	---	X	---	---	X	X	---	---	---	---	---	
Cannon Beach Fire	---	---	X	---	---	X	---	---	---	X	---	---	---	---	---	
Knappa Fire	---	---	---	---	---	X	---	---	---	---	---	---	---	---	---	
Lewis and Clark Fire	---	---	---	---	---	X	---	---	---	---	---	---	---	---	---	
Arch Cape Water	---	X	---	---	---	---	---	---	---	X	---	---	X	---	---	
Arch Cape Sanitary	---	X	---	---	---	---	---	---	---	X	---	---	X	---	---	
Falcon Cove Water	---	X	---	---	---	---	---	---	---	X	---	---	X	---	---	

F. Economic Analysis of Hazard Mitigation Projects

- This summary was originally developed by the Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Community Service Center (now the Institute for Policy Research and Engagement or IPRE) and included in the 2015 Clatsop County NHMP. It has been reviewed and accepted by the Federal Emergency Management Agency (FEMA) as a means of documenting how the prioritization of mitigation actions includes a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and associated costs.

This appendix outlines three approaches for conducting economic analyses of natural hazard mitigation projects:

- Benefit/Cost Analysis,
- Cost-Effectiveness Analysis
- STAPLE/E Approach

The appendix 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 Oregon Interagency Hazard Mitigation Team, *State Hazard Mitigation Plan* (Oregon Office of Emergency Management, 2000), and FEMA Publication 331, *Report on Costs and Benefits of Natural Hazard Mitigation*. The resource section was updated in January 2020 as part of the Clatsop County NHMP Update. The Economic Analysis 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. 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 such as these three:

- Natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools.
- 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.
- 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 in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison.

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.

Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by OEM, FEMA, 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 the mitigation action exceed the cost of the mitigation action. A Benefit/Cost Analysis (BCA), also known as a Benefit/Cost Ratio (BCR), for a mitigation action is an output from a computer program that can assist communities in determining whether a project is worth undertaking now to avoid disaster-related damages later. It is a required part of a FEMA mitigation grant application.

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 (the net benefits will exceed the net costs) to be eligible for FEMA funding. FEMA's BCA help line: 1-855-540-6744 or email bchelpline@dhs.gov

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, required to conform to a mandated standard may consider the following options:

- Request cost sharing from public agencies;
- Dispose of the building or land either by sale or demolition;
- Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
- 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 action could be time consuming and impractical. There are approaches for conducting a quick evaluation of the proposed mitigation actions which could be used to identify those that merit more detailed assessment. One of those methods is the STAPLE/E approach.

Using STAPLE/E criteria, mitigation actions can be evaluated quickly. This set of criteria requires the assessment of the mitigation actions based on the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLE/E) constraints and opportunities of implementing the particular mitigation action 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: 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 city board of commissioners, 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.

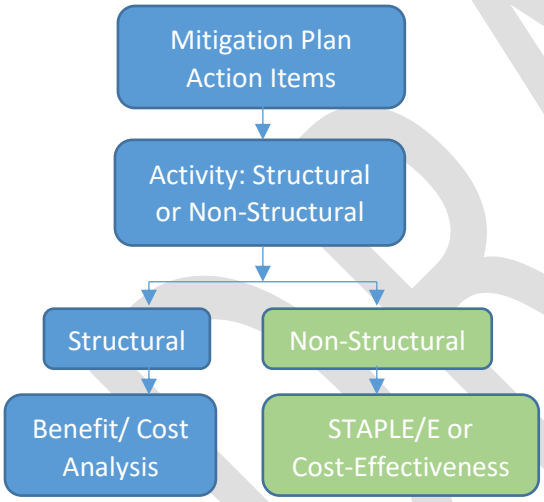
- How will the action impact the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

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 III-2. Economic Analysis Flowchart



Source: Oregon Partnership for Disaster Resilience at the University of Oregon's Community Service Center, 2005.

Implementing the Approaches

Below is a framework that could be used in further analyzing the feasibility of implementing prioritized mitigation actions after determining – through the use of one of the economic analysis approached described above – whether or not to implement the mitigation action.

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

These items support the development and funding of hazard mitigation actions:

Federal Emergency Management Agency. (Mar. 2007). *Appendix D: Determining Cost Effectiveness;* From FEMA Publication 551, *Selecting Appropriate Mitigation Measures for Floodprone Structures*. Available at: https://www.fema.gov/sites/default/files/2020-08/fema_551.pdf

Federal Emergency Management Agency. (Jan. 2017). Benefit Cost Toolkit Version 6.0 Available at: https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis

Federal Emergency Management Agency. (Dec. 2018). DRRA - Section 1215 Management Costs FAQs. https://www.fema.gov/drra-1215-faq

Federal Emergency Management Agency. (2015). FY 2015 Hazard Mitigation Assistance Guidance and Addendum. https://www.fema.gov/media-library/assets/documents/103279

Goettel, K. (Nov. 2016). *Benefit-Cost Analysis of the Proposed Seismic Retrofit Ordinance*. Goettel and Associates for the City of Portland, Oregon.

Lehman, D. and S. Loper. (1996). *Report on the Costs and Benefits of Natural Hazards Mitigation*. Prepared by Woodward-Clyde Federal Services for FEMA. Available at https://www.fema.gov/media-library-data/20130726-1511-20490-6222/haz_cost.pdf

Rose, A., K. Porter, N. Dash, J. Bouabid, et al. (2007). *Benefit-Cost Analysis of FEMA Hazard Mitigation Grants*. Natural Hazards Review. 8. 97-111. 10.1061/(ASCE)1527-6988(2007)8:4(97). https://www.researchgate.net/publication/4729207_Benefit-Cost_Analysis_of_FEMA_Hazard_Mitigation_Grants Accessed January 23, 2020.

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. https://www.fema.gov/media-library/assets/documents/96200

IV. REFERENCES

Allan, J. C. (2017, Apr.17). Erosion Data webpage. Beachapedia by Surfrider Foundation. http://www.beachapedia.org/State_of_the_Beach/State_Reports/OR/Beach_Erosion

Allan, J. C. & Priest, G. (2001). *Coastal Erosion Hazard Zones along the Clatsop Plains, Oregon: Gearhart to Fort Stevens (*Open-File Report O-01-04). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/O-01-04.pdf

Allan, J. C., O'Brien, F. C., Bauer J. M., and Williams, M. C. (2020, Dec.) *Earthquake and tsunami impact analysis for coastal Clatsop County, Oregon* (Open-File Report O-20-10). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-20-10.htm

Allan, Jonathan C., Fletcher E. O'Brien, and Laura L. S. Gabel. (2018). *Beach and shoreline dynamics in the Cannon Beach littoral cell: Implications for dune management* (Special Paper 49). Oregon Department of Geology and Mineral Industries. Retrieved from https://www.oregongeology.org/pubs/sp/p-SP-49.htm

Allan, Jonathan C., & Hart, Roger (2007). *Assessing the temporal and spatial variability of coastal change in the Neskowin littoral cell: Developing a comprehensive monitoring program for Oregon beaches* (Open-File Report O-07-01). Portland, OR: Oregon Department of Geology and Mineral Industries. Retrieved from http://www.oregongeology.org/pubs/ofr/O-07-01.pdf

Ash Creek Associates, Inc. (2007). *Geologic and geotechnical hazards assessment: Bay City, Oregon.* Prepared for City of Bay City, OR. Portland, OR.

Ballou, B. (2004, Nov. 3). *A short history of Wildland/Urban Interface Fires in Oregon,* State Natural Hazard Mitigation Plan. Oregon Dept. of Forestry and Oregon Emergency Management. https://www.oregon.gov/ODF/Documents/Fire/UrbanInterface/WildlandUrbanHistory.pdf

Bauer, John M., Jonathan C. Allan, Laura L. S. Gabel, Fletcher E. O'Brien, and Jed T. Roberts. (2020). *Analysis of earthquake and tsunami impacts for people and structures inside the tsunami zone for five Oregon coastal communities: Gearhart, Rockaway Beach, Lincoln City, Newport, and Port Orford* (Open-File Report O-20-03). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-20-03.htm

Burns, W. J., & Mickelson, K. A. (2013). Landslide inventory, susceptibility maps, and risk analysis for the City of Astoria, Clatsop County, Oregon (Open-File Report O-13-05). Portland, OR: Oregon Department of Geology and Mineral Industries.

Business Oregon. (2017). *Regional Competitive Industry Analysis: Clatsop, Columbia, and Tillamook Counties.* https://www.oregon4biz.com/Oregon-Business/Regions/reports/Clat-Col-Till16.pdf

Bureau of Labor and Industries. (2020). Economy At A Glance. https://www.bls.gov/eag/eag.or.htm

Centers for Disease Control and Prevention / Agency for Toxic Substances and Disease Registry. (2016). *CDC's Social Vulnerability Index 2016*. https://svi.cdc.gov/Documents/CountyMaps/2016/Oregon/Oregon2016_Clatsop.pdf

Chittenden County Regional Planning Commission. (2018). *ACS guide: Best practices for reporting American Community Survey in municipal planning*. https://www.ccrpcvt.org/wp-content/uploads/2018/10/ACS_Guide_Final_20181003.pdf

City of Astoria. (2020). *Astoria Dispatch: A message from the 911 Manager*. https://www.astoriadispatch.com/Message_from_911_Manager.aspx

City of Astoria. (n.d.) *Geologic and Flood Hazards* (Section CP.390). City of Astoria Comprehensive Plan. http://www.astoria.or.us/Assets/dept_1/pm/pdf/cp%20390%20to%20400.geologic%20and%20flood%20hazards.pdf

City of Astoria. (2020). *Homepage website*. https://www.astoria.or.us/

City of Cannon Beach. (2020). *Emergency Management website*. https://www.ci.cannon-beach.or.us/emergencymgmt/.

City of Seaside. (2020). *Police Department Dispatch and 9-1-1.* http://police.cityofseaside.us/dispatch-and-9-1-1

Clatsop County. (2020). *Website*. https://www.co.clatsop.or.us/

Columbia River Bar Pilots. (2014). *Pilotage Grounds.* http://www.columbiariverbarpilots.com/columbiariverbarpilots_pilotage.html

Curran-McLeod, Inc., Consulting Engineers. (2018, Sept.) *Draft FCBWD Water System Development Charge Update and Capital Improvement Plan*.

Cybersecurity and Infrastructure Security Agency. (2020, Mar. 24.) *Critical Infrastructure Sectors*. https://www.cisa.gov/critical-infrastructure-sectors

Dalton, Meghan M. (2020, Feb.). *Future Climate Projections: Clatsop County*. Oregon Climate Change Research Institute. College of Earth, Ocean and Atmospheric Sciences, Oregon State University.

Dean Runyan Associates. (2009, May). *Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon 2008*. State and County Expenditure Estimates. https://static1.squarespace.com/static/5ea0c297db073c065cc8f3a7/t/5ebaf6b0823c6d68ccea9d50/1589311159499/ODFW.pdf

Dean Runyan Associates. (2019, Mar.) *Oregon Travel Impacts: 1992–2018.* http://www.deanrunyan.com/doc_library/ORImp.pdf

Deloitte. (2020). *Data USA: Clatsop County, OR*. https://datausa.io/profile/geo/clatsop-county-or#economy

Dice, C. (2018). *Operations & Maintenance Manual*. Falcon Cove Beach Domestic Water Supply District.

Federal Emergency Management Agency. (2019). *Community lifelines implementation toolkit, version 2.0.* https://www.fema.gov/media-library-data/1576770152678-87196e4c3d091f0319da967cf47ffd9c/CommunityLifelinesToolkit2.0v2.pdf Accessed January 9, 2020.

Federal Emergency Management Agency. (2018). *Clatsop County Flood Insurance Study*.

Federal Emergency Management Agency. (n.d.) *Map of wind zones in the United States*. Taking Shelter from the Storm: Building a Safe Room Inside Your House. https://www.fema.gov/pdf/library/ism2_s1.pdf

Gabel, Laura L. S. and Jonathan C. Allan. (2016). *Local tsunami evacuation analysis of Warrenton and Clatsop Spit, Clatsop County, Oregon* [Beat the Wave] (Open-File Report O-16-08). Newport, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-16-08.htm

GeoScience, Inc. (2008). *Debris Flow Assessment*. Eilertsen Creek/Woodson.

Government of the Republic of Trinidad and Tobago. (2020). *Office of Disaster Preparedness and Management, Vulnerability and Risk webpag*e. http://www.odpm.gov.tt/node/162

Institute of Medicine (US). (2003). *Committee on Responding to the Psychological Consequences of Terrorism*; Stith Butler A, Panzer AM, Goldfrank LR, editors. Washington (DC): National Academies Press (US); https://www.ncbi.nlm.nih.gov/books/NBK221638/

Komar, P. D., & Rea, C. C. (1976). Erosion of Siletz Spit. Oregon, *Shore and Beach*, *44*(1), 9–15.

National Drought Mitigation Center. (2020). *Types of Drought*. https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx

National Oceanic and Atmospheric Administration. (2018). *What is a waterspout?* National Ocean Service website. https://oceanservice.noaa.gov/facts/waterspout.html

Niewendorp, C. A., & Neuhaus, M. E. (2003). Map of selected earthquakes for Oregon, 1841-2002 (OpenFile Report O-03-02). Portland, OR: Oregon Department of Geology and Mineral Industries.

NW Oregon Transit. (2018). Sunset Empire Transportation District Website. https://www.nworegontransit.org/agencies/sunset-empire-transportation-district

Office of Governor Kate Brown. (2020, June). *State of Oregon Equity Framework for COVID-19 Response and Recovery.* https://www.oregon.gov/gov/policy/Documents/EquityFrameworkCovid19_2020.pdf

Oregon Department of Energy. (2017, Oct.) *Oregon Fuel Action Plan*. https://www.oregon.gov/energy/safety-resiliency/Documents/Oregon-Fuel-Action-Plan.pdf

Oregon Department of Forestry. 2004. Identifying and assessment of communities at risk in Oregon. https://oregonexplorer.info/content/oregon-communities-risk-assessment-and-planning?topic=95&ptopic=62

Oregon Department of Forestry. (2012). Clatsop County Community Wildfire Protection Plan (CWPP). https://www.oregon.gov/odf/Documents/Fire/CWPP/ClatsopCounty.pdf

Oregon Department of Geology and Mineral Industries. (2013). Local Source (Cascadia Subduction Zone) Tsunami Inundation Map - Gearhart - Seaside, Oregon. https://www.oregongeology.org/pubs/tim/Clat08_Gearhart_Seaside_Plate1_onscreen.pdf

Oregon Department of Geology and Mineral Industries. (n.d.) *Coastal Geohazards in Oregon webpage*. https://www.oregongeology.org/Coastal/CoastalHazardsMain.htm

Oregon Department of Geology and Mineral Industries. (n.d.) *Landslide hazards in Oregon*, factsheet. https://www.oregongeology.org/pubs/fs/landslide-factsheet.pdf

Oregon Department of Land Conservation and Development. (2019). *Citizen Science webpage*. Newport, OR. https://www.oregon.gov/LCD/OCMP/Pages/Citizen-Science.aspx

Oregon Department of Land Conservation and Development. (2015). *Oregon natural hazards mitigation plan*. Salem, OR. http://www.oregon.gov/LCD/HAZ/pages/nhmp.aspx

Oregon Department of Land Conservation and Development. (2019). *Oregon's Statewide Land Use Planning Goals webpage*. Salem, OR. https://www.oregon.gov/lcd/OP/Pages/Goals.aspx

Oregon Department of Transportation (ODOT). (2014, Oct.) *Oregon Highways Seismic Plus Report*. https://www.oregon.gov/gov/policy/orr/Documents/ODOT%20seismic%20plus%20report.pdf

Oregon Department of Transportation. (n.d.) www.oregon.gov/ODOT/HWY/BRIDGE/docs/SpanningOregonsCoast/newest_spanning_brochure.pdf

Oregon Emergency Management. (Jan. 2016). Drought Annex, State of Oregon Emergency Operations Plan. https://www.oregon.gov/owrd/WRDPublications1/2016ORDroughtAnnex.pdf

Office of Emergency Management. (2015, May). *Hazard Analysis Methodology*. Salem, OR: Oregon Military Department. https://www.oregon.gov/lcd/NH/Documents/Apx_9.1.19_OEM_Hazard_Analysis_Methodology_OPT.pdf

Oregon Emergency Management. (2003, July). County Hazard Analysis Scores.

Oregon Emergency Management. (2011, July). County Hazard Analysis Scores.

Oregon Emergency Management. (n.d.) PSAP Directory by County. https://www.oregon.gov/oem/Documents/psap_directory.pdf

Oregon Tsunami Clearinghouse. (2013). *Large-Extent Tsunami Evacuation Maps*. Newport, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/tsuclearinghouse/pubs-evacbro.htm

Oregon Water Resources Department. (2011, Sept.) Dam Safety in Oregon. https://www.oregon.gov/owrd/WRDPublications1/DamSafetyInOregon.pdf

Portland State University. (2017). Population Research Center; Jurjevich, Jason R.; Chun, Nicholas; Rancik, Kevin; Proehl, Risa; Michel, Julia; Harada, Matt; Rynerson, Charles; and Morris, Randy, *Coordinated Population Forecast for Clatsop County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2017-2067.* Oregon Population Forecast Program. https://pdxscholar.library.pdx.edu/opfp/27

Port of Astoria. (2020, Apr.) *Airport Information*. https://www.portofastoria.com/Airport_Information.aspx

Priest, George R., Laura L. Stimely, Ian P. Madin, and Rudie J. Watzig. (2015). *Local tsunami evacuation analysis of Seaside and Gearhart, Clatsop County, Oregon* [Beat the Wave] (Open-File Report O-15-02). Newport, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-15-02.htm

Ruggiero, Peter, Paul D. Komar, Jonathan C. Allan. (2010, May). *Increasing wave heights and extreme value projections: The wave climate of the U.S. Pacific Northwest*. Coastal Engineering, Volume 57, Issue 5, pages 539-552.

Seaside School District. (2020). *SSD Website*. http://seasidesd.schoolinsites.com/

Smith, Tom AIA. TL Smith Consulting Inc. (June 2017). *Wind Safety Of The Building Envelope*. https://www.wbdg.org/resources/wind-safety-building-envelope Accessed 12/03/2019.

Sullivan, W.L. (2018). Oregon's Greatest Natural Disasters. Navillus Press.

Sunset Empire Transportation District. (Sept. 2016). Long Range Comprehensive Transit Plan.

Sudarsanan, S., Chaudhury, S., Pawar, A. A., Salujha, S. K., & Srivastava, K. (2004). Psychiatric Emergencies. Medical journal, Armed Forces India, 60(1), 59–62. https://doi.org/10.1016/S0377-1237(04)80162-X)

United Nations Office for Disaster Risk Reduction. (2020). *Terminology webpage*. https://www.undrr.org/

US Census Bureau.(2020). *2014–2018 American Community Survey 5-Year Estimates*. Tables DP05, S1810,. www.data.census.gov https://data.census.gov/cedsci/table?q=United%20States&table=DP05&tid=ACSDP5Y2017.DP05&lastDisplayedRow=29&vintage=2017&layer=state&cid=DP05_0001E&hidePreview=true&g=0100000US_0500000US41007

US Geological Survey (USGS). (2020). *Earthquake Hazards*. https://earthquake.usgs.gov/earthquakes/ or https://www.usgs.gov/natural-hazards/earthquake-hazards (new).

USGS. (2004). *Landslide Types and Processes*. https://pubs.usgs.gov/fs/2004/3072/pdf/fs2004-3072.pdf

US Drought Monitor. (2020). https://www.drought.gov/drought/data-gallery/us-drought-monitor

Williams, Matt C., Lowell H. Anthony, and Fletcher E. O'Brien. (2020). *Natural Hazard Risk Report for Clatsop County, Oregon, Including the Cities of Astoria, Cannon Beach, Gearhart, Seaside, and Warrenton and the Unincorporated Communities of Arch Cape, Svensen-Knappa, and Westport* (Open-File Report O-20-16). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-20-16.htm

Winterbrook Planning. (2017, June 8). *Seaside School District: Comprehensive Plan and Zoning Map and Text Amendment Request*.

V. PLANNING PROCESS

A. Introduction

This Appendix describes the plan history; the planning process and participation, including Steering Committee who oversees the process of updating the plan and outreach and public involvement in the plan; and specific changes made to the 2015 Clatsop County Natural Hazard Mitigation Plan (2015 NHMP) during the 2021 plan update process.

Plan History

2008 Clatsop County Natural Hazard Mitigation Plan

The first Clatsop County Multi-Jurisdictional NHMP was approved by FEMA in 2008.

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 Partnership provided participating communities with print and web- based resources and facilitated a quarterly series of plan development work sessions that focused on the four phases of the mitigation planning process. In addition, The Partnership also provided communities with a number of regional mitigation products to be utilized in the local process. Those products include Plan Templates, a training manual, regional profile and risk assessment, and the Household Preparedness Survey Report.

Each community is responsible for facilitating the mitigation planning process locally, utilizing the resources provided by The Partnership, OEM and other state partners. Participating jurisdictions reviewed the resources provided by the various organizations and applied local knowledge, information and data about community characteristics, assets and resources in order to identify potential mitigation actions aimed at reducing overall risk.

The planning process and associated resources used to create Clatsop County's Multi-Jurisdictional Natural Hazards Mitigation Plan were developed and was 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.

2015 Clatsop County Natural Hazard Mitigation Plan

Beginning in the fall of 2012, the Clatsop County worked with Steering Committee representatives to convene the following jurisdictions: Clatsop County, City of Astoria, City of Cannon Beach, City of Gearhart, City of Seaside, City of Warrenton, and the Port of Astoria. The plan update steps included the following:

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 mitigation actions generated during this phase of the planning process came from a variety of sources. The initial list of mitigation actions was born out of a work session during the third steering committee meeting. The plan facilitator went around the room and asked all of the Steering Committee members to contribute their ideas. This session generated the largest share of mitigation actions, about 35 of them.

Another major contribution of potential actions came from the two public forums in which the public was given blank action forms and asked to offer any mitigation project ideas they may have. Additionally, over the course of phase three, more mitigation ideas were submitted to the planning team from Committee members, local officials, and the general public.

2021 Clatsop County Natural Hazard Mitigation Plan

Clatsop County and its five cities were included, along with several other jurisdictions, in a Pre-Disaster Mitigation (PDM) grant application DLCD made to FEMA in 2018 to update the Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan. During the long delays, DLCD began project planning. A Memorandum of Agreement with a Scope of Work was developed and signed by the original six participating jurisdictions and an additional ten special districts.

Clatsop County, the five municipalities in the County, and other interested jurisdictions were included in a Pre-Disaster Mitigation (PDM) grant application DLCD made to FEMA in 2017 to update the Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan. After a significant delay, DLCD received grant approval and funding from FEMA. At this time, FEMA identified a requirement to conduct robust invitations and engagement to special districts within the County who may be interested in conducting mitigation. Clatsop County, as plan co-convener, conducted targeted invitations to more than 25 districts, resulting in the addition of ten new entities joining the plan during the 2021 update. A draft Intergovernmental Agreement (IGA) and Scope of Work was developed by DLCD to guide the process. As such, the first pre-award meeting of the plan update brought together the potentially-interested jurisdictions and consisted of a presentation about the mitigation planning process and a review of the proposed IGA and Scope of Work. Ultimately, ten of the eleven jurisdictions who participated in that pre-award recruitment meeting continued with the plan update process—resulting in one signed and adopted IGA between the sixteen jurisdictions and DLCD for project work. The County, cities and special districts provided in-kind services as part of the required cost share.

The full list of participating jurisdictions is:

- Clatsop County
- Astoria
- Cannon Beach
- Gearhart
- Seaside
- Warrenton
- Port of Astoria
- Sunset Empire Transportation District
- Clatsop Community College
- Seaside School District
- Cannon Beach Rural Fire Protection District
- Lewis and Clark Rural Fire Protection District
- Knappa-Svensen-Burnside Rural Fire Protection District
- Arch Cape Domestic Water Supply District
- Arch Cape Sanitary District
- Falcon Cove Beach Domestic Water Supply District

Risk Assessment Methodology

The Clatsop County Risk Assessment is based on input provided by plan update participants, the 2020 DOGAMI Natural Hazard Risk Report for Clatsop County, Oregon, and previous plan information. It is also informed by a Future Climate Conditions Report for Clatsop County that was produced by the Oregon Climate Change Research Institute (OCCRI) as part of this plan update project.

Hazard risk is relative because the impacts from hazards are scenario and site-specific. Variations in the physical landscape and its conditions, local preparedness, and response capabilities all can affect the overall risk level of a particular hazard. Furthermore, it is important for jurisdictions to utilize their specific authorities and budgets to implement hazard mitigation activities. As such, the local assessment of relative hazard risk is conducted using a standard methodology developed by FEMA and refined by the Oregon Office of Emergency management (OEM). This methodology leads local jurisdiction managers through a process of scoring risk in terms of vulnerability and probability, resulting in scores that range from 24 to 240 for each hazard. This analysis is a useful first step in evaluating hazards that was used in this process so that new risk assessments could be produced for the ten new special districts joining the 2021 plan update.

The Oregon Department of Geology and Mineral Industries (DOGAMI) made a successful Cooperating Technical Partners (CTP) application that resulted in the Natural Hazard Risk Report for Clatsop County, which forms the basis of the Risk Assessment for this plan update. The timing of this funding and document release was specially coordinated by DLCD, DOGAMI, and other partners who support the development of a consistent, accurate, and timely dataset for the estimation of potential losses from natural hazards. DOGAMI produces multi-hazard risk reports with two objectives: 1) to provide a quantitative risk assessment that informs communities of their risks related to certain natural hazards; and 2) interpret the results to identify specific mitigation opportunities (i.e. areas of mitigation interest) upon which the communities may act. This report contains information and analysis providing the

vulnerability and risk assessment (exposure, and where possible loss estimation) for coastal erosion, earthquakes, flooding, landslides, tsunamis, and wildfires. Mitigation actions suggested by the report's findings were considered by the communities in developing mitigation actions.

A priority for assessing risk is loss estimation and exposure assessment for the local population and the buildings they may be occupying during a disaster. The methodology is summarized in the Project Scope and Methods sections of the report. Access the full report on page 417 in Appendix A1.

Planning for Climate Change

FEMA now requires that hazard mitigation plans include a review of hazards in terms of potential climate impacts. As part of DLCD's application to the Pre-Disaster Mitigation program for project funding, a climate assessment was scoped to be conducted by the Oregon Climate Change Research Institute (OCCRI) based at Oregon State University and completed in February 2020.

Dalton, M. M. (2020). *Future Climate Projections: Clatsop County.* Oregon Climate Change Research Institute, College of Earth, Ocean and Atmospheric Sciences, Oregon State University.

The 2021 Clatsop County plan update relies primarily on this source for its estimation of the impact of climate change on natural hazards in Clatsop County.

Mitigation Strategy

Mitigation actions were discussed and identified throughout the process. At the first meeting of the Steering Committee, the group discussed their interest in the process and their areas of concern for mitigation. Then, during individual risk assessment meetings with jurisdictions, mitigation actions were discussed. Some jurisdictions were ready to identify new action items or report out progress on existing actions. Next the mitigation actions were compiled with the draft Mitigation Strategy chapter. The DLCD Project Manager then presented them at the January 2020 Steering Committee Meeting about the Mitigation Strategy. Feedback and refinement of the mitigation action items occurred at the meeting, in follow up emails and calls over the next months, and in targeted meetings. As part of the review and update process and to ensure a plan that meets the needs of the whole community, the Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County sought input from input from the citizens who live and/or work in Clatsop County and asked the public's opinion on topics such as identified hazards, personal impacts, and personal preparedness.

.

B. Plan Participation

The following sections describe in detail the outreach that was conducted during the 2021 Clatsop County MJNHMP Update.

Steering Committee

The Steering Committee meetings held during the plan update were open to the public, advertised via public notice, and usually had good participation from an array of community organizations with interest or capabilities associated with hazard mitigation. The Clatsop County Natural Hazard Mitigation Plan (NHMP) Steering Committee was originally convened in 2007. Two plan maintenance meetings are held annually, except during plan updates when the meetings occur in accordance with the plan update process.

For the 2021 Plan Update, extensive outreach and engagement of special districts was conducted by the Clatsop County Emergency Manager as plan convener which expanded the multi-jurisdictional partnership from six to sixteen jurisdictions.

Clatsop County Emergency Management (CCEM) was contacted by DLCD in 2018 about an opportunity to receive technical assistance updating the County NHMP, and to consider contacting special service districts to see if they were interested in participating along with cities/county for the first time. The entire list of districts contacted was more than 20 and broadly included the port, transportation, recreation, school, fire, water, sewer, and diking districts. CCEM already worked closely with the rural fire and a variety of other small districts and knew that their administrative resources/capabilities are extremely limited and that it would be necessary to balance the type of new special districts that joined in order to have sufficient support time.

Recruitment began with an introductory email explaining to opportunity and providing general information regarding the benefits and what to expect if they elected to participate in the MJNHMP Update process. Next, each received an individual email to see if they had any questions and notify them of the October meeting where we would explain the project more fully. CCEM then attended the County Fire Defense Board meeting and had a lunch meeting with the Port Director. The recreation district participated in the October meeting but decided subsequently that they would not participate in the plan update. The Port, Seaside School, and three fire districts (Lewis & Clark, Cannon Beach, and Knappa-Svensen-Burnside) decided to participate. With six new districts in hand and three of them fire districts, CCEM, with support of DLCD, assessed remaining capacity and focused on limiting the additional jurisdictions to those with capacity but also balancing the capacity of CCEM and DLCD to coordinate. The remaining special districts who had not responded to that point were not contacted again with the exception of the community college and Arch Cape water/sanitary district. Arch Cape has an active community club in place and they are arguably the most vulnerable of our districts from an isolation standpoint, and particularly with respect to Cascadia planning. The addition provided some insight as to what we would encounter if we lead an effort later to develop plans for water/sanitary districts.

On October 22, 2018 a Special District Informational Meeting was held and subsequently ten of the eleven attending entities decided to join the plan update. Over the course of the plan update process, several other jurisdictions inquired about joining the process, but due to capacity limits, were denied.

Steering Committee Roster – January 2019

Appendix F: CLATSOP NHMP STEERING COMMITTEE ROSTER

ARCH CAPE DOMESTIC WATER SUPPLY DISTRICT & ARCH CAPE SANITARY DISTRICT

Plan Representative (Primary)
Name: Ron Schiffman
Title: District(s) President,
Email: ron.scheffman@acutil.com
Phone: 503-436-2229

Plan Representative (Alternate)
Name: Phil Chick
Title: Manager, ACDWSD & ACSD
Email: philchickacutil.com
Phone: 503-436-2790

Fiscal Point of Contact
Name: Steve Hill
Title: Administrator, ACDWSD
Email: stevehill@acutil.com

CITY OF ASTORIA

Plan Representative (Primary)
Name: Rosemary Johnson
Title: Planning Consultant
Email: rosemaryjcurt@gmail.com
Phone: 503-325-6434 (home land line)

Plan Representative
Name: Brett Estes
Title: City Manager
Email: bestes@astoria.or.us
Phone: 503-325-5824 ext. 2400 (work)
503-791-3391 (cell)

Fiscal Point of Contact
Name: Susan Brooks
Title: Finance Director
Email: sbrooks@astoria.or.us
Phone: 503-325-5821 ext. 2433

CITY OF CANNON BEACH

Plan Representative (Primary)
Name: Jeff Adams
Title: Community Development Director
Email: adams@ci.cannon-beach.or.us
Phone: 503.436.8040

Plan Representative (Alternate)
Name: Karen La Bonte
Title: Public Works Director
Email: labonte@ci.cannon-beach.or.us
Phone: 503.436.8068

Fiscal Point of Contact
Name: Laurie Sawyer
Title: Finance Director
Email: sawyer@ci.cannon-beach.or.us
Phone: 503.436.8058

CANNON BEACH RFPD

Plan Representative (Primary & Fiscal)
Name: Matt Benedict
Title: Fire Chief/Paramedic
Email: mbenedict@cbfire.com
Phone: 503-436-2949

Plan Representative (Alternate)
Name: Marc Reckmann
Title: Training Officer
Email: mreckmann@cbfire.com
Phone: 503-436-2949

CLATSOP COUNTY

Plan Representative (Primary & Fiscal)
Name: Tiffany Brown
Title: EM Director
Email: tbrown@co.clatsop.or.us
Phone: 503-338-3774

Plan Representative (Alternate)
Name: Gail Henrikson
Title: Planning Director
Email: ghenrikson@co.clatsop.or.us
Phone: 503-325-8611

CLATSOP COMMUNITY COLLEGE

Plan Representative (Primary)
Name: Joann Zahn
Title: Vice-President
Email: jzahn@clatsopcc.edu
Phone: 503-338-2421

Plan Representative (Alternate)
Name: Stephanie Homer
Title: Special Projects Coordinator
Email: shomer@clatsopcc.edu
Phone: (503)325-4241

Fiscal Point of Contact
Name: Jennifer Bakke

Title: HR Assistant
Email: jbakke@clatsopcc.edu
Phone: 503-338-2406

FALCON COVE BEACH WATER
Plan & Fiscal Representative
Name: Charles Dice
Title: Board Chair
Email: caddice@gmail.com
Phone: 503-436-0146

CITY OF GEARHART
Plan & Fiscal Representative
Name: Chad Sweet
Title: City Administrator
Email: chadsweet@cityofgearhart.com
Phone: 503-738-5501

Plan Representative (Alternate)
Name: Kristi Ficker
Title: Executive Assistant
Email: krysti@cityofgearhart.com

Fiscal Point of Contact
Name: Cheryl Lund
Title: Planning/Court Clerk
Email: planning@cityofgearhart.com

KNAPPA-SVENSEN-BURNSIDE RFPD
Plan & Fiscal Representative
Name: Paul Olheiser
Title: Fire Chief
Email: p.olheiser@knappafire.com
Phone: (503) 458-6610

LEWIS & CLARK FIRE DEPARTMENT
Plan & Fiscal Representative
Name: Jeff Golightly
Title: Fire Chief
Email: lewisclarkfire@gmail.com
Phone: 503-325-4192

PORT OF ASTORIA
Plan Representative (Primary & Fiscal)
Name: Jim Knight
Title: Executive Director
Email: jknight@portofastoria.com
Phone: 503-741-3300

Plan Representative (Alternate)
Name: Matt McGrath
Title: Operations Manager
Email: mmcgrath@portofastoria.com

CITY OF SEASIDE
Plan Representative (Primary)
Name: Kevin Cupples
Title: Community Development Director
Email: kcupples@cityofseaside.us
Phone: (503)738-7100

Plan Representative (Alternate & Fiscal)
Name: Anne McBride
Title: Emergency Coordinator
Email: amcbride@cityofseaside.us

SEASIDE SCHOOL DISTRICT
Plan Representative (Primary)
Name: Sheila Roley
Title: Superintendent
Email: sroley@seasidek12.org
Phone: 503-738-5591

Plan Representative (Alternate)
Name: Chuck Loesch
Title: Building Maintenance
Email: cloesch@seasidek12.org
Phone: 503-738-5591
Plan Representative (Alternate & Fiscal)
Name: Justine Hill
Title: Business Manager
Email: jhill@seasidek12.org
Phone: 503-738-5591

SUNSET EMPIRE TRANSPORTATION DISTRICT
Plan Representative (Primary)
Name: Jeff Hazen
Title: Executive Director
Email: jeff@ridethebus.org
Phone: 503-861-5399

Plan Representative (Alternate)
Name: Paul Lewicki
Title: Chief Operating Officer
Email: paul@ridethebus.org
Phone: 503-861-5364

Fiscal Point of Contact
Name: Tracy Lofstrom

Title: Finance Officer
Email: tracy@ridethebus.org
Phone: 503-861-5363

CITY OF WARRENTON
Plan Representative (Primary)
Name: Kevin A Cronin, AICP
Title: Community Development Director
Email: cityplanner@ci.warrenton.or.us
Phone: 503-861-0920

Plan Representative (Alternate)
Name: Collin Stelzig, PE
Title: Public Works Director
Email: cstelzig@ci.warrenton.or.us
Phone: 503-861-0914

Fiscal Point of Contact
Name: April Clark
Title: Finance Director
Email: aclark@ci.warrenton.or.us
Phone: (503) 861-2233

WHOLE COMMUNITY STAKEHOLDERS

American Red Cross
Name: DB Lewis
Title: Volunteer
Email: db@dblcy.net
Phone: 503-325-0381

Clatsop Community Action
Name: Dusten Martin
Title: Food Bank Manager
Email: dmartin@ccaservices.org
Phone: 503-325-1400

Clatsop Healthcare District
Name: David Miller
Title: Director
Email: admincchr@clatsopcare.org
Phone: 503-325-0515

Clatsop Soil & Water District
Name: Chris Farrar
Title: Board Member
Email: tochrisfarrar@gmail.com
Phone:

Columbia Memorial Hospital
Name: Paula Larson
Title: Emergency Manager
Email: plarson@columbiamemorial.org
Phone: 503-325-4321

CREST
Name: Hannah Dankbar
Title: Planner
Email: hdankbar@columbiaestuary.org

Phone: 503-325-0435

Voluntary Organizations Active in Disaster
Name: Charlene Larsen
Title: Volunteer
Email: crl.larsen@charter.net
Phone: 503-325-0590

Providence Seaside Hospital
Name: Erik Meyer
Title: Emergency Manager
Email: Erik.Meyer@providence.org
Phone: 503-717-7501

PENDING REQUESTS/RESPONSES

Clatsop Economic Development Resources
Columbia River Business Journal
Columbia Press
Oregon Department of Forestry
Oregon Department of Transportation
Columbia Maritime Museum
Seaside Museum & Historical Society
Cannon Beach History Center & Museum
Lower Columbia Hispanic Council

Steering Committee Meetings: 2021 Plan Update Process

November 2017

At the November 15, 2017 Biannual Review Meeting of the Clatsop NHMP Plan Maintenance Committee, Clatsop County Emergency Services reported out about the initiation of the project to representatives from the cities of Gearhart and Seaside.

June 2018

At the June 7, 2018 Biannual Review Meeting of the Clatsop NHMP Plan Maintenance Committee, Clatsop County Emergency Services reported out about the initiation of the project to an invitation list of eighteen people which included the five cities, Clatsop Community College, Arch Cape Water and Sanitary Districts, OSU SeaGrant, and the Fire Defense Board.

October 2018

Clatsop County Emergency Services conducted an extensive Steering Committee recruitment process. At the **October 22, 2018 Special District Informational Meeting** of the Clatsop NHMP Plan Maintenance Committee, fourteen (14) attendees representing eleven participating jurisdictions considered a presentation by DCLD about the NHMP update process and the requirements for special districts in the planning process. Other participants included 1 representative from Sunset Empire Park & Recreation District.

November 2018

At the **November 26, 2018 Clatsop Multi-Jurisdictional NHMP Steering Committee Semi-Annual Meeting & 2021 Update Organizational Meeting**, seventeen (17) attendees represented twelve participating jurisdictions, DLCD staff, and included a representative from Columbia Memorial Hospital.

January 2019

At the **September 29, 2019 Organizational Meeting of the Clatsop NHMP Update Steering Committee**, thirty-seven (37) attendees included Steering Committee members and staff from fourteen participating jurisdictions as well as representatives from American Red Cross, Clatsop Soil & Water Conservation District, Clatsop Care, CREST, and Providence Memorial Hospital. Five decisions were made at this meeting: 1) Adopt Steering Committee Operating Protocols (see below), 2) Approve minutes from 11/26/2018 meeting (two abstentions), 3) Discuss and approve three plan update priorities:

1. Use an integrated plan approach; Develop processes to guide the integration of natural hazard data into local plans; and integrate relevant local plan data into the NHMP.
2. Develop new mitigation actions using SMART methodology
3. Coordinate outreach; Use a variety of public participation methods to solicit residential and agency contributions resulting in a more comprehensive collaboration.

4) Affirm that the Steering Committee and Stakeholder rosters represent the whole community of stakeholders for Clatsop County's NHMP (that is that the recruitment conducted is sufficient).

5) Affirm the Public Engagement Plan Matrix as the preliminary Clatsop NHMP Outreach Strategy.

April 2019

At the **April 3, 2019 Organizational Meeting of the Clatsop NHMP Update Steering Committee**, forty (40) attendees represented fourteen participating jurisdictions. Other participants included representatives from Clatsop Soil & Water Conservation District, Columbia Memorial Hospital, Columbia River Estuary Study Taskforce (CREST), Columbia River Maritime Museum, Elsie-Vinemaple Rural Fire Protection District, Oregon Voluntary Organizations Active in Disaster (ORVOAD), Oregon Dept. of Forestry, and Oregon Dept. of Transportation. The meeting was immediately followed by a CTP presentation by Oregon Dept. of Geology and Mineral Industries (DOGAMI) regarding the Clatsop County Natural Hazard Risk Report

September 2019

At the **September 24, 2019 Risk Assessment meeting of the Clatsop NHMP Update Steering Committee**, thirty-two (32) attendees represented X participating jurisdictions. Other participants included X members of the public and representatives from the following Columbia Memorial Hospital, Providence Seaside Hospital, Columbia River Estuary Study Taskforce, Clatsop Soil & Water Conservation District, Northwest Coast Trails, Kate Cox Consulting, Dept. of Land Conservation and Development, and OSU Extension.

Meg Reed, DLCD Coastal Shores Specialist, gave a presentation entitled Tsunami Hazard & Mitigation Practices about her work supporting communities doing tsunami facility and evacuation planning work. Public review of the risk assessment included a presentation on findings and breakout discussions. The group discussed the findings of the OCCRI Climate Report and the DOGAMI, 2018 *Natural hazard risk report for Clatsop County*, unpublished, as well as the rankings of the sixteen jurisdictions in their Hazard Vulnerability Assessment (HVA) matrices.

January 2020

At the **January 28, 2020 Mitigation Strategy meeting of the Clatsop NHMP Update Steering Committee** twenty-five (25) attendees represented eight (8) participating jurisdictions. Other participants included representatives from the Clatsop Soil & Water Conservation District.

Maria Ross and Katie Kopania of Oregon Health Authority, gave a presentation on “Building Coastal Hospital Resiliency” and Tiffany Brown presented “Emergency Fuel Planning: A Local and Regional Overview”. She provided background and information on the vulnerabilities of the Critical Energy Infrastructure (DEI) Hub in Portland as well as the local risks of fuel storage in an earthquake event. The group reviewed and discussed the draft mitigation plan and discussed the role of climate change.

January 2021

At the **January 19, 2021 Plan Approval meeting of the Clatsop NHMP Update Steering Committee** thirty-two (32) attendees represented ten (10) participating jurisdictions. Other participants included representatives from the Columbia River Estuary Study Taskforce. Tiffany Brown hosted the meeting and Pam Reber gave a presentation on the plan update itself, as well as the plan approval and adoption process. As the plan update was a complete re-write and a transition from an annex-based plan to an integrated plan, the presentation featured highlights of integrated data tables, such as that sourced from the individual jurisdictions’ hazard vulnerability rankings or the hazard analysis provided by the newly published DOGAMI Natural Hazard Risk Report for Clatsop County. The meeting concluded with adoption of the plan, including Appendix A that lists numerous geotechnical reference documents.

Semi-Annual Meetings: 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.

The Committee will meet on a semi-annual basis (April and September) to complete the following tasks.

During the first meeting (April/Spring) 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 in Section III. F of the Mitigation Strategy, Economic Analysis of Hazard Mitigation Projects.

During the second meeting (September/Fall) 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. The process the Committee will use to prioritize mitigation projects is detailed in the Mitigation Strategy section III, F. Economic Analysis of Hazard Mitigation Projects. The County and participating jurisdictions are encouraged 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.

Steering Committee Operating Protocols

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan January 29, 2019

Basic Requirements:

- One representative from each jurisdiction will attend each full Steering Committee meeting (4-7 anticipated over 2019). This representative will sign in and provide cost share documentation for their meeting attendance and preparation.
- Each jurisdiction will facilitate an internal planning process to complete Elements A-D and duly engage the public. All meetings and public engagement efforts will be documented to the best of the ability of the participants.
- Each jurisdiction agrees to the terms of IGA/scope of work as proposed and to adopt the final plan.
- Completing the basic FEMA requirements is the responsibility of each jurisdiction.

Overall Process:

- Ask questions or ask for help if needed.
- Participate and share; allow space for others to do the same.
- Leave negative expectations at the door; lead with trust/openness to ideas.
- Engage this opportunity for collaboration; Help formulate a joint vision.
- Foster a respectful sharing dynamic: offer knowledge and share needs—but without specific expectations.

Decision-making Process: *Proposal—Discussion—Decision*

- Decisions will be associated primarily with written proposals, shared in advance, or with enough substantive presentation at the meeting that the proposal is clear and the group can adequately discuss it prior to a decision. Many concepts and ideas will be discussed that will not require formal decisions, however, there will be specific proposals for how the plan is outlined, etc.
- We will strive for consensus but use a voting process to make decisions. **Each jurisdiction formally participating in the plan will receive one vote (yes or no)**. The primary representative or the person in attendance will be the voting representative for the jurisdiction and is expected to wield voting authority. However, if the person wants to register their vote either as a 'stand-aside' due to a moral quandary or an 'abstention' due a lack of understanding of the question being called, that is acceptable.

Plan Maintenance: Record of Revisions Form

DATE	JURISDICTION(S)	REVISION

Public Outreach and Notices

Clatsop MJNHMP Public Engagement Plan

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update—Public Engagement Plan Matrix

Strategy	Clatsop County	Astoria	Cannon Beach	Gearhart	Seaside	Warrenton	Arch Cape Drinking Water District	Arch Cape Sanitary	Cannon Beach Fire	Clatsop Community College	Falcon Cove Beach Water	Knappa Fire	Lewis & Clark RFPD	Port of Astoria	Seaside School District	Sunset Empire Transp. District
Steering Committee Meetings: • 3-4 over the course of the project	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Public Meeting: Adoption Proceedings: The final plan must be formally adopted by all participating jurisdictions.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Public Meeting: *Draft Risk Assessment*	X	X	X							X						
Public Meeting: *Draft Mitigation Strategy*	X	X	X													
Public Meeting: *Board/Council Workshop**		?	X	X Joint												
Public Meeting: *Planning Commission**				Joint												
Public Meeting: Other Event Jurisdiction will host a presentation, tour, or other activity about hazards or mitigation actions. This could include inviting the County Emergency Services staff to give a talk.	X		X		X	X Mayor's Town Hall	X	X	X	X Alex & Ideas	X	X	X	X	X	X Relocation tour
HAZARD TOOLKIT: Clatsop County plans to offer quarterly hazard information, graphics, links, and other information as an outreach media packet. Check this box if you would like to coordinate on this hazard toolkit.	X		X													

PUBLIC: Businesses, neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, academia, and other private and non-profit interests.
PARTIAL COMMUNITY and are as set forth by FEMA: 1) Emergency management, 2) Economic Development, 3) Land Use and Development, 4) Housing, 5) Health and Social Services, 6) Infrastructure, and 7) Natural and Cultural Resources

---

Clatsop County MJNHMP Update—Public Engagement Program **February 2019**

Page 2

Strategy	Clatsop County	Astoria	Cannon Beach	Gearhart	Seaside	Warrenton	Arch Cape Drinking Water District	Arch Cape Sanitary	Cannon Beach Fire	Clatsop Community College	Falcon Cove Beach Water District	Knappa Fire	Lewis & Clark RFPD	Port of Astoria	Seaside School District	Sunset Empire Transp. District
WEBSITE: Establish a website where citizens can review and comment on plan drafts, learn about how to prepare, and otherwise learn about natural hazards and the NHMP.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LEGAL NOTICES: Create and publish legal notices for public meetings and other plan engagement opportunities via established media avenues (print, radio, and television).	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
EMAIL LIST: Jurisdiction will establish an email list where citizens, businesses, and other interested parties can receive news about the plan update.		X	X												X	
SOCIAL MEDIA: Jurisdiction will establish, or use established social media outlets (Facebook, Instagram, etc.) to convey meeting times, hazard information, and news about the plan update.	X			X						X		X	X		X	X
UTILITY BILLS: Jurisdiction will insert information about upcoming meetings and events into utility bills on a monthly or bimonthly cycle.		X	X				X	X			X					
DISTRIBUTE FLYERS: Provide information at booths or tables during public events. Deliver to local businesses. Display at Community Centers & Offices.		X	X				X	X								
SURVEY: Distribute NHMP survey via electronic or print methods. Return the results to Clatsop County in a timely fashion.	X	X	X	X	X	X			X		X	X	X	X		
OTHER:	X		X Hotel engagement		X	X			X	X				X		X Signs on boats and bus shelters.

Websites

In this 2021 plan update, the following websites were used as a primary method of outreach by Clatsop County, the five cities, and many of the ten special districts who joined the mitigation planning process:

The 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan website is available here: https://www.co.clatsop.or.us/em/page/multi-jurisdictional-natural-hazards-mitigation-plan-mjnhmp-update-2021

Clatsop County
https://www.co.clatsop.or.us/

City of Astoria
https://www.astoria.or.us/

City of Cannon Beach
https://www.ci.cannon-beach.or.us/

City of Gearhart
https://www.cityofgearhart.com/

City of Seaside
http://www.cityofseaside.us/

City of Warrenton
https://www.ci.warrenton.or.us/

Port of Astoria
https://www.portofastoria.com/

Sunset Empire Transportation District
https://www.nworegontransit.org/agencies/sunset-empire-transportation-district/

Clatsop Community College
https://www.clatsopcc.edu/

Seaside School District
http://www.seaside.k12.or.us/
http://www.seaside.k12.or.us/?DivisionID=22431&ToggleSideNav=ShowAll

Cannon Beach Rural Fire Protection District
https://www.cbfire.com/
https://www.cbfire.com/natural-hazards-mitigation-and-emergency-operations-plans
https://www.cbfire.com/earthquakes
https://www.cbfire.com/floods
https://www.cbfire.com/severe-storms

Lewis and Clark Rural Fire Protection District
https://www.facebook.com/Lewis-Clark-Volunteer-Fire-Dept-142191469145305/

Knappa-Svensen-Burnside Rural Fire Protection District
https://www.knappafire.com/

Arch Cape Domestic Water Supply District
https://www.archcapewater.org/

Arch Cape Sanitary District
https://www.archcapewater.org/

Falcon Cove Beach Domestic Water Supply District
No website. Email, utility bills, and public posting used to communicate with customers.

Hazard Survey

As part of the review and update process and to ensure a plan that meets the needs of the whole community, we need input from the citizens who live and/or work in Clatsop County. The Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County asked the public's opinion on topics such as identified hazards, personal impacts, and personal preparedness. Three methods were provided completing the survey (online survey via SmartSheets, fillable PDF, and print PDF).

Clatsop County Plan Update Website: https://www.co.clatsop.or.us/em/page/multi-jurisdictional-natural-hazards-mitigation-plan-mjnhmp-update-2021

Survey (SmartSheet, Fillable PDF, and print PDF):

https://app.smartsheet.com/b/form/68ac314866304d8c8a1e6017b4140796

https://www.co.clatsop.or.us/sites/default/files/fileattachments/emergency_management/page/18941/nhmp_survey-fillable.pdf

https://www.co.clatsop.or.us/sites/default/files/fileattachments/emergency_management/page/33668/nhmp_survey.pdf

The survey was opened in July 2020 and data was gathered about preparedness and hazard concerns until early December 2020. Then once the plan update was posted, the survey was revised and reissued until January 15, 2021.

See Appendix B2 for the Hazard Survey Documentation.

Plan Review Outreach

Clatsop County

In addition to creating the detailed Plan Update website and three mechanisms for responding to the Clatsop survey which is a plan feedback tool, Clatsop County Emergency Management also created a display ad.

Clatsop County Emergency Management shared this email to 91 persons on January 11, 2021—a list comprised of the Clatsop MJNHMP Steering Committee and Stakeholders.

Figure V-1. Clatsop County Plan Update Outreach Email

Fri 1/8/2021 10:38 AM

Tiffany Brown <TBrown@co.clatsop.or.us>

Clatsop County MJNHMP - Public Comment Period

To RIZZO Althea; Anne McBride; Barbara Fryer; Bill Campbell; Brett Estes (bestes@astoria.or.us); Bruce Jones (jones@crmm.org); Bruce St. Denis; Carole Connell; Chad Sweet; Charlene Larsen; Charles Dice ; Cheryl Lund; Chris Farrar; Chuck Loesch ; Collin Stelzig; Courtney Bangs; D.B. Lewis; David Miller; Denise Lofman; Don Bohn; 'Dusten Martin'; Erik Meyer ; Flint Helligso; Gail Henrikson; Gary Kobes ; 'Jeff Adams'; Jeff Golightly (lewisclarkfire@gmail.com); Jeff Harrington; Jeff Hazen (Jeff@ridethebus.org); 'JoAnn Zahn'; John Toyooka; Adam Niles; Jon Rahl (jrahl@cityofseaside.us); Justine Hill (jhill@seasidek12.org); 'Karen LaBonte'; Kate Cox; KC Christensen; Kevin Cupples ; Krysti Ficker; Kurt Donaldson; Laura Morales; Lianne Thompson;

Follow up. Start by Monday, January 11, 2021. Due by Monday, January 11, 2021. Reminder: Monday, January 11, 2021 11:00 AM.

Dear Clatsop County MJNHMP Steering Committee Members & Stakeholders,

We launched the public comment period for the Clatsop MJNHMP this past week, so I'm following up with some information and guidance to assist with reviewing the document and better understanding what we have left of the process.

January Steering Committee Meeting
First things first—we need to get the next meeting set in January. We anticipate that we may host two more meetings before the entire process has wrapped up, but for now, we want to set on in the next couple of weeks to wrap up the public comment and discuss the remaining timeline/tasks that must occur prior to final approval. If you are part of the steering committee or a stakeholder with interest in attending, please indicate your availability here: https://doodle.com/poll/f22sp88bnwmxdvx9?utm_source=poll&utm_medium=link

NHMP Public Review
The document outreach page is posted on the county website here: https://www.co.clatsop.or.us/em/page/multi-jurisdictional-natural-hazards-mitigation-plan-mjnhmp-update-2021

Also found on this page is an online survey that we're encouraging the public, steering committee members and stakeholders like to complete: https://app.smartsheet.com/b/form/68ac314866304d8c8a1e6017b4140796 If you or someone you know needs a paper/electronic version, they can be found on the same page as the online link.

Note: If you've already tried viewing the page and had trouble downloading or heard the same from others, it is a potential issue we've resolved by loading the PDF onto the County website directly instead of pulling from the state file server.

Thank you for your participation in this important project and for sticking with us through the strangeness of 2020—we're almost to the finish line!

We look forward to our next meeting-- please don't hesitate to reach out to either of us in the meantime.

CCEM CLATSOP COUNTY EMERGENCY MANAGEMENT

Tiffany Brown, MA
Emergency Manager/Director
t 503.325.8645/ c 503.791.6131
www.co.clatsop.or.us/em

Pamela Reber
Natural Hazard Planner
Direct: 971-304-5505
pamela.reber@state.or.us | www.oregon.gov/LCD

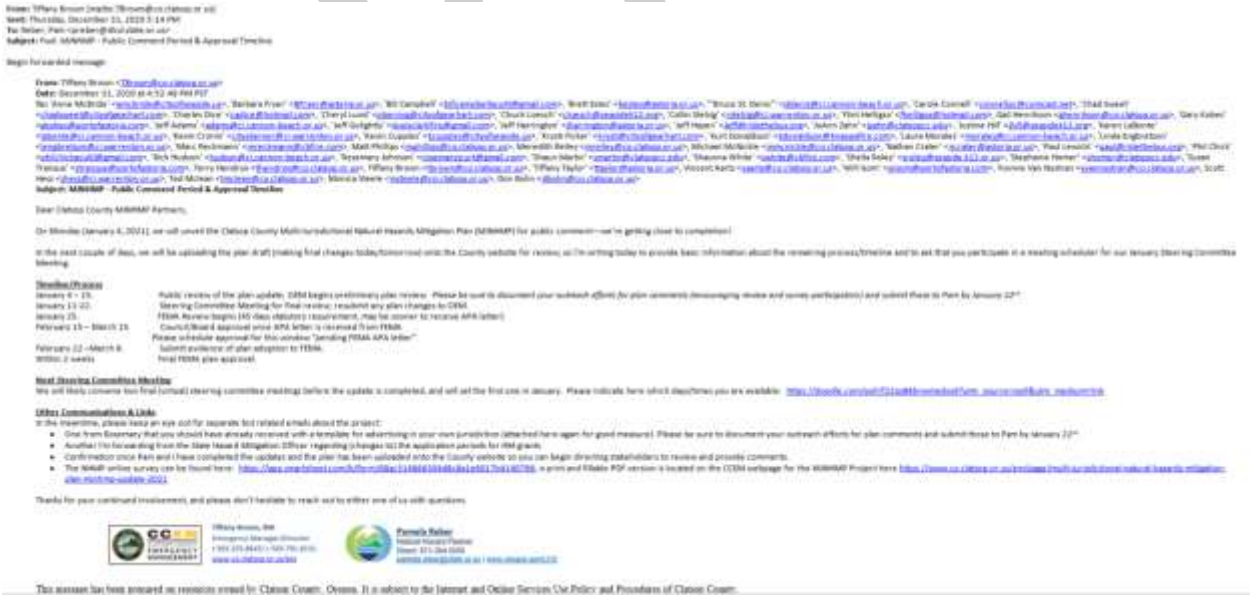
This message has been prepared on resources owned by Clatsop County, Oregon. It is subject to the Internet and Online Services Use Policy and Procedures of Clatsop County.

Tiffany Brown <TBrown@co.clatsop.or.us>; RIZZO Althea <althea.rizzo@state.or.us>; Anne McBride <amcbride@cityofseaside.us>; Barbara Fryer <bfryer@astoria.or.us>; Bill Campbell <billcampbellacutil@gmail.com>; Brett Estes (bestes@astoria.or.us); Bruce Jones (jones@crmm.org); Bruce St. Denis <stdenis@ci.cannon-beach.or.us>; Carole Connell <connellpc@comcast.net>; Chad Sweet <chadsweet@cityofgearhart.com>; Charlene Larsen <crl.larsen@charter.net>; Charles Dice <cadice@hotmail.com>; Cheryl Lund <planning@cityofgearhart.com>; Chris Farrar <tochrisfarrar@gmail.com>; Chuck Loesch <cloesch@seasidek12.org>; Collin Stelzig <rstelzig@ci.warrenton.or.us>; Courtney Bangs <cbangs@co.clatsop.or.us>; D.B. Lewis <db@dblcy.net>; David Miller <admincchr@clatsopcare.org>; Denise Lofman <dlofman@columbiaestuary.org>; Don Bohn <dbohn@co.clatsop.or.us>; 'Dusten Martin' <dmartin@ccaservices.org>; Erik Meyer <erik.meyer@providence.org>; Flint

Helligso <fhelligso@hotmail.com>; Gail Henrikson <ghenrikson@co.clatsop.or.us>; Gary Kobes <gkobes@portofastoria.com>; 'Jeff Adams' <adams@ci.cannon-beach.or.us>; Jeff Golightly (lewisclarkfire@gmail.com); Jeff Harrington <jharrington@astoria.or.us>; Jeff Hazen (Jeff@ridethebus.org); 'JoAnn Zahn' <jzahn@clatsopcc.edu>; John Toyooka <jtoyooka@co.clatsop.or.us>; Adam Niles <aniles@co.clatsop.or.us>; Jon Rahl (jrahl@cityofseaside.us); Justine Hill (jhill@seasidek12.org); 'Karen LaBonte' <labonte@ci.cannon-beach.or.us>; Kate Cox <kcoxconsulting@gmail.com>; KC Christensen <karen.christensen@odot.state.or.us>; Kevin Cupples <kcupples@cityofseaside.us>; Krysti Ficker <krysti@cityofgearhart.com>; Kurt Donaldson <kdonaldson@knappafire.com>; Laura Morales <lmorales@co.clatsop.or.us>; Lianne Thompson <lthompson@co.clatsop.or.us>; Linda Engbretson (lengbretson@ci.warrenton.or.us); Phipps, Lisa <lphipps@dlcd.state.or.us>; Marc Reckmann <mreckmann@cbfire.com>; Lahav, Marian <mlahav@dlcd.state.or.us>; Mariko Froehle <mfroehle@gmail.com>; Mark Kujala <mkujala@co.clatsop.or.us>; 'Matt McGrath ' <mmcgrath@portofastoria.com>; Matt Phillips <MPhillips@co.clatsop.or.us>; 'Matt Williams' <Matt.WILLIAMS@oregon.gov>; Meredith Reiley <mreiley@co.clatsop.or.us>; Michael Kerwin <mkerwin@clatsopcare.org>; Michael McNickle <mmcnickle@co.clatsop.or.us>; Michelle Hamrick <michelle.hamrick@redcross.org>; Monica Steele <MSteele@co.clatsop.or.us>; Morgan Murray <mmurray@ci.warrenton.or.us>; Nancy Ferber <nferber@astoria.or.us>; 'Nathan Crater ' <ncrater@astoria.or.us>; Pam Birmingham <pamb@windermere.com>; Pamela Wev <pwev@co.clatsop.or.us>; 'Patrick Corcoran' <patrick.corcoran@oregonstate.edu>; Paul Lewicki <paul@ridethebus.org>; Paula Larson <plarson@columbiamemorial.org>; Phil Chick (philchickacutil@gmail.com); Reed, Meg <mreed@dlcd.state.or.us>; Rick Hudson <hudson@ci.cannon-beach.or.us>; Rizzo, Althea (althea.rizzo@mil.state.or.us); Ron Schiffman (ronschiffmanacutil@gmail.com); Rosemary Johnson <rosemaryjcurt@gmail.com>; Ross Maria J (MARIA.J.ROSS@dhsoha.state.or.us); Scott Hess (shess@ci.warrenton.or.us); 'Shane Watson ' <maintenance@clatsopcare.org>; 'Shaun Martin ' <smartin@clatsopcc.edu>; Shaunna White <swhite@cbfire.com>; Sheila Roley <sroley@seaside.k12.or.us>; Stephanie Homer <shomer@clatsopcc.edu>; Stewart Emmons <wse@emmonscompany.net>; Stewart Schultz <sschultz@unizd.hr>; Susan Penrod <spenrod@seasidek12.org>; Ted Mclean <TMclean@co.clatsop.or.us>; Terry Hendryx <THendryx@co.clatsop.or.us>; Tiffany Taylor <ttaylor@astoria.or.us>; Tom Bennett <TBennett@co.clatsop.or.us>; Trila Bumstead (trila.bumstead@ohanamediagroup.com); Viviana Matthews (vmatthews@ccaservices.org); Wayne Carmichael <wayne.carmichael@wright.edu>; Will Isom <wisom@portofastoria.com>; Yvonne Van Nostran <yvannostran@co.clatsop.or.us>; 'Nicole Bales' <nbales@dailyastorian.com>

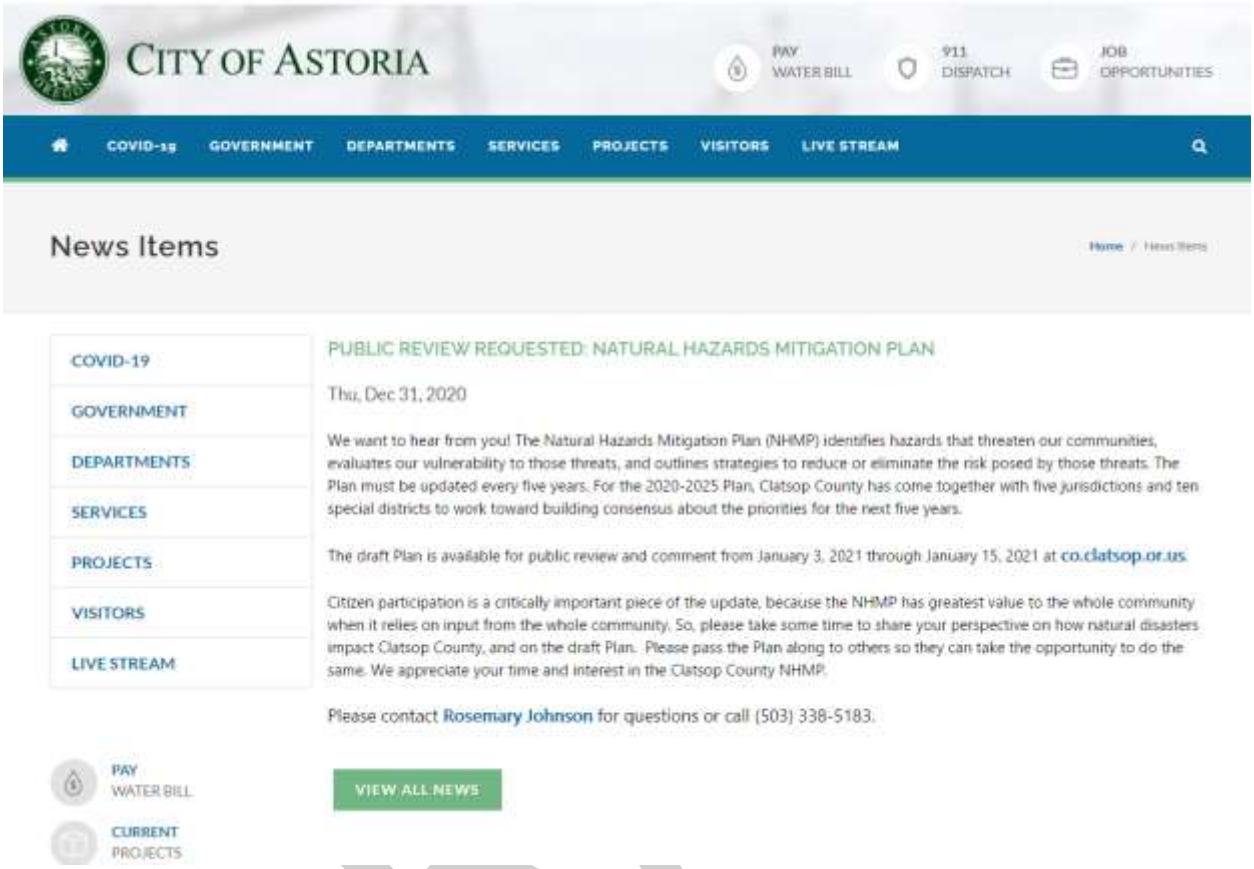
This communication was in follow up to the original notice about the plan update draft availability on December 31, 2020, but it provided an improved web link. The original notice was sent to 53 people:

Figure V-2. Clatsop County Plan Update Outreach Email



City of Astoria

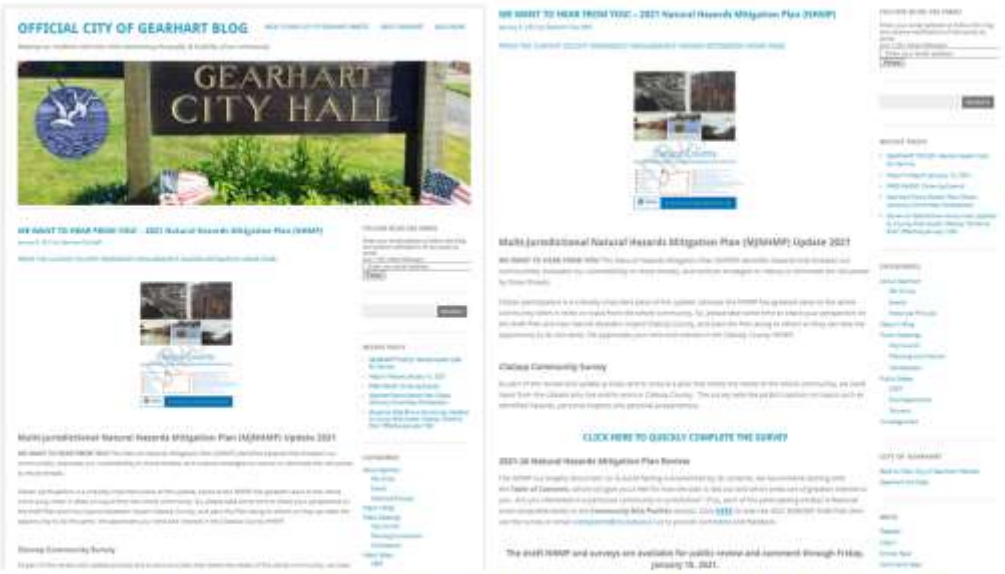
Figure V-3. Astoria Plan Update Web Announcement



Source: https://www.astoria.or.us/news/1813?deptid=1

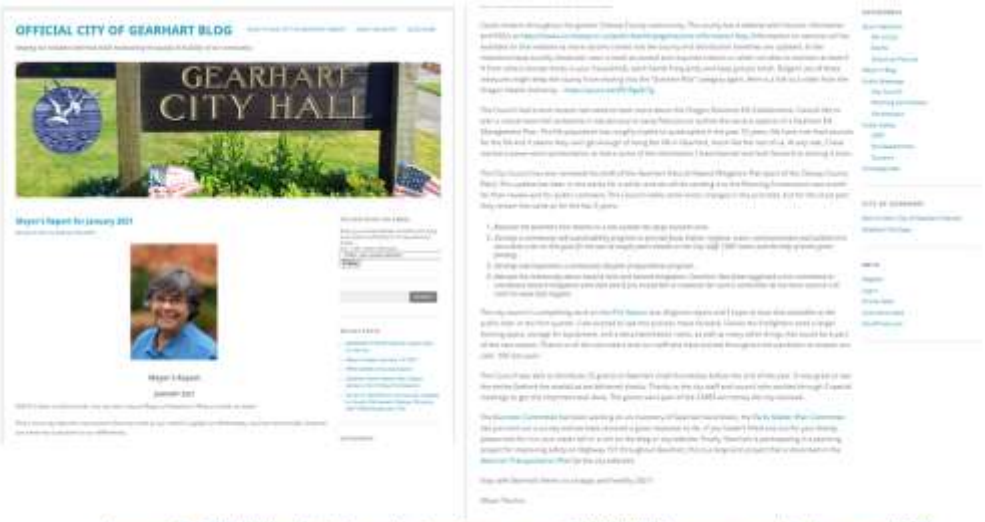
City of Gearhart

Figure V-4. Gearhart blog 1



January 8, 2021: https://cityofgearhart.wordpress.com/2021/01/08/we-want-to-hear-from-you-2021-natural-hazards-mitigation-plan-nhmp/

Figure V-5. Gearhart blog 2



January 8, 2021: https://cityofgearhart.wordpress.com/2021/01/08/mayors-report-for-january-2021/

Figure V-6. Gearhart blog 3.1

August 9, 2020: https://cityofgearhart.wordpress.com/2019/08/09/mayors-report-for-august-2019/

Figure V-7. Gearhart blog 3.2

August 9, 2020:

Figure V-8. Gearhart blog 3.3

August 9, 2020: https://cityofgearhart.wordpress.com/2019/08/09/mayors-report-for-august-2019/

Figure V-9. Gearhart blog 4: Plan Review Outreach

June 9, 2020: https://cityofgearhart.wordpress.com/2020/06/09/gearhart-share-your-feedback/

Figure V-10. Gearhart blog 5: Plan Review Outreach

June 20, 2020:https://cityofgearhart.wordpress.com/2020/06/30/gearhart-share-your-feedback-2/

July 27, 2020: https://cityofgearhart.wordpress.com/2020/07/27/last-chance-for-natural-hazards-mitigation-feedback/

Arch Cape Water and Sanitary Districts

Arch Cape Water Supply and Sanitary Districts sent an email requesting input to 48 individual emails on their shared distribution list. The following public notice was posted about the plan update in the Arch Cape Community Center where 50-75 residents pick up their mail.

Figure V-11. Arch Cape Plan Update Outreach Email

Phil Chick <philchickacutil@gmail.com>

Re: OOPS: MJNHMP - Public Comment Period & Approval Timeline

the distribution email list is shared by both districts. Below is the message that was emailed. And attached is a photo of the notice that was posted at the community mailboxes.
Phil

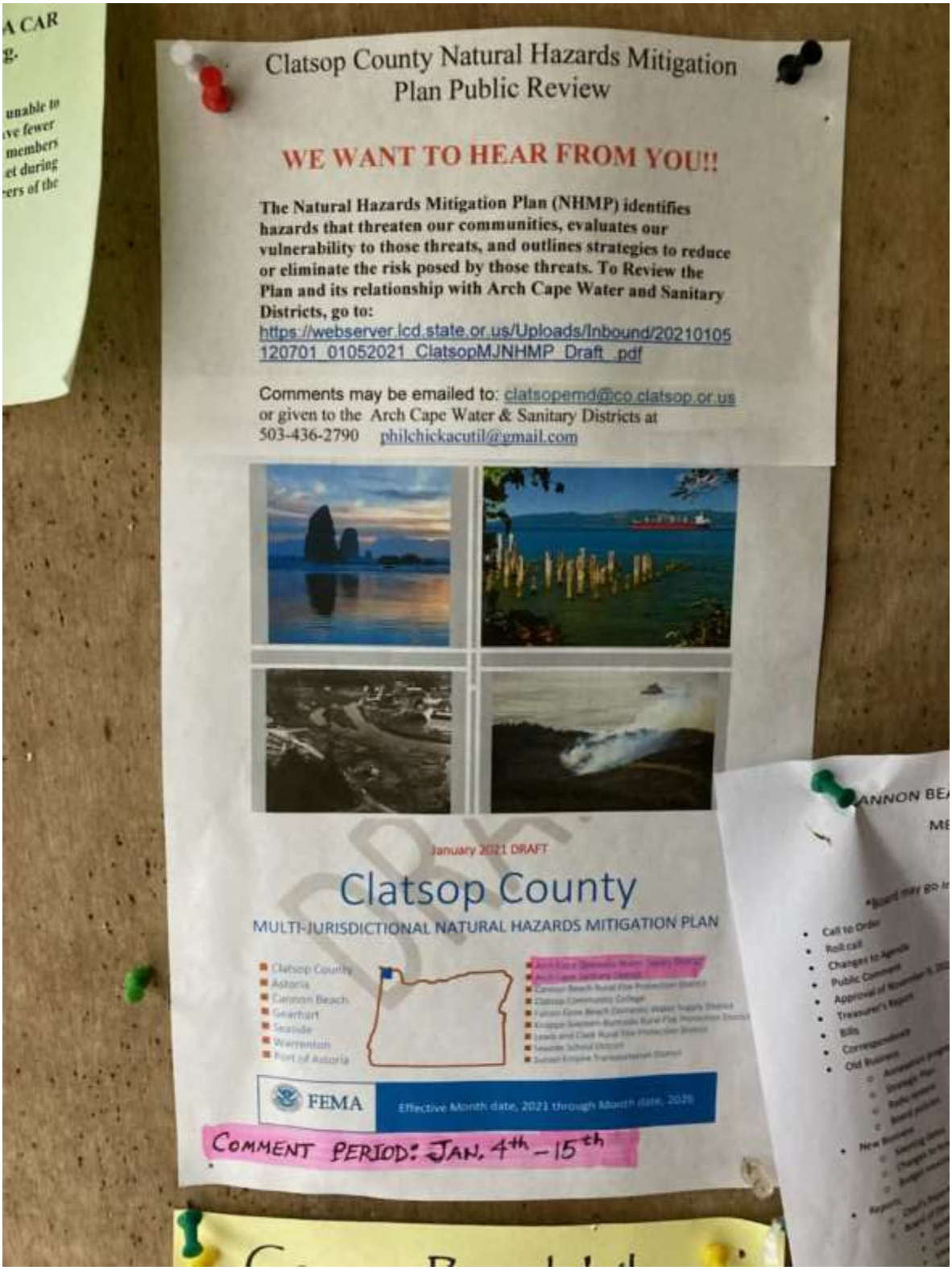
WE WANT TO HEAR FROM YOU!!

Clatsop County Natural Hazards Mitigation Plan Public Review Period January 4th - 15th

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats. To Review the Plan and its relationship with Arch Cape Water and Sanitary Districts, go to: https://webserver.lcd.state.or.us/Uploads/Inbound/20210105120701_01052021_ClatsopMJNHMP_Draft_.pdf

Comments may be emailed to: clatsopemd@co.clatsop.or.us or given to the Arch Cape Water & Sanitary Districts at 503-436-2790 philchickacutil@gmail.com

Figure V-12. Arch Cape Plan Update Public Notice



Plan Update Comment Matrix

Table V-1. Comments and Responses

#	Commenter	Comment	Response
	n/a	Why is hazard mitigation limited to physical events like earthquakes and not inclusive of public health/pandemic like events?	Pandemics have not been widely included in hazard mitigation plans, however mitigation can include public health events like pandemics. Unfortunately the multi-jurisdictional coordination on the emerging event was beyond the capacity of the group to include in this plan update.
	n/a	Make sure utilities companies are involved and resilient and / or have emergency backup such as solar. Our population depends daily on electricity, gas and communications. Water and sewer need utilities to function properly too.	Great point. The Clatsop County Emergency Manager does a good deal of coordination with utilities as do the participating jurisdictions in their capacity as drinking water and sanitary service providers.
	n/a	No mention here of tornado hazard, which seems to be a growing threat in this area.	Thank you for the feedback on the survey. The tornado hazard is included in the Windstorm and winter storm plan section.
	Sherri Gray	Need better info about the location and contents in the community emergency kits stationed in the neighborhoods in town and more of these kits.	Community emergency kits are a priority for many of the participating jurisdictions in this plan update. Please see the City of Seaside Community Risk Profile section for more information on this topic.
	n/a	No information given to public outside of city council meeting - again no community involvement to those who actually live work here.	Thank you for the feedback on the survey. The plan update process included five public steering committee meetings during plan development and a public review period for the plan after this comment was received.
	n/a	Moving the high school was the wrong choice in my opinion. Instead for the money we could have built a new tsunami-proof facility including an upper level escape platform thereby saving countless lives during the initial event, whether it hits during school times or any other time.	Thank you for the feedback and honest opinion. Consider two factors that informed this decision: a) the availability of state monies for seismic school safety; and b) the grave concern of decision makers that in the event of a tsunami, every parent will rush into the tsunami zone to save their child if it occurs

#	Commenter	Comment	Response
			during the school day. Fortunately, the school relocation does not preclude other relocations and the manner in which the project was implemented demonstrates the deep commitment and professionalism of civic leaders who are capable of doing more, like constructing a tsunami evacuation tower with future public support.
	Dolores Matthys	It's a lot to wrap your head around and plan for as a single homeowner with multiple pets to consider.	Thank you for taking the time to consider these hazards. It can be overwhelming, but by taking small steps towards preparedness, a good amount of progress can be made.
	Neil Grubb	With age comes wisdom that we really can't forecast what Mother Nature will throw at us: Columbus Day Storm, Mt. St. Helens, Floods of 1996. All happened in a different way than predicted. Let's plan for the known events like traffic accidents and winter storms and not for those that Mother Nature will decide how, and when.	Thank you for the feedback and honest opinion. This plan update is conducted in accordance with Stafford Act requirements so that the participating jurisdictions will continue to qualify for hazard mitigation funds from the Federal Emergency Management Authority. Mitigation activities can save $6 for each one spent and is thus considered a fiscally responsible course of action.
	Suzanne Myhra	I'm one of "those" Portland people who have a second home in Gearhart. I've gone through emergency preparedness in my HOA in Portland and know some of this but not things unique to the coast.	Thank you for your feedback and interest in coastal hazards. Please consider signing up for email alerts from Clatsop County Emergency Management if you haven't done so already. https://www.co.clatsop.or.us/em/page/clatsopalerts
	Stephen Davis	"Note: I am retired, so did not answer workplace questions. For the majority of the categories of concern I agree in general with the planning and preparation being considered. In the case of tsunami: EARLY WARNING should be THE PRIME CONCERN. That is the only thing that will save lives. In the case of a major Cascade Fault quake, the resulting tsunami will be totally devastating to the entire OR North Coast. Preservation of property within the contact zone, if	Thank you for the feedback on the survey. Unfortunately you are correct about the relative risk of a Cascadia subduction event. You will likely find the specific data included in the newly-published final Natural Hazard Risk Report for Clatsop County to be of significant interest. We also think you'll appreciate much of the updated plan sections on earthquake and tsunami.

#	Commenter	Comment	Response
		anything should be a minor subject. There won't be any structural and in some areas geographical property remaining. Finances and efforts to reinforce infrastructure, other than bridge quake reinforcement are a waste of time and effort. There won't be anything there. And anyone who isn't out of the danger zone by the time the tsunami comes ashore---won't come out. That may sound harsh, but take a look at the Japan disaster videos for confirmation. Again, Early Warning is the only thing that will save lives. That should be where all effort is focused. Secondary planning for food, water, medical need to be in the plan, but first people have to survive. I really don't think that most citizens here fully understand what will happen. There seems to be an attitude of---Oh my, a big wave could come in, and we will need to get up to the hill while it happens, and then go back home. I hope the Emergency Planning Committee understands that there won't be any home to go to, if fact there won't be any Seaside---and that is the scenario that has to be planned for. Any assistance from military sources should probably be forgotten. Especially those on the coast--they won't be there. Any plan involving tsunami disaster should have a control center located inland and well designed for earthquake protection. And people expected to manage the event and aftermath should not live in the coastal zones. One last comment. The existing Seaside early warning system speaker system from where I live is terrible. It is mushy and not understandable. Also, constant testing has made it commonplace practice and consequently people tune it out. Enough out of me.	Fortunately we do know that seismic improvements to buildings DO save lives and money in the variability of events that occur as evidenced by the seismic resilience of Chile after decades of significant rehabilitation efforts following numerous earthquake disasters. But the potential impact of improvements like this do vary by location and again, the new Risk Report addresses this subject with some model results. Early warning is beyond the scope of local mitigation, but it is supported by the group. Finally, thank you for your note about the Seaside early warning speaker system—the public officials there are working to improve hazard mitigation tools like this so your input is valuable.

#	Commenter	Comment	Response
		Thanks for all your hard work and concern. It is appreciated."	
	n/a	Confidental Please! As a employee of Safeway I have carded people from all over th US with Covid 19 going & some of these poeple are from hot zones. Yes I understand they pay are wages, but this does scares me for my safety & other in are communety.	Thank you for the feedback on the survey. Essential workers like yourself are on the frontlines of the war against this virus. Successful methods for encouraging or requiring the public to stay home over an extended time period is proving to be one of the biggest challenges of this long-duration pandemic event. We wish you health and safety.
	n/a	Why not mention t o r n a d o destruction, more of which can be expected here owing to climate change. Manzanita has already experienced severe tornado damage twice. First responders need to have mitigation and cleanup equipment, which they don't currently.	Thank you for the feedback on the survey. The tornado hazard is included in the Windstorm and winter storm plan section.
	Matthew Johnson	Does the county have redundant back up plans for shelter/first aid?	Clatsop County recently completed a Mass Care Plan which augments the Emergency Operations Plan. Hopefully these documents address your question.
	Rosemary Johnson	SHPO has a great site for information about cultural resources and disasters. We need to reference it somehow. https://www.oregon.gov/oprd/OH/Pages/DisasterPrep.aspx	Yes, thank you. The link and this text was added to the Cultural and Historical Resources section of the Community Profile (page 115). See SHPO resources on Disaster Preparedness, Recovery, and Resilience for heritage sites and museums. The website includes models, guidebooks, tools, etc. to assist in the preparation of local plans and best practices for management of the cultural resources in a disaster.
	Meg Reed	Can you please add the local web-page that we manage? www.oregonkingtides.net	Yes, thank you. It has been added to the Future Climate Conditions, Coastal Erosion Hazard section (page 129).
	Meg Reed	As Coastal Shores Specialist with DLCD, I am working on a communication toolkit for the DOGAMI tsunami hazard models (Hazus). This could go well alongside the community	Yes, thank you. The language from the toolkit could assist communities in the next plan update or as a plan maintenance revision.

#	Commenter	Comment	Response
		hazard profiles for better clarity about the meaning of this data for the layperson.	

C. Plan Changes

CLATSOP COUNTY REVIEW TOOL COMPARISON: Approved 2016 Clatsop NHMP to Proposed 2021 Plan Update:

Table of Contents/Plan sections of the 2015 plan as compared with proposed sections for the 2021 update to meet the FEMA-required elements.

REQUIREMENT	FEMA REVIEW TOOL ELEMENT	Approved 2015 Clatsop NHMP	Proposed 2021 Plan Update
Requirement: **44 CFR §201.6(c)(1)**	*A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction?*	Introduction (Vol. I: pp 5 to 12) City Addendums (Vol. III: pp. 117-118, pp.167- 17(?), pp.219-226, pp. 268-270, pp. 321-322)	Acknowledgements Community Risk Profile Planning & Public Process: Meeting Sign-In Sheets & Notes
Requirement: **44 CFR §201.6(b)(2)**	*A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process?*	City Annexes (Vol. II: pp. 285-287) Planning & Public Process Vol IV: Appendix B, pp. 459-470, pp. 493-521; Community Organizations (Appendix G, pp. 641-651.)	Acknowledgements Community Risk Profile Planning & Public Process: Meeting Sign-In Sheets & Notes.
Requirement: **44 CFR §201.6(b)(1)**	*A3. Does the Plan document how the public was involved in the planning process during the drafting stage?*	Survey 1(Vol. IV: Appendix E, pp. 611-631); Survey 2 (Appendix F, pp. 633-640).	Acknowledgements Community Risk Profile Planning & Public Process: Meeting Sign-In Sheets & Notes Survey?
Requirement: **44 CFR §201.6(b)(3)**	*A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information?*	Existing Plans and Policies (Vol. I: p. 31) City Addenda (Vol. III: pp. 130-132, pp. 183-185, p.232, pp. 284-285.)	Existing Plans and Policies Hazard Chapters Community Risk Profile
Requirement: **44 CFR §201.6(c)(4)(iii)**	*A5. Is there discussion of how the communities will continue public participation in the plan maintenance process?*	Continued Public Involvement & Participation (Vol. I: pp. 43-44) City Annex (Vol. III: p. 260)	Plan Maintenance: Continued Public Involvement & Participation
Requirement: **44 CFR §201.6(c)(4)(i)**	*A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)?*	Plan Maintenance (Vol. I: pp. 40-44)	Plan Maintenance

REQUIREMENT	FEMA REVIEW TOOL ELEMENT	Approved 2015 Clatsop NHMP	Proposed 2021 Plan Update
Requirement: **44 CFR §201.6(c)(2)(i)**	*B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)?*	Hazard Annexes (Vol. II: pp. 47-111) City Addendums (Vol. III: pp. 135-157, pp. 186-200, pp.224-225, pp. 289-311, pp. 343-364)	Hazard Chapters Community Risk Profiles
Requirement: **44 CFR §201.6(c)(2)(i)**	*B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction?*	Hazards (Vol. II: p. 48, p. 54, p. 58, pp.66-67, p.77, p.81, pp. 95-96, pp. 100-101, pp. 107-108) Cities (Vol. III: pp. 135-157, pp.186-200, pp. 224-225, pp. 289-311, pp. 343-364.)	Hazard Chapters
Requirement: **44 CFR §201.6(c)(2)(ii)**	*B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction?*	Hazards (Vol. II: pp. 47-111) City Annexes (Vol. III: pp. 135-157, pp. 186-200, pp. 224-225)	Community Risk Profiles
Requirement: **44 CFR §201.6(c)(2)(ii)**	*B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods?*	Flood Hazard Chapter (Vol. II: p. 72)	Flood Hazard Chapter Community Risk Profiles
Requirement: **44 CFR §201.6(c)(3)**	*C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?*	Plan Implementation and Maintenance (Vol. I: pp. 38-39)	Plan Implementation and Maintenance Gov. Org/ Geography, Risk Assessment; Com Risk Profile, RA; Tools & Assets, Mitigation Strategy
Requirement: **44 CFR §201.6(c)(3)(ii)**	*C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate?*	Flood Hazard Chapter Vol. I: 71-72 City Addenda (Vol. II: pp. 145-146, pp. 194-195, pp. 297-298, pp. 351-356)	Flood Hazard Chapter Community Risk Profiles
Requirement: **44 CFR §201.6(c)(3)(i)**	*C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?*	Goals (Vol. I: p.35) City Addenda (Vol. II: p. 249, pp. 365-366)	Mitigation Strategy
Requirement: **44 CFR §201.6(c)(3)(ii)**	*C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?*	City Addenda (Vol. III: pp. 157-159, pp. 200-211, pp. 250-252, pp. 312-314, pp. 365-366, pp. 369-393) Action Item Forms (Vol. IV: pp. 397-458)	Mitigation Strategy
Requirement:	*C5. Does the Plan contain an action plan that describes how the actions identified will be*	Project Prioritization (Vol. I: pp. 40-43)	Project Prioritization

REQUIREMENT	FEMA REVIEW TOOL ELEMENT	Approved 2015 Clatsop NHMP	Proposed 2021 Plan Update
44 CFR §201.6(c)(3)(iv)); Requirement: 44 CFR §201.6(c)(3)(iii)	*prioritized (including cost benefit review), implemented, and administered by each jurisdiction?*	Econ Analysis of NHM Projects (Vol. IV: Appendix C pp. 523-532)	Econ Analysis of NHM Projects
Requirement: 44 CFR §201.6(c)(4)(ii)	*C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?*	Plan Implementation and Maintenance (Vol. I: pp. 38-39) City Addendums (Vol. III: p. 160, pp. 202-211, pp. 255-257, p.367) Action Item Forms? (Vol. IV: pp. 400-401)	Plan Implementation and Maintenance, Implementing the Plan
Requirement: 44 CFR §201.6(d)(3)	*D1. Was the plan revised to reflect changes in development?* a. The plan must describe changes in development that have occurred in hazard prone areas and increased or decreased the vulnerability of each jurisdiction since the last plan was approved. If no changes in development impacted the jurisdiction's overall vulnerability, plan updates may validate the information in the previously approved plan. Changes in development means recent development, potential development, or conditions that may affect the risks and vulnerabilities of the jurisdictions (for example, climate variability, declining populations or projected increases in population, or foreclosures). Not all development will affect a jurisdiction's vulnerability.	Community Overview (Vol. I: pp. 15-22)	Community Profile
Requirement: 44 CFR §201.6(d)(3)	*D2. Was the plan revised to reflect progress in local mitigation efforts?* The plan must describe the status of hazard mitigation actions in the previous plan by identifying those that have been completed or not completed. For actions that have not been completed, the plan must either describe whether the action is no longer relevant or be included as part of the updated action plan.	Action Item Forms (Vol. IV: Appendix A pp. 397-458)	Community Risk Profile(s)

REQUIREMENT	FEMA REVIEW TOOL ELEMENT	Approved 2015 Clatsop NHMP	Proposed 2021 Plan Update
Requirement: **44 CFR §201.6(d)(3)**	***D3. Was the plan revised to reflect changes in priorities?*** The plan must describe if and how any priorities changed since the plan was previously approved. If no changes in priorities are necessary, plan updates may validate the information in the previously approved plan.	Plan Maintenance (Vol. I: pp. 40-43) Economic Analysis of NHM Projects (Vol. IV: Appendix C pp. 523-532) How did these meet this req.?	Mitigation Strategy Planning Process

VI. APPENDICES

A. Appendix A

1. DOGAMI O-20-16 Risk Report for Clatsop County

This report forms the basis of the risk assessment for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update. It

Williams, Matt C., Lowell H. Anthony, and Fletcher E. O'Brien. (2020). *Natural Hazard Risk Report for Clatsop County, Oregon, Including the Cities of Astoria, Cannon Beach, Gearhart, Seaside, and Warrenton and the Unincorporated Communities of Arch Cape, Svensen-Knappa, and Westport* (Open-File Report O-20-16). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-20-16.htm

After the first in-text citation by section, this report is cited as Williams et al, 2020.

What's in this report?
This report describes the methods and results of a natural hazard risk assessment for Clatsop County communities. The risk assessment can help communities better plan for disaster.

Report downloads:

- Text report, including all appendices (93 p., 21 MB PDF)
- Appendix E. Map Plates (7 plates; 23 MB PDF; view/download individual plates below)
- GIS metadata bundle (3 .xml files; 11 KB zip file)
- Full GIS data bundle, with .xml metadata (4.5 MB, zip file; view .xml metadata links below)
- Complete publication bundle (86 MB zip file)

Executive Summary (excerpt):
This report was prepared for the communities of Clatsop County, Oregon, with funding provided by the Federal Emergency Management Agency (FEMA). It describes the methods and results of the natural hazard risk assessment performed in 2018 by the Oregon Department of Geology and Mineral Industries (DOGAMI) within the study area. The purpose of this project was to provide communities with a detailed understanding of their risk from natural hazards, to give communities the ability to compare their risk across multiple hazards, and to prioritize and take actions that will reduce risk. The results of this study can also inform the natural hazard mitigation planning process. We arrived at our findings and conclusions by completing three main tasks: compiling an asset database, identifying and using the best available hazard data, and performing a natural hazard risk assessment. Results were broken out for the following geographic areas:

- Unincorporated Clatsop County (rural)
- Community of Svensen-Knappa
- City of Astoria
- City of Gearhart
- City of Warrenton
- Community of Arch Cape
- Community of Westport
- City of Cannon Beach
- City of Seaside

2. OCCRI Future Climate Projections: Clatsop County

This report informs the consideration of hazards for the local risk assessment evaluations conducted for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update. The production of this report was contracted by the Oregon Department of Land Conservation and Development for the purpose of the plan update. The report is only publically available as an appendix to this plan update.

Dalton, Meghan M. (2020, Feb.). *Future Climate Projections: Clatsop County*. Oregon Climate Change Research Institute. College of Earth, Ocean and Atmospheric Sciences, Oregon State University. https://www.oregon.gov/lcd/CL/Documents/Clatsop_County_Future_Projections_Report_02132020.pdf

3. DOGAMI Earthquake and Tsunami Impact Reports

DOGAMI O-20-10 Earthquake and tsunami impact analysis for coastal Clatsop County, Oregon

This report informs the consideration of earthquake and tsunami hazards for the local risk assessment evaluations conducted for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Allan, Jonathan C., Fletcher E. O'Brien, John M. Bauer, and Matthew C. Williams. (2020, Dec.) *Earthquake and tsunami impact analysis for coastal Clatsop County, Oregon* (Open-File Report O-20-10). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-20-10.htm

- After the first in-text citation, this report is cited as Allan et al, 2020.
- Reissued 12-11-20 – This report supersedes the file set originally released 10-29-2020. The reissue includes a spreadsheet containing data that are the basis for the report's tables and figures. Appendix community profile Figures C and D are revised to subtract 10 mins from the tsunami wave arrival time, which then determines the travel distance threshold.

DOGAMI O-20-03 Analysis of earthquake and tsunami impacts for people and structures inside the tsunami zone for five Oregon coastal communities: GEARHART EXCERPT

This report informs the consideration of earthquake and tsunami hazards for the local risk assessment evaluations conducted for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Bauer, John M., Jonathan C. Allan, Laura L. S. Gabel, Fletcher E. O'Brien, and Jed T. Roberts. (2020). *Analysis of earthquake and tsunami impacts for people and structures inside the tsunami zone for five Oregon coastal communities: Gearhart, Rockaway Beach, Lincoln City, Newport, and Port Orford* (Open-File Report O-20-03). Portland, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-20-03.htm

- After the first in-text citation, this report is cited as Bauer et al, 2020.
- Only the Gearhart section is proposed for this appendix, although the methods and overall findings are relevant.

4. DOGAMI Earthquake and Tsunami Evacuation Analyses

Large-Extent Tsunami Evacuation Maps

These maps informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Oregon Tsunami Clearinghouse. (2013). *Large-Extent Tsunami Evacuation Maps*. Newport, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/tsuclearinghouse/pubs-evacbro.htm

Warrenton & Clatsop Spit

https://www.oregongeology.org/pubs/tsubrochures/WarrentonEvacBrochure-5-29-13_onscreen.pdf

Astoria

https://www.oregongeology.org/pubs/tsubrochures/AstoriaEvacBrochure-6-6-13_onscreen.pdf

Sunset Beach & Del Rey Beach

https://www.oregongeology.org/pubs/tsubrochures/SunsetDelReyEvacBrochure-6-7-13_onscreen.pdf

Youngs River Valley

https://www.oregongeology.org/pubs/tsubrochures/YoungsRiverValleyEvacBrochure-6-7-13_onscreen.pdf

Seaside & Gearhart

https://www.oregongeology.org/pubs/tsubrochures/SeasideGearhartEvacBrochure-6-3-13_onscreen.pdf

Cannon Beach

https://www.oregongeology.org/pubs/tsubrochures/CannonBeachEvacBrochure-5-21-13onscreen.pdf

Arch Cape

https://www.oregongeology.org/pubs/tsubrochures/ArchCapeEvacBrochure-5-21-13_onscreen.pdf

DOGAMI O-16-08 Beat the Wave WARRENTON, CLATSOP SPIT

This report informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Gabel, Laura L. S. and Jonathan C. Allan. (2016). *Local tsunami evacuation analysis of Warrenton and Clatsop Spit, Clatsop County, Oregon* [Beat the Wave] (Open-File Report O-16-08). Newport, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-16-08.htm

DOGAMI O-15-02 Beat the Wave SEASIDE, GEARHART

This report informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Priest, George R., Laura L. Stimely, Ian P. Madin, and Rudie J. Watzig. (2015). *Local tsunami evacuation analysis of Seaside and Gearhart, Clatsop County, Oregon* [Beat the Wave] (Open-File Report O-15-02). Newport, OR: Oregon Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/p-O-15-02.htm

5. DOGAMI Hospital Resilience Guidance

This report informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Wang, Yumei and K.L. Nourse. (2019.) *Resilience Guidance for Oregon Hospitals* (Open-File Report O-19-02). Portland, OR: Department of Geology and Mineral Industries. https://www.oregongeology.org/pubs/ofr/O-19-02/O-19-02_report.pdf

Cascadia Region Earthquake Workgroup (CREW) Guidance Documents

The guidance documents provide basic information on the importance of preparing hospitals by addressing issues related to building structures and the power and water services required to operate the hospital. They are designed to be easy to understand, promote resilience action planning, and point to detailed reference documents.

- Preparing Hospitals for Earthquakes: Structural and Nonstructural Issues (CREW Fact Sheet 9, 659 KB PDF) https://www.oregongeology.org/pubs/ofr/O-19-02/CREW_Fact Sheet_9_Hosp_07-23-2018_final.pdf
- Emergency Power for Hospitals: Preparing for Cascadia (CREW Fact Sheet 10, 1,033 KB PDF)
- Emergency Water for Hospitals: Preparing for Cascadia (CREW Fact Sheet 11, 808 KB PDF)
- https://www.oregongeology.org/pubs/ofr/O-19-02/CREW_Fact Sheet_10_Hosp_power_07-23-2018_final.pdf

6. 2020 Oregon NHMP: Region 1 Risk Assessment

This report was completed after this plan update, but can be referred to in plan maintenance and grant applications during the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan implementation process.

State of Oregon. (2020). *Risk Assessment Region 1 – Oregon Coast, Oregon Natural Hazards Mitigation Plan*. Salem, OR: Department of Land Conservation and Development. https://www.oregon.gov/lcd/NH/Documents/Approved_2020ORNHMP_07_RA1.pdf

For links to the full plan and other sections, see:

https://www.oregon.gov/lcd/NH/Pages/Mitigation-Planning.aspx#NHMP

7. Local Risk Assessment

During the 2020 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update, jurisdiction staff met with the DLCD project manager for risk assessment meetings during which staff developed hazard rankings using the Oregon Emergency Management (OEM) methodology as adapted on the following pages.

Office of Emergency Management. (2015, May). *Hazard Analysis Methodology*. Salem, OR: Oregon Military Department. https://www.oregon.gov/lcd/NH/Documents/Apx_9.1.19_OEM_Hazard_Analysis_Methodology_OPT.pdf

Hazard Vulnerability Analysis Methodology

Clatsop County MJNHMP 2020 Plan Update
Adaptation of: Oregon Office of Emergency Management (OEM)
HAZARD ANALYSIS METHODOLOGY

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 (and many cities and districts) producing an analysis using this methodology.

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;
- 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 riskFor OEM and other state and regional organizations such as the Oregon Department of Land Conservation & Development, this analysis allows comparison of the same hazard across various local jurisdictions. Each local hazard analysis produced using this methodology is ultimately comprised of two main pieces: a hazard analysis matrix (table) and a narrative.

POSSIBLE HAZARDS TO CONSIDER

NATURAL HAZARDS

In accordance with Statewide Planning Goal 7, jurisdictions must examine the following hazards when they overlap with their legal boundary: earthquakes and related hazards, wildfires, floods (coastal and riverine), landslides and debris flows, coastal erosion, and tsunamis. Jurisdictions should also develop scores, where applicable, for coastal hazards other than erosion, for drought, dust storms, windstorms, winter storms, and for volcanic hazards. With respect to volcanic hazards, score direct hazards such as blast and lahar separately from secondary hazards such as ashfall.

COMPLETING THE HAZARD ANALYSIS MATRIX

The Hazard Analysis Matrix Worksheet on page 5 is provided for you and your team to complete. You would probably benefit by transferring this worksheet onto a large format, such as a flipchart, dry erase board, etc., to assist in facilitating your meeting.

SEVERITY RATING: In this analysis, *severity ratings* are applied to the four categories of: history, vulnerability, maximum threat (worst-case scenario), and probability. Your jurisdiction can choose to score low-medium-high (choose 1 rating) and assign one number to each category or provide nuance by choosing one of the numbers in the range, based on the ranges below:

LOW = 1 point (or a number between 1-3)
MEDIUM = 5 points (or a number between 4-7)
HIGH = 10 points (or a number between 8-10)

WEIGHT FACTORS: *Weight factors* also apply to each of the four categories as shown below.

HISTORY (weight factor for category = **2**) History is the record of previous occurrences. Events to include in assessing history of a hazard in your jurisdiction are events for which the following types of activities were required:

- The EOC or alternate EOC was activated;
- Three or more EOP functions were implemented;
- An extraordinary multi-jurisdictional response occurred; and/or
- A "Local Emergency" was declared.

LOW – 1 point (or a number between 1-3) based on 0 - 1 event past 100 years.
MEDIUM – 5 points (or a number between 4-7) based on 2 - 3 events past 100 years.
HIGH – 10 points (or a number between 8-10) based on 4 + events past 100 years.

VULNERABILITY (weight factor for category = **5**) Vulnerability is the percentage of population and property likely to be affected under an "average" occurrence of the hazard.

LOW – 1 point (or a number between 1-3) based on < 1% affected.
MEDIUM – 5 points (or a between 4-7) based on 1 - 10% affected.
HIGH – 10 points (or a number between 8-10) based on > 10% affected.

MAXIMUM THREAT (weight factor for category = **10**) Maximum threat is the highest percentage of population and property that could be impacted under a worst-case scenario.

LOW – 1 point (or a number between 1-3) based on < 5% affected.
MEDIUM – 5 points (or a between 4-7) based on 5 - 25% affected.
HIGH – 10 points (or a number between 8-10) based on > 25% affected.

PROBABILITY (weight factor for category = **7**) Probability is the likelihood of future occurrence within a specified period of time.

LOW – 1 point (or between 1-3) based one incident likely within 75 to 100 years.
MEDIUM – 5 points (or between 4-7) based on one incident likely within 35 to 75 years.
HIGH – 10 points (or between 8-10) based on one incident likely within 10 to 35 years.

By multiplying the *weight factors* associated with the categories by the *severity ratings*, we can arrive at a subscore for history, vulnerability, maximum threat, and probability for each hazard. Adding the subscores will produce a total score for each hazard.

For example, look at "landslide" on the "Sample Hazard Analysis Matrix" shown on page 6. The history of landslides is high in the sample jurisdiction. History has a weight factor of two (2), and in this case, high is scored with ten (10) points for the severity rating. 2 X 10 = subscore of 20. The vulnerability of the sample jurisdiction is medium. However, a landslide normally would not affect much more than 1% of the people and property in the jurisdiction. Vulnerability has a factor weight of five (5) and this team decided on four (4) points for the severity rating. 5 X 4 = subscore of 20. After figuring maximum threat and probability, the total score for landslides is 133.

The total score isn't as important as how it compares with the total scores for other hazards the jurisdiction faces. By comparing scores, the jurisdiction can determine priorities: Which hazards should the jurisdiction be most concerned about? Which ones less so?

COMPLETING THE NARRATIVE

Your hazard analysis should begin with a description of the local jurisdiction (sometimes called a community profile). These often include an overview of key demographic information, and sometimes include climate data or a climate summary.

In addition to the matrix used to score the hazards, each local hazard analysis should include a narrative that describes how these hazards affect that particular local jurisdiction, especially critical facilities, key infrastructure, and the most important facilities of the jurisdiction's economic base.

One should provide this narrative minimally on those hazards receiving the highest total scores in the jurisdiction; for example, you may include history, areas of vulnerability, areas of planned or current mitigation measures, maps and displays, or any other facts or data that may be relevant.

Some jurisdictions include a brief section on hazards that were considered, but not scored (or scored, but not included in the written hazard analysis), offering the rationale for not scoring or not writing narrative about certain minor hazards.

OTHER METHODOLOGIES

There are many other ways of assessing risk. The OEM Hazard Analysis Methodology should be considered simply one tool in the risk assessment "tool bag." This methodology, in fact, is a "big picture" tool that will often lead to more detailed vulnerability assessments and risk analyses. Among the other prominent tools are various Geographic Information Systems (GIS), FEMA's Hazards U.S. (HAZUS), and Oregon Department of Forestry's (wildfire) "Communities at Risk Assessment." This is only a partial list of the many ways of evaluating risk.

The OEM Hazard Analysis Methodology can and should be one tool used in the development or revision of risk assessments required as part of the local natural hazard mitigation planning process under 44 CFR 201.6(c)(2), which have as their bottom line using best available data.

SAMPLE HAZARD ANALYSIS MATRIX

Hazards		History WF = 2	Vulnerability WF = 5	Maximum Threat WF = 10	Probability WF = 7	Total Score
FLOOD	WF X SR Subscore	2 X 10 = 20	5 X 9 = 45	10 X 7 = 70	7 X 10 = 70	**205**
WILDFIRE	WF X SR Subscore	2 X 10 = 20	5 X 8 = 40	10 X 5 = 50	7 X 10 = 70	**180**
EARTHQUAKE	WF X SR Subscore	2 X 2 = 4	5 X 10 = 50	10 X 10 = 100	7 X 3 = 21	**175**
WINDSTORM	WF X SR Subscore	2 X 8 = 16	5 X 6 = 30	10 X 6 = 60	7 X 8 = 56	**162**
HAZMAT	WF X SR Subscore	2 X 7 = 14	5 X 5 = 25	10 X 6 = 60	7 X 6 = 42	**141**
LANDSLIDE	WF X SR Subscore	2 X 10 = 20	5 X 4 = 20	10 X 3 = 30	7 X 9 = 63	**133**
DAM FAILURE	WF X SR Subscore	2 X 1 = 2	5 X 5 = 25	10 X 2 = 20	7 X 2 = 14	**61**

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 (% of population and property 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

May 2019 page 4

HAZARD ANALYSIS MATRIX WORKSHEET

JURISDICTION: _____ **DATE:** _____ **PARTICIPANTS:** (See sign in sheet)

Hazards	History WF = 2	Vulnerability WF = 5	Max Threat WF = 10	Probability WF = 7	Total Score
WINDSTORM & SEVERE WINTER STORM	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
EARTHQUAKE	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
TSUNAMI	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
FLOOD	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
LANDSLIDE	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
WILDFIRE	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
DROUGHT	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
COASTAL EROSION	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	
VOLCANIC ASH FALL	L M H 2 X ____	L M H 5 X ___	L M H 10 X ___	L M H 7 X ___	

May 2019 page 5

EXAMPLE SCENARIOS Hazards	Scenario 1	Scenario 2
WINDSTORMS & SEVERE WINTER STORMS	2007 Event; 15-20 year interval.	
EARTHQUAKE	Liquefaction risk is high for any size event.	CSZ M 9.0
TSUNAMI	Distant tsunami event (with time to evacuate)	CSZ M 9.0
FLOOD (+ DAMS & LEVEES)	Annual event with groundwater and precipitation-driven flooding behind levees.	Levee breach in one or more locations; every 1-5 yrs.
LANDSLIDE	Generally low risk, closure of a road temporarily.	Closure of a road permanently.
WILDFIRE	Slash pile burn goes out of control into a 30-50 acre event.	Severe east wind causing a large event.
DROUGHT	Water supply could be subject to conservation.	
COASTAL EROSION	A few structures at risk.	A major section of Hwy 101 at risk.
VOLCANIC ASH FALL	1980 Mount Saint Helens Event	
Hazards	**Scenario 1**	**Scenario 2**
WINDSTORMS & SEVERE WINTER STORMS		
EARTHQUAKE		
TSUNAMI		
FLOOD (+ DAMS & LEVEES)		
LANDSLIDE		
WILDFIRE		
DROUGHT		
COASTAL EROSION		
VOLCANIC ASH FALL		

May 2019 page 6

8. Clatsop County Community Organizations

Community Organization + Web Address	Focus Area(s)
Social Service Agencies	
American Red Cross: Cascades Region serving Oregon + SW Washington https://www.redcross.org/	Blood donations, crisis counseling, first aid, recovery planning.
Clatsop Care Health District https://www.clatsopcare.org/	Provides a range of services for seniors and others who need specialized care.
Clatsop Community Action https://ccaservices.org/	Providing emergency food, housing, energy assistance, and other basic critical services
CCA Food Bank List https://ccaservices.org/food/food-pantries/	List of nine food pantries in Clatsop County.
Oregon Voluntary Organizations Active in Disaster (VOAD) https://orvoad.communityos.org/cms/	ORVOAD consists of voluntary organizations with disaster relief roles, which work in partnership with state, local, and tribal governments.
Educational Facilities and Services	
Seaside School District http://www.seaside.k12.or.us/	The public school district for the Seaside, Gearhart, Cannon Beach area of Clatsop County.
Astoria School District http://www.astoria.k12.or.us/	The public school district for the Astoria area of Clatsop County.
Warrenton-Hammond School District https://www.warrentonschools.com/	The public school district for the Warrenton area of Clatsop County.
Jewell School District http://www.jewell.k12.or.us/	The public school district for the rural center of Clatsop County.
Knappa School District http://www.knappa.k12.or.us/	The public school district for Northeast Clatsop County.
Fire Mountain School	An independent charter school in Falcon Cove.

http://www.firemountainschool.org/	
Northwest Regional Education Service District - Clatsop Service Center http://www.nwresd.org/clatsop-service-center.html	Specialized services for children K-21; for students, educators, child care providers and families living in Clatsop, Columbia, Tillamook and Washington counties.
Seaside Head Start http://www.nworheadstart.org/seaside.html	Pre-school, parenting classes, and support for parents of young children.
Warrenton/Astoria Head Start http://www.nworheadstart.org/warrentn.html	Pre-school, parenting classes, and support for parents of young children.
Sunset Empire Park + Recreation District https://www.sunsetempire.com/	Provides education and recreation programs at the Seaside Youth Center.
Tongue Point Job Corps Center https://tonguepoint.jobcorps.gov/	Career technical training program administered by the U.S. Department of Labor for people ages 16 to 24.
Economic Development	
Astoria-Warrenton Area Chamber of Commerce http://www.oldoregon.com/	Expertise in local business and resources related to economic development and resilience.
Cannon Beach Chamber of Commerce http://www.cannonbeach.org/	Expertise in local business and resources related to economic development and resilience.
Seaside Visitors Bureau http://www.seasideor.com/	Expertise in local business and resources related to economic development and resilience.
Seaside Chamber of Commerce http://www.seasidechamber.com/	Expertise in local business and resources related to economic development and resilience.
Clatsop Economic Development Resources http://www.clatsoped.com/	Expertise in local business and resources related to economic development and resilience.
Astoria Downtown Historic District Association http://www.astoriadowntown.com/	Expertise in local business and resources related to economic development and resilience.
PacifiCorp https://www.pacificorp.com/	Expertise in local business and resources related to economic development and resilience.

West Oregon Electric Coop https://www.westoregon.org/	Expertise in local business and resources related to economic development and resilience.
Clatskanie PUD https://www.clatskaniepud.com/	Expertise in local business and resources related to economic development and resilience.
Health Services	
Columbia Memorial Hospital https://columbiamemorial.org/ https://columbiamemorial.org/services/urgent-care-clinics/	Columbia Memorial Hospital (CMH) is a 49-bed full-service, not-for-profit, accredited Level IV Trauma and Critical Access Hospital. CMH manages urgent care clinics online and in Astoria, Warrenton, and Seaside.
Seaside Providence Hospital www.providence.org/northcoast	Providence Seaside Hospital is a 25-bed critical access accredited hospital.
Medix Ambulance Service http://www.medix.org/	Ambulance services: transportation and pre-hospital emergency care.
Life Flight Network https://www.lifeflight.org/	Regional nonprofit air medical transport service.
Natural Resource Organizations	
OSU Extension Sea Grant Extension https://seagrant.oregonstate.edu/outreach-and-engagement/coastal-hazards	Two staff located in Astoria who specialize in Coastal Hazards.
Clatsop Soil and Water Conservation District http://clatsopswcd.org/	Expertise and resources related to flood and drought mitigation.
Columbia River Estuary Study Taskforce (CREST) https://www.columbiaestuary.org/	Potential partner in projects related to flooding, drought, water quantity, and water quality. Provide estuary expertise, advice to member jurisdictions.
North Coast Land Conservancy https://nclctrust.org/	Potential partner in projects related to flooding, drought, water quantity, and water quality.
Lower Nehalem Watershed Council https://lnwc.nehalem.org/	Potential partner in projects related to flooding, drought, water quantity, and water quality.

Upper Nehalem Watershed Council https://unwc.nehalem.org/	Potential partner in projects related to flooding, drought, water quantity, and water quality.
Necanicum Watershed Council https://www.necanicumwatershed.org/	Potential partner in projects related to flooding, drought, water quantity, and water quality.
The North Coast Watershed Association http://www.clatsopwatersheds.org/watersheds/	Potential partner in projects related to flooding, drought, water quantity, and water quality.
Columbia Land Trust https://www.columbialandtrust.org/	Potential partner in projects related to flooding, drought, water quantity, and water quality.
Clatsop State Forest https://www.oregon.gov/odf/recreation/guides/clatsop-state-forest-recreation-guide.pdf	Managed by Oregon Dept. of Forestry, Clatsop State Forest lands span across the eastern 2/3rds of the County.
Cultural Organizations	
Confederated Tribes of Siletz Indians http://www.ctsi.nsn.us/	Potential partner in projects related to cultural heritage or natural resources.
Confederated Tribes of Grand Ronde https://www.grandronde.org/	Potential partner in projects related to cultural or natural resources

9. Policy Framework for Natural Hazards in Oregon

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) is the latest federal legislation addressing mitigation planning. It reinforces the importance of mitigation planning and emphasizes planning for natural hazards before they occur. As such, this Act established the Pre-Disaster Mitigation (PDM) grant program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP). Section 322 of the Act specifically addresses mitigation planning at the state and local levels. State and local jurisdictions must have approved mitigation plans in place in order to qualify to receive post-disaster HMGP funds. Mitigation plans must demonstrate that their proposed mitigation measures are based on a sound planning process that accounts for the risk to the individual and their capabilities.

Statewide Land Use Planning Goals

https://www.oregon.gov/lcd/OP/Pages/Goals.aspx

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.

The comprehensive land use planning system in Oregon begins with a set of 19 Statewide Land Use Planning Goals. These goals address the local process of land use planning, direct the state's resource preservation, give guidance for urban development, and offer direction to cities and counties who need to plan for coastal assets. The outcome of the goals is as unique as each city and county of Oregon – each local government develops a comprehensive plan that addresses the resources, constraints and opportunities specific to the place.

The following land use planning goals are particularly relevant in the management of hazards by local communities. The Department of Land Conservation and Development (DLCD) supports communities in their implementation of these goals.

Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces

Read full text version of Goal 5

Goal 5 is a broad statewide planning goal that covers more than a dozen resources. The resources range from wildlife habitat, to historic places, and gravel mines. To protect and plan for them, local governments are asked to create a number of inventories. The inventories in a local plan may address only a portion of the resources included in Goal 5.

Goal 7: Areas Subject to Natural Hazards

Read full text version of Goal 7

Goal 7 requires local comprehensive plans to address Oregon's natural hazards. Protecting people and property from natural hazards requires knowledge, planning, coordination, and education. Good planning does not put buildings or people in harm's way. Planning, especially for the location of essential services like schools, hospitals, fire and police stations, is done with sensitivity to the potential impact of nearby hazards.

A local government addresses natural hazards in its comprehensive land use plan. They do this by adopting a natural hazard inventory, overlay zones, hazard code, and supporting plans and policies.

DLCD works with the Oregon Department of Geology and Mineral Industries, the Federal Emergency Management Agency, and others to help communities plan for natural hazards. In most 2-year state legislative cycles, a limited amount of planning grant money is available through DLCD to help communities address these planning needs.

Goal 16: Estuarine Resources Read the full text version of Goal 16

Statewide Planning Goal 16 provides the principal guidance for the planning and management of Oregon's estuaries. The overall objective of Goal 16 is to "to recognize and protect the unique environmental, economic and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long term environmental, economic and social values, diversity and benefits of Oregon's estuaries". To accomplish this, the goal establishes detailed requirements for the preparation of plans and for the review of individual development projects and calls for coordinated management by local, state and federal agencies that regulate or have an interest in activities in Oregon's estuaries.

Goal 17: Coastal Shorelands Read the full text version of Goal 17

Statewide Planning Goal 17 outlines planning and management requirements for the lands bordering estuaries (as well lands bordering the ocean shore and coastal lakes). In general, the requirements of Goal 17 apply in combination with other planning goals to direct the appropriate use of shoreland areas. Provisions in Goal 17 specifically focus on the protection and management of resources unique to shoreland areas; examples of such resources include areas of significant shoreland habitat, lands especially suited for water dependent uses, lands providing public access to coastal waters, and potential restoration or mitigation sites.

The goal focuses on the management of shoreland areas and resources in a manner that is compatible with the characteristics of the adjacent coastal waters. Goal 17 requirements are implemented primarily through local comprehensive plans and zoning.

Water Dependent Shorelands Rule: Goal 17 use requirements direct that shorelands "especially suited for water dependent uses" be protected for such uses, and that local zoning regulations prevent the establishment of uses which would preempt the availability of such lands for water dependent development. In 1999 LCDC adopted an administrative rule to provide additional guidance for implementing this Goal 17 requirement. Known as the water dependent shorelands rule, OAR 660, Division 37 establishes a methodology for calculating the minimum amount of shorelands to be protected for water dependent and also provides more detailed guidance on the qualifications of shorelands suitable for water dependent uses, as well as suggested land use regulations and standards appropriate for the protection of these shoreland sites.

Goal 18: Beaches and Dunes Read the full text version of Goal 18

Statewide Planning Goal 18 focuses on conserving and protecting Oregon's beach and dune resources, and on recognizing and reducing exposure to hazards in this dynamic, sometime quickly changing environment. Goal 18 is central to the work of coastal communities in addressing the impacts of coastal hazards and climate change in areas along the ocean shore.

Local governments are required to inventory beaches and dunes and describe the stability, movement, groundwater resources, hazards and values of the beach, dune, and interdune areas. Local governments must then apply appropriate beach and dune policies for use in these areas.

Goal 18 includes some requirements are of particular importance:

- Prohibition Areas
- Shoreline Armoring
- Dune Grading
- Ocean Shore Regulation

Goal 19 Ocean Resources *Read full text version of Goal 19*

Goal 19 deals with matters such as dumping dredge spoils and discharge of waste products into the open sea, and prioritizes the protection of renewable marine resources over the development of non-renewable resources. It outlines state interest in conserving resources within the Ocean Stewardship Area, which includes Oregon's territorial sea out to 3 nautical miles as well as the continental margin seaward to the toe of the continental slope, and adjacent ocean areas.

Regulatory Agencies

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

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

Department of State Lands

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 agency recently integrated Local Wetland Inventories (LWIs) into a statewide dataset available at: https://www.oregon.gov/dsl/WW/Pages/SWI.aspx

Oregon Water Resource Department

Oregon Revised Statute (ORS) Chapter 536 identifies authorities available during a drought. To trigger specific actions from the Water Resources Commission and the Governor, a "severe and continuing drought" must exist or be likely to exist. Oregon relies upon two inter-agency groups to evaluate water supply conditions, and to help assess and communicate potential drought-related impacts: Oregon Drought Readiness Council and the Water Supply Availability Committee.

Drought Resources:

Oregon Water Resources Department's *2017 Integrated Water Resources Strategy*:
https://www.oregon.gov/OWRD/wrdpublications1/2017_IWRS_Final.pdf
The *Drought Annex of the State of Oregon Emergency Operations Plan* was updated in January 2016 following the record drought of 2015:
https://www.oregon.gov/owrd/WRDPublications1/2016ORDroughtAnnex.pdf
Monitor the status of drought in Oregon at: https://www.drought.gov/drought/states/oregon

U.S. Army Corps of Engineers

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.

B. Appendix B

1. Steering Committee Meeting Documentation

October 22, 2018 - Special District Informational Meeting

November 26, 2018 - Steering Committee Meeting #1: Semi-Annual Plan Maintenance Meeting

January 29, 2019 Steering Committee Meeting #2: NHMP Update 2020 Organizational Meeting

April 3, 2019 Steering Committee Meeting #3: NHMP Update 2020 Organizational Meeting #2

September 24, 2019 Steering Committee Meeting #4: Risk Assessment Meeting

January 28, 2020 Steering Committee Meeting #5: Mitigation Strategy Meeting

January 19, 2021 Steering Committee Meeting #6: Final Plan Review and Approval

Clatsop County
Natural Hazards Mitigation Plan Steering Committee
Special Meeting

Monday, October 22 @ 2:00 p.m.
Public Services Building
800 Exchange Street, Suite 430
Astoria, OR 97103

I. Welcome & Introductions

Ii. Local NHMP Perspective – Clatsop County

- City/County history
- Does my district need a plan?
- Why now versus later?

IV. State NHMP Presentation – DLCD (Department of Land Conservation & Development)

- Review offer (scope & conditions) of State assistance
- Discuss new NHMP Requirements for Special Service Districts
- General timeline – IGA & Project Completion

V. Discussion – Who will participate, what assistance needs are shared by all, and how to set milestones moving forward.

VI. Public Comments

Adjournment

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Clatsop County Offices
800 Exchange Street, Astoria, OR 97103

Informational Meeting
Monday, October 22, 2018
2:00 – 4:00 PM

PLEASE SIGN IN

	Printed Name and FULL SIGNATURE	Title	Representing	Phone	Email
1.	Matthew Benedict	Fire Chief	Cannon Beach RFPD	503 739 1274	mbenedict@cbfire.com
2.	RON SCHIFFMAN	CHAIR ARCH CAPE WATER / SANITARY	AC DOMESTIC WATER DISTRICT SANITARY DISTRICT	503 436 2229	RON.SCHIFFMAN@AKUTL.COM
3.	Jeff Golightly	Fire Chief	Lewis & Clark RFPD	503-325-4192	lewisclarkfire@gmail.com
4.	JEFFREY S. ADAMS	COMMUNITY DEVELOPMENT DIR.	CANNON BEACH	503 436. 2050	adams@ci.cannon-beach.or.us
5.	GAIL HENRIKSON	Community Dev. Dir.	CLATSOP Co.	503-325-8611	ghenrikson@co.clatsop.or.us
6.	Mark Barnes	Planning Dir.	Cannon Beach	503 436 8040	barnes@ci.cannon-beach.or.us
7.	Marian Lahav	NHMP Coord	DLCD	503-934-0024	marian.lahav@state.or.us
8.	Rosemary Johnson	Planning Consultant	City of Astoria	503-325-6434	rosemaryjcurt@gmail.com
9.	Jim Knight	Executive Director	Port of Astoria	503-741-3337	JKnight@PortofAstoria.com
10.	Skyler Archibald	Executive Director	Sunset Empire Park & Rec District	503-738-3311	sarchibald@sunsetempire.com
11.	JEFF HAZEN	EXEC. DIRECTOR	SUNSET EMPIRE TRANSPORTATION DIST.	503-861-5399	JEFF@RIDETHEBUS.ORG
12.	Sheila Roley	Superintendent	Seaside School District	503-738-5591	sroley@seaside K12.org
13.	Kevin Cupples	Planning Director	City of Seaside	(503) 738-7100	Kcupples@cityofseaside.us
14.	Pamela Reben	National Hazards Planner	DLCD	(503) 934-0066	pamela.reben@state.or.us
15.	TIFFANY BROWN	COUNTY EM	CCEM	503/338-3774	tbrown@co.clatsop.or.us

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Semi-Annual & 2020 Update Organizational Meeting

Monday, November 26, 2018
11:00 AM – 2:00 PM

Clatsop County Emergency Management
800 Exchange Street, Suite 430, Astoria, OR 97103

AGENDA

Welcome & Introductions — 10 minutes

Clatsop County MJNHMP Update Project Requirements — 1 hour +

A. Project Schedule
B. Intergovernmental Agreement (IGA)
C. Scope of Work
D. Public Engagement Plan

Working Lunch — 20 minutes

- Confirm Steering Committee Participant List
- Confirm Cost Share Point of Contact List
- Public Engagement Plan Sign Ups

Clatsop County MJNHMP Update Project Logistics: — 1 hour

E. Plan Update Discussion
F. Hazard Table Review
G. Cost Share

Next Steps: — 10 minutes

NEXT MEETING: Late January 2019 - THE CLATSOP NHMP KICKOFF!

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update

Clatsop County Offices
800 Exchange Street Ste. 430, Astoria, OR 97103

Organizational Meeting

Monday, November 26, 2018
11:00 – 2:00 PM

PLEASE SIGN IN

	Printed Name & SIGNATURE	Title	Representing	Phone	Email
1.	Pam Reber	Natural Hazards Planner	Oregon DLCD	(503)934-0066	pamela.reber@state.or.us
2.	Marian Lahav	NHMP Program Coordinator	Oregon DLCD	(503)934-0024	marian.lahav@state.or.us
3.	Tiffany Brown	Director	Clatsop County Emergency Mgmt	(503)338-3774	tbrown@co.clatsop.or.us
4.	Vincent Aarts	Coordinator	Clatsop County Emergency Mgmt	(503)325-8645	vaarts@co.clatsop.or.us
5.	Gail Henrikson	Director	Clatsop County Community Development	(503)325-8611	ghenrikson@co.clatsop.or.us
6.	Ted McLean	Deputy Director	Clatsop County Public Works	(503)325-8645	tmclean@co.clatsop.or.us
7.	Chad Sweet	City Manager	City of Gearhart	(503)738-~~7100~~ 5501	chadsweet@cityofgearhart.com
8.	Rosemary Johnson	Planner	City of Astoria	(503)325-6434	rosemaryjcurt@gmail.com
9.	Mark Barnes	Planner	City of Cannon Beach	(503)436-8040	barnes@ci.cannon-beach.or.us
10	Jeff Adams	Director	City of Cannon Beach Community Development	(503)436-2050	adams@ci.cannon-beach.or.us

PLEASE SIGN IN

	Printed Name & SIGNATURE	Title	Representing	Phone	Email
11	Kevin Cupples	Planning Director	City of Seaside	(503)738-7100	kcupples@cityofseaside.us
12	Kevin Cronin	Planning Director	City of Warrenton	(503)861-0920	cityplanner@ci.warrenton.or.us
13	Paula Larson	Emergency Manager	Columbia Memorial Hospital	(503)325-4321	plarson@columbiamemorial.org
14	Joann Zahn	Vice-President/Operations	Clatsop Community College	(503)338-4241	jzahn@clatsopcc.edu
15	Stephanie Homer	Special Projects Coordinator	Clatsop Community College	(503)325-4241	shomer@clatsopcc.edu
16	Ron Schiffman	Chair Chair	Arch Cape Water District Arch Cape Sanitary District	(503)436-2229	ron.shiffman@acutil.com
17	Sheila Roley	Superintendent	Seaside School District	(503)738-5591	Sroley@seasidek12.org
18	Paul Olheiser	Fire Chief	Knappa-Svensen Fire District	(503) 458-6610	olheiser@pacifier.com
19	Matthew Benedict	Fire Chief	Cannon Beach RFPD	(503)739-1234	mbenedict@cbfire.com
20	Jeff Golightly	Fire Chief	Lewis & Clark RFPD	(503)325-4192	lewisclarkfire@gmail.com
21	Jeff Hazen	Executive Director	Sunset Empire Transportation District	(503)861-5399	jeff@ridethebus.org
22	Jim Knight	Executive Director	Port of Astoria	(503)741-3337	jknight@portofastoria.com

PLEASE SIGN IN

	Printed Name & SIGNATURE	Title	Representing	Phone	Email
23	Paula Larson	Safety, Security + EM Coord.	Columbia Memorial Hospital	503.680-8442	plarson@columbiamemorial.org
24	Hannah Dankbar	Coastal Planner	CREST	503 325 0435 ext 213	hdankbar@columbiaestuary.org
25	Yvonne Van Nostran M. Van Mostran for Mike McNickle	Environmental Health Specialist Director	C. C. Public Health	(503) 338-3667	yvannostran@co.clatsop.or.us mmcnickle@co.clatsop.or.us
26	Mcjanis Bynd	GIS Project Planner	Clatsop PW		
27	DRUCE ST. DENIS	CITY MANAGER	CANNON BEACH	503-440-5557	stdenis@ci.cannon-beach.or.us
28	Marian Lahav	NHMP Prog. Coord	DLCD	503-934-0024	marian.lahav@state.or.us
29					
30					

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) 2020 Update Organizational Meeting #2

Tuesday, January 29, 2019
1:00 PM – 4:00 PM

Clatsop County Emergency Management
Guy Boyington Building 9th/Exchange Streets, Astoria, OR 97103

AGENDA

Welcome 30 minutes

Business 45 minutes

- Hazards 101
- Operating Protocols

2015 Plan 30 minutes

- Element A: Planning Process
- Element B: Hazard Identification & Risk Assessment
- Element C: Mitigation Strategy
- Element D: Plan Integration, Evaluation, and Implementation

2020 Plan 45 minutes

- Update Priorities
- Final Pre-Award Tasks

Wrap Up 15 minutes

- Affirm decisions
- Cost Share
- Next meeting

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update Meeting Roster
January 29, 2019

Representing	Printed Name and FULL SIGNATURE	Title	Phone	Email
PLANHOLDERS				
Clatsop County Emergency Management	TIFFANY BROWN TCBrown	DIRECTOR		
Clatsop County PIO	TOM BENNETT			
Clatsop County Community Development	G A Henrikson	DIRECTOR	503-325-8611	ghenrikson@co.clatsop.or.us
Clatsop County Public Works	Michael J Summers Michael J Summers	County Engineer	503 325-8631	msummers@co.clatsop.or.us
Clatsop County Public Works	Alejandro Bancke	GIS Project Planner	"	
Clatsop County Public Health				
City of Astoria	Nathan Crater	City Engineer	503-338-5173	ncrater@astoria.or.us
City of Astoria	Nancy Ferber	City Planner	503.338.5183	nferber@astoria.or.us
City of Astoria	ROSEMARY JOHNSON Rosemary Johnson	Planning Consultant	325-6434	
City of Astoria	JEFF HARRINGTON Jeff Harrington	CITY PUBLIC WORKS DIRECTOR	503-338-5177	jharrington@astoria.or.us

Representing	Printed Name and FULL SIGNATURE	Title	Phone	Email
PLANHOLDERS				
City of Cannon Beach	JEFF ADAMS Jeff Adams	CD Director	503.436.9041	adams@ci.cannon.beach.or.us
City of Cannon Beach				
City of Gearhart				
City of Seaside	KEVIN CUPPLES Kevin Cupples	Planning Director	(503)738-7100	KCupples@cityofseaside.us
City of Seaside	ANNE MCBRIDE Anne McBride	EMERGENCY PREP COORDINATOR	"	amcbride@cityofseaside.us
City of Warrenton				
City of Warrenton	KEVIN A. GRONN K A G	CD DIRECTOR		
Sunset Empire Transportation District	JEFF HAZEN JEFF HAZEN	EXEC. DIR.	503-861-5399	JHAZEN@THEBUS.ORG
Port of Astoria	JOHN KNIGHT			
Port of Astoria				
Clatsop Community College	JoAnn Zahn	VP Finance & Ops	503 338-2421	jzahn@clatsopcc.edu
Clatsop Community College	Shawn Martin	Facilities	971 601 0295	smartin@clatsopcc.edu

Representing	Printed Name and FULL SIGNATURE	Title	Phone	Email
Clatsop Community College	STEPHANE HOMER	Special Projects & Compliance Dir		SHomer@Clatsopcc.edu
PLANHOLDERS				
Seaside School District	CHUCK LOESCH			
Lewis & Clark Rural Fire District	Jeff Golightly			
Knappa-Svensen-Burnside Fire District				
Cannon Beach Rural Fire Protection District	Marc Reckman	Div Chief	503 380 1544	mreckman@cbfire.com
Arch Cape Water & Sewer Districts	RON SCHIFFMAN	BOARD PRESIDENT	503 436 2229	RANOSCHIFFMAN@GMAIL.COM
Falcon Cove Water & Sewer Districts	CHARLES DICE	SECRETARY	503-436-0146	CADICE@HOTMAIL.COM
WHOLE COMMUNITY STAKEHOLDERS				
Columbia Memorial Hospital				
Providence Seaside Hospital	ERIK Meyer	SM MGR	503-440-6747	ERIK.MEYER@providence.org
Coast River Business Journal				
Columbia Press				

Representing	Printed Name and FULL SIGNATURE	Title	Phone	Email
Voluntary Organizations Active in Disaster				
American Red Cross	D Douglas Lewis	Liaison	503 717-5977	dlb@dblcy.net
Clatsop Economic Development Resources				
Clatsop Soil & Water District	CHRIS FARRAR	Rep.	530 412.4555	tochrisfarrar@gmail.com
Clatsop Community Action				
Northwest Oregon Housing Authority				
CREST	Hannah Dankbar	Coastal Planner	503 325 0435 ext 213	hdankbar@columbiaestuary.org
CLATSOP CARE	DAVID MILLER	Administrator		
CLATSOP CARE				
Sheriff's Office	Matt Phillips	Lt.	338-9954	mphillips@co.clatsop.or.us
Clatsop County	Monica Steele	Interim County Mgr.	325-8565	msteele@co.clatsop.or.us
Clatsop Caty Public Health	Yvonne Van Nostrand	Envi. Health Specialist	338.3687	
DLCD	Lisa M. Phipps	North Coast Regional Rep	503 812 5448	lisa.phipps@state.or.us

Representing	Printed Name and FULL SIGNATURE	Title	Phone	Email
* DLCD	MEG REEDS			
SETD	PAUL LEWICKI	COO	714 305 9007	paul@ridethebus.org
Cl. County	PAMELA WEYNOUSKI PAMELA	Commissioner	971-207-5660	pameweu@gmail.com
DLCD	Pamela Robbins	Nat. Hazard Planner	971-304-5505	on file

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) STEERING COMMITTEE 2020 Update Organizational Meeting #3

Tuesday, April 3, 2019
1:00 PM – 4:00 PM

Clatsop County Emergency Management
Guy Boyington Building 9th/Exchange Streets, Astoria, OR 97103

AGENDA

1:00 PM	**Welcome & Agenda Review**	5 minutes
1:05 PM	**Introductions** • Everyone in the room is invited to introduce themselves with their name, title, organization.	15 minutes
1:20 PM	**January 2019 Steering Committee Meeting Notes** • Review & Approve the Steering Committee Meeting Notes from January 29, 2019 • Review PEP edits and discuss websites for project launch	15 minutes
1:35 PM	**Scope of Work Revision** • Review & Approve the Revised Scope of Work • Next Steps	20 minutes
1:55 PM	**Public Comment** • Comments or questions about the NHMP process as a whole are welcome from the stakeholders and public at this time.	10 minutes
2:05 PM	**Short Break**	5 minutes
2:10 PM	**CTP Project Presentation: Clatsop County Multi-Hazard Risk Report** • Matt Williams, Geohazard Analyst with the Oregon Dept. of Geology and Mineral Industries, will present the Clatsop County Multi-Hazard Risk Report. • The report is available for download. See the handout that describes how to access the full report. • Q & A	50 minutes

3:00 PM	**Discussion: How to use the Risk Report in the 2020 NHMP Update?**
	• Steering Committee Debrief:
	  ○ How will you use this data?
	  ○ What are the implications for plan priorities and actions?
	• Provide input on hazard profile & critical facilities data.
		30-60 minutes

3:55 PM	**Wrap Up**	5 minutes

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update

Steering Committee & Stakeholder Roster – 04.03.19

Representing	FULL SIGNATURE	Printed Name	Title	Phone	Email
Clatsop County		Tiffany Brown	Director	(503)338-3774	tbrown@co.clatsop.or.us
Clatsop County	G Henrikson	Gail Henrikson	Director	(503)325-8611	ghenrikson@co.clatsop.or.us
ALTERNATE: (not listed above)		Alejandro Bancke			
City of Astoria	—	Rosemary Johnson	Planning Consultant	(503)325-6434	rosemaryjcurt@gmail.com
City of Astoria	See other sheet	Brett Estes	City Manager	(503)325-5824 x2400	bestes@astoria.or.us
ALTERNATE: (not listed above)					
City of Cannon Beach		Jeff Adams	Community Development Director	(503)436-2050	adams@ci.cannon-beach.or.us
City of Cannon Beach		Karen La Bonte	Public Works Director	(503)436-8068	labonte@ci.cannon-beach.or.us
City of Cannon Beach		Mike Myers	Emergency Manager	(503)436-8055	mmyers@ci.cannon-beach.or.us
ALTERNATE: (not listed above)					
City of Gearhart		Chad Sweet	City Manager	(503)738-5501	chadsweet@cityofgearhart.com
City of Gearhart		Kristi Ficker	Executive Assistant		kristi@cityofgearhart.com
ALTERNATE: (not listed above)					
City of Seaside	Kevin Cupples	Kevin Cupples	Planning Director	(503)738-7100	kcupples@cityofseaside.us
City of Seaside	Anne McBride	Anne McBride	Emergency Coordinator	(503) 738-7100	amcbride@cityofseaside.us
ALTERNATE: (not listed above)					
City of Warrenton	See other sheet	Kevin Cronin	Community Development Director	(503)861-0920	cityplanner@ci.warrenton.or.us
City of Warrenton		Collin Stelzig, PE	Public Works Director	(503)861-0914	rstelzig@ci.warrenton.or.us

Representing	FULL SIGNATURE	Printed Name	Title	Phone	Email
ALTERNATE: (not listed above)					
Arch Cape Domestic Water District and Arch Cape Sanitary District		Ron Shiffman	Chair	(503)436-2229	ron.shiffman@acutil.com
Arch Cape Domestic Water District and Arch Cape Sanitary District		Phil Chick	Manager, ACDWSD & ACSD	(503)436-2790	philchick@acutil.com
ALTERNATE: (not listed above)					
Cannon Beach Rural Fire Protection District		Matthew Benedict	Fire Chief	(503)739-1234	mbenedict@cbfire.com
Cannon Beach Rural Fire Protection District		Marc Reckmann	Training Officer	(503)436-2949	mreckmann@cbfire.com
ALTERNATE: (not listed above)					
Clatsop Community College		Joanne Zahn	Vice President, Finance & Operations	(503)338-2421	jzahn@clatsopcc.edu
Clatsop Community College		Stephanie Homer	Special Projects Coordinator	(503)338-4241	shomer@clatsopcc.edu
ALTERNATE: (not listed above)					
Falcon Cove Beach Domestic Water Supply District		Charles Dice	Board Chair	(503)436-0146	caddice@gmail.com
ALTERNATE: (not listed above)					
Knappa-Svensen-Burnside Rural Fire Protection District		Paul Olheiser	Fire Chief	(503)458-6610	p.olheiser@knappafire.com
ALTERNATE: (not listed above)					
Lewis & Clark Rural Fire Protection District		Jeff Golightly	Fire Chief	(503)325-4192	lewisclarkfire@gmail.com
ALTERNATE: (not listed above)					
Port of Astoria		Jim Knight	Executive Director	(503)741-3337	jknight@portofastoria.com
Port of Astoria		Matt McGrath	Operations Manager	503)741-3337	mmcgrath@portofastoria.com
ALTERNATE: (not listed above)					

Representing	FULL SIGNATURE	Printed Name	Title	Phone	Email
Seaside School District		Sheila Roley	Superintendent	(503)738-5591	sroley@seasidek12.org
Seaside School District		Justine Hill	Business Manager	503-738-5591	jhill@seasidek12.org
ALTERNATE: (not listed above)					
Sunset Empire Transportation District		Jeff Hazen	Executive Director	(503)861-5399	jeff@ridethebus.org
Sunset Empire Transportation District		Paul Lewicki	Chief Operating Officer	(503)861-5364	paul@ridethebus.org
ALTERNATE: (not listed above)					
OTHER JURISDICTION PARTICIPANTS					
Clatsop County		Vincent Aarts	Coordinator, Clatsop County Emergency Management	503 338 3773	vaarts @ co. clatsop .or .us
Clatsop County	See other sheet	Alejandro Banke	GIS Project Planner, Clatsop County Public Works		
Clatsop County		Tom Bennett	Public Information Officer, Clatsop County		
Clatsop County	See other sheet	Ted Mclean	Interim Director, Clatsop County Public Works		
Clatsop County		Michael McNickle	Director, Clatsop County Public Health	503-338-3686	
Clatsop County		Matt Phillips	Lieutenant, Clatsop County Sheriff's Office		
Clatsop County		Michael J. Summers	County Engineer, Clatsop County Public Works		
Clatsop County		Monica Steele	Interim County Manager, Clatsop County		
Clatsop County		Yvonne Van Nostran	Environmental Health Specialist, Clatsop County Public Health	503 338-3687	yvannostran @ co. clatsop.or.us
Clatsop County		Pamela Wev	District 3 County Commissioner, Clatsop County		
City of Astoria		Nathan Crater	City Engineer	503-338-5173	ncrater@ astoria.or.us

Clatsop Co.

LIANNE THOMPSON DIS. 5
COMMISSIONER

Representing	FULL SIGNATURE	Printed Name	Title	Phone	Email
City of Astoria		Nancy Ferber	City Planner	503.338.5183	
City of Astoria	See other sheet	Jeff Harrington	Public Works Director		
City of Cannon Beach		Bruce St.Denis	City Manager		
City of Cannon Beach		Mike Myers	Emergency Manager		
City of Warrenton		Linda Engbretson	City Manager		
Clatsop Community College		Shaun Martin	Facilities		
Seaside School District		Chuck Loesch	Facilities	503-791-5190	
State/Federal Agency Participants					
Oregon Dept. of Transportation		Karen Christensen			
OSU SeaGrant/County Extension		Patrick Corcoran	Coastal Natural Hazard Specialist		
Oregon Coastal Management Program, Oregon DLCD		Meg Reed	Coastal Shores Specialist		
Oregon Dept. of Land Conservation and Development (DLCD)		Lisa Phipps	North Coast Regional Representative		
Oregon Dept. of Land Conservation and Development (DLCD)		Pamela Reber	Natural Hazard Planner/ Clatsop NHMP Project Manager		
Oregon Dept. Forestry		David Horning	Wildland Fire Supe		
Oregon Dept of Transportation	Kc Christensen		ADM		
OR Dept. of Geology	Matt Williams		Geohazard Analyst		

Steering Committee / Stakeholder Roster

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update

PUBLIC COMMENT SIGN UP – 04.03.19

Representing	FULL SIGNATURE	Printed Name	Title	Phone	Email
ARCH CAPE WATER + SANITARY		RON SCHIFFMAN	PRES BD OF DIR.	503 436-2229	RONSCHIFFMAN@GMAIL
City of Astoria		Brett Estes	City Manager	503-640-5648	bestes@astoria.or.us
" "	Jeff Harrington	JEFF HARRINGTON	CITY PUBLIC WORKS DIRECTOR	503-338-5177	jharrington@astoria.or.us
Clatsop County	Ted McLean	Ted McLean	PWD	503 791-2907	TMcLean@co.clatsop.or.us
CITY OF WARRENTON KEVIN A CONN	KC				
Port Jim Knight		Jim Knight	EXEC. D	503-741-3337	JKnights@PortofAstoria.Com

Representing	FULL SIGNATURE	Printed Name	Title	Phone	Email
STAKEHOLDERS					
American Red Cross		DB Lewis	Volunteer		
American Red Cross		Michelle Hamrick			
Clatsop Care		David Miller	~~Director~~ Admin Asst	360-470-6616 cell	Adminchr@clatsopcare.org
Clatsop Care		Michael Kerwin			
Clatsop Care		Shane Watson	Maintenance		
Clatsop Community Action		Dusten Martin			
Clatsop Soil & Water Conservation District (Clatsop SWCD)		Chris Farrar	Board Member		
Clatsop Soil & Water Conservation District (Clatsop SWCD)	See below	Wayne Carmichael	Board Member		
Columbia Memorial Hospital	Paula Larson	Paula Larson	Safety, Security and Emergency Management Coordinator	503. 680-8442	PLarson@ColumbiaMemorial.org
Columbia River Estuary Study Taskforce (CREST)		Denise Lofman	Director	503-325-0435 x218	dlofman@columbiaestuary.org
Columbia River Maritime Museum (CRMM)		Bruce Jones			jones@crmm.org
Providence Seaside Hospital		Erik Meyer	Emergency Manager		
ORVOAD-LTDR Lutheran Disaster Res. MD 36 Oregon Lions	Charlene Larsen	Charlene Larsen	Chair Rep-OR-WA-ID Chair	503-791-6207	crl@pacifier.com
Elsie Vinamgrole Fire Rescue District	Wayne Carmichael	Wayne Carmichael	President Board of Directors	503-755-0711	Wayne.carmichael@wright.edu

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) STEERING COMMITTEE 2020 Update Meeting #4

Tuesday, September 24, 2019
9:00 AM – Noon

Clatsop Community College - Columbia Hall Room 219
1651 Lexington Ave., Astoria, OR 97103
Parking is available behind the Columbia Hall building.

AGENDA

8:30 AM	**Doors Open—DOGAMI Hazard Map Viewing, Cost Share, Sign In**	30 minutes
9:00 AM	**Welcome & Agenda Review**	5 minutes
9:05 AM	**Introductions** • Everyone in the room is invited to introduce themselves with their name, title, organization.	15 minutes
9:20 AM	**April 2019 Steering Committee Meeting Notes** • Approve the Steering Committee Meeting Notes from April 3, 2019.	5 minutes
9:25 AM	**OCCRI Scoping Meeting Notes** • Review & Approve the OCCRI Scoping Meeting Notes.	10 minutes
9:35 AM	**Risk Assessment** • Summary of Findings • Breakout Discussion (see attached)	20 minutes 50 minutes
10:45 AM	**Break**	15 minutes
11:00 AM	**Tsunami Hazard & Mitigation Practices** • Meg Reed, Coastal Shores Specialist with the Oregon Dept. of Land Conservation & Development, will present on her work supporting communities doing tsunami evacuation and facility planning. • Q & A	55 minutes
11:55 AM	**Wrap Up**	5 minutes

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Clatsop Community College, Columbia Hall Room 219
9:00 AM – NOON

Steering Committee Meeting #4
1651 Lexington Ave., Astoria, OR 97103
Tuesday, September 24, 2019

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Rosemary Johnson	City of Astoria	(503)325-6434	rosemaryjcurt@gmail.com
Brett Estes	City of Astoria	(503)325-5824 x2400	bestes@astoria.or.us
Jeff Harrington	City of Astoria Public Works	(503) 338-5177	jharrington@astoria.or.us
Nathan Crater	City of Astoria Public Works	(503)338-5173	ncrater@astoria.or.us
Jeff Adams	City of Cannon Beach Community Development	(503)436-2050	adams@ci.cannon-beach.or.us
Rick Hudson	City of Cannon Beach Emergency Management	(530)391-5300	hudson@ci.cannon-beach.or.us
Chad Sweet	City of Gearhart	(503)738-5501	chadsweet@cityofgearhart.com
Kristi Ficker	City of Gearhart	(503)738-5501	kristi@cityofgearhart.com
Kevin Cupples	City of Seaside	(503)738-7100	kcupples@cityofseaside.us
Anne McBride	City of Seaside	(503) 738-7100	amcbride@cityofseaside.us
Kevin Cronin	City of Warrenton	(503)861-0920	cityplanner@ci.warrenton.or.us
Collin Stelzig, PE	City of Warrenton	(503)861-0914	rstelzig@ci.warrenton.or.us

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Clatsop Community College, Columbia Hall Room 219
9:00 AM – NOON

Steering Committee Meeting #4
1651 Lexington Ave., Astoria, OR 97103
Tuesday, September 24, 2019

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Bill Campbell	Arch Cape Water and Sanitary Districts	(503) 436-4031	billcampbellacutil@gmail.com
Matthew Benedict	Cannon Beach Rural Fire Protection District	(503)739-1234	mbenedict@cbfire.com
Marc Reckmann	Cannon Beach Rural Fire Protection District	(503)436-2949	mreckmann@cbfire.com
Joanne Zahn	Clatsop Community College	(503)338-2421	jzahn@clatsopcc.edu
Stephanie Homer	Clatsop Community College	(503)338-4241	shomer@clatsopcc.edu
Shaun Martin	Clatsop Community College	(977)601-0295	smartin@clatsopcc.edu
Charles Dice	Falcon Cove Beach Domestic Water Supply District	(503)436-0146	caddice@gmail.com
Kurt Donaldson	Knappa-Svensen-Burnside Rural Fire Protection District	(503)458-6610	kdonaldson@knappafire.com
Jeff Golightly	Lewis & Clark Rural Fire Protection District	(503)325-4192	lewisclarkfire@gmail.com
Sue Transue	Port of Astoria	(503)741-~~3337~~ 3342	stransue@portofastoria.com
Gary Kobes	Port of Astoria	(503) 741-3338; (314) 409-8392	gkobes@portofastoria.com
Will Isom	Port of Astoria	(503) 741-3300	wisom@portofastoria.com

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Clatsop Community College, Columbia Hall Room 219
9:00 AM – NOON

Steering Committee Meeting #4
1651 Lexington Ave., Astoria, OR 97103
Tuesday, September 24, 2019

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Lianne Thompson Lianne Thompson	Clatsop County Board of County Commissioners	(503) 741-1715	lthompson@co.clatsop.or.us
Pamela Wev	Clatsop County Board of County Commissioners	(971) 207-5666	pwev@co.clatsop.or.us
Tiffany Brown	Clatsop County Emergency Management	(503)338-3774	tbrown@co.clatsop.or.us
Gail Henrikson	Clatsop County Community Development	(503)325-8611	ghenrikson@co.clatsop.or.us
Vincent Aarts	Clatsop County Emergency Management	(503)338-3773	vaarts@co.clatsop.or.us
Alejandro Bancke Alejandro Bancke	Clatsop County Public Works	(503) 325-1000 x2512	abancke@co.clatsop.or.us
Tom Bennett Tom Bennett	Clatsop County Public Information	(503) 325-1000	TBennett@co.clatsop.or.us
Ted Mclean	Clatsop County Public Works	(503) 325-8631	TMclean@co.clatsop.or.us
Terry Hendrix	Clatsop County Public Works	(503) 325-1000	THendrix@co.clatsop.or.us
Michael McNickle	Clatsop County Public Health	(503)338-3686	mmcnickle@co.clatsop.or.us
Matt Phillips	Clatsop County Sheriff's Dept	503-325-8641 x2402	MPhillips@co.clatsop.or.us
Yvonne Van Nostran Yvonne Van Nostran Yvonne Van Nostran	Clatsop County Public Health	(503)338-3687	yvannostran@co.clatsop.or.us

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Clatsop Community College, Columbia Hall Room 219
9:00 AM – NOON

Steering Committee Meeting #4
1651 Lexington Ave., Astoria, OR 97103
Tuesday, September 24, 2019

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Sheila Roley	Seaside School District	(503)738-5591	sroley@seasidek12.org
Chuck Loesch	Seaside School District	(503)791-5190	cloesch@seasidek12.org
Jeff Hazen	Sunset Empire Transportation District	(503)861-5399	jeff@ridethebus.org
Paul Lewicki	Sunset Empire Transportation District	(503)861-5364	paul@ridethebus.org
Pamela Reber	Oregon DLCD	(503)934-0066	pamela.reber@state.or.us
Meg Reed on the phone	OR Coastal Management Program, Oregon DLCD	(541) 574-0811	meg.reed@state.or.us
Lisa Phipps	Oregon DLCD	(503) 842-8222 x4004	lisa.phipps@state.or.us
Kate Cox	K. Cox Consulting	503-369-7720	kcoxconsulting@gmail.com
Stuart Emmons		503-705-3050	wse@emmonsdesign.com
Barbara Fryer	City of Astoria	503 338 5183	bfryer@Astoria.or.us
Mariko Froehle	CMH OR RN	503-893-0663	ariko mfroehle@gmail.com
Morgan Murray	City of Warrenton	315-794-7434	mmurray@ci.warrenton.or.us

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Clatsop Community College, Columbia Hall Room 219
9:00 AM – NOON

Steering Committee Meeting #4
1651 Lexington Ave., Astoria, OR 97103
Tuesday, September 24, 2019

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Charlene Larson	Oregon VOAD	(503)791-6207	crl@pacifier.com
Patrick Corcoran	OSU SeaGrant/County Extension	(503)325-8573	patrick.corcoran@oregonstate.edu
DB Lewis	American Red Cross	503-325-0381	db@dblcy.net
David Miller	Clatsop Healthcare District (Clatsop Care)	503-325-0515	admincchr@clatsopcare.org
Dusten Martin	Clatsop Community Action	503-325-1400	dmartin@ccaservices.org
Chris Farrar	Clatsop Soil & Water Conservation District (Clatsop SWCD)	(503) 325-4571	tochrisfarrar@gmail.com
Paula Larson	Columbia Memorial Hospital	(503)680-8442	plarson@columbiamemorial.org
Bruce Jones	Columbia River Maritime Museum (CRMM)	(503) 325-2323	jones@crmm.org
Nancy Ferber	Columbia River Estuary Study Taskforce (CREST)	(503) 325-0435 x213	nferber@columbiaestuary.org
Wayne Carmichael	Elsie-Vinemaple RPFD	(503)755-0711	wayne.carmichael@wright.edu
Erik Meyer	Providence Seaside Hospital	503-717-7501	Erik.Meyer@providence.org

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) STEERING COMMITTEE 2020 Update Meeting #4

Tuesday, January 28, 2020
9:00 AM – Noon

Guy Boyington Building
857 Commercial Street, Astoria, OR 97103

AGENDA

8:30 AM	**Doors Open & Sign In** –*Refreshments likely*	30 minutes
9:00 AM	**Welcome & Introductions** • Everyone in the room is invited to introduce themselves with their name, title, organization. • Steering Committee members are welcome to give a brief update or announcement.	25 minutes
9:25 AM	**September 2019 Steering Committee Meeting Notes** • Approve notes from the September 24, 2019 meeting.	5 minutes
9:30 AM	**Coastal Hospital Resilience** • Maria Ross, Oregon Health Authority Public Health Emergency Preparedness Liaison for Clatsop County, will present. • Q & A	30 minutes
10:00 AM	**Liquid Fuel Update** (Tiffany Brown) • Discussion	10 minutes
10:10 AM	**Climate Change in the Hazard Vulnerability Analysis** • How did your jurisdiction consider climate change in the HVA? • A question for the group from a SC member.	10 minutes
10:20 AM	**Break**	5 minutes
10:25 AM	**Mitigation Strategy & Risk Assessment Summary** (Pam Reber & all) • Break out groups review/discuss mitigation strategic vision, goals, and objectives. • Each group will be given a copy to mark up: o Highlight sections you like, strikeout text to delete. • Report back to the larger group.	45 minutes
11:15 AM	**SMART Mitigation Actions** • Review & development of SMART mitigation action items • What are the priority mitigation actions for the group? • Set timeline for developing mitigation actions.	25 minutes
11:40 AM	**Public Engagement** • Discuss plan outreach. • Public survey?	15 minutes
11:55 AM	**Wrap Up**	5 minutes

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Tuesday, January 28, 2020
9:00 AM – NOON

Steering Committee Meeting #5
Guy Boyington Building
857 Commercial Street, Astoria, OR 97103

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Rosemary Johnson	City of Astoria	(503)325-6434	rosemaryjcurt@gmail.com
Brett Estes	City of Astoria	(503)325-5824 x2400	bestes@astoria.or.us
Jeff Harrington	City of Astoria Public Works	(503) 338-5177	jharrington@astoria.or.us
Nathan Crater	City of Astoria Public Works	(503)338-5173	ncrater@astoria.or.us
Jeff Adams JEFFREY S. ADAMS	City of Cannon Beach Community Development	(503)436-2050	adams@ci.cannon-beach.or.us
Rick Hudson	City of Cannon Beach Emergency Management	(530)391-5300	hudson@ci.cannon-beach.or.us
Chad Sweet	City of Gearhart	(503)738-5501	chadsweet@cityofgearhart.com
Kristi Ficker	City of Gearhart	(503)738-5501	kristi@cityofgearhart.com
Kevin Cupples	City of Seaside	(503)738-7100	kcupples@cityofseaside.us
Anne McBride	City of Seaside	(503) 738-7100	amcbride@cityofseaside.us
Kevin Cronin	City of Warrenton	(503)861-0920	cityplanner@ci.warrenton.or.us
Collin Stelzig, PE	City of Warrenton	(503)861-0914	rstelzig@ci.warrenton.or.us
Bill Campbell	Arch Cape Water and Sanitary Districts	(503) 436-4031	billcampbellacutil@gmail.com
Matthew Benedict	Cannon Beach Rural Fire Protection District	(503)739-1234	mbenedict@cbfire.com
Marc Reckmann	Cannon Beach Rural Fire Protection District	(503)436-2949	mreckmann@cbfire.com
Joanne Zahn	Clatsop Community College	(503)338-2421	jzahn@clatsopcc.edu
Stephanie Homer	Clatsop Community College	(503)338-4241	shomer@clatsopcc.edu

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Tuesday, January 28, 2020
9:00 AM – NOON

Steering Committee Meeting #5
Guy Boyington Building
857 Commercial Street, Astoria, OR 97103

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Shaun Martin	Clatsop Community College	(977)601-0295	smartin@clatsopcc.edu
Lianne Thompson	Clatsop County Board of County Commissioners	(503) 741-1715	lthompson@co.clatsop.or.us
Pamela Wev	Clatsop County Board of County Commissioners	(971) 207-5666	pwev@co.clatsop.or.us
Tiffany Brown	Clatsop County Emergency Management	(503)338-3774	tbrown@co.clatsop.or.us
Gail Henrikson	Clatsop County Community Development	(503)325-8611	ghenrikson@co.clatsop.or.us
Vincent Aarts	Clatsop County Emergency Management	(503)338-3773	vaarts@co.clatsop.or.us
Alejandro Bancke	Clatsop County Public Works	(503) 325-1000 x2512	abancke@co.clatsop.or.us
Tom Bennett	Clatsop County Public Information	(503) 325-1000	TBennett@co.clatsop.or.us
Ted Mclean	Clatsop County Public Works	(503) 325-8631	TMclean@co.clatsop.or.us
Terry Hendrix	Clatsop County Public Works	(503) 325-1000	THendrix@co.clatsop.or.us
Michael McNickle	Clatsop County Public Health	(503)338-3686	mmcnickle@co.clatsop.or.us
Matt Phillips	Clatsop County Sheriff's Dept	503-325-8641 x2402	MPhillips@co.clatsop.or.us
Yvonne Van Nostran	Clatsop County Public Health	(503)338-3687	yvannostran@co.clatsop.or.us
ROBERT JOHNSTON	CITY OF WARRENTON	503-861-0920	BJOHNSTON@CI.WARRENTON.OR.US
Pooka Morales	Clatsop County Emergency Mgmt	503-325-8645	lmorales@co.clatsop.or.us

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Tuesday, January 28, 2020
9:00 AM – NOON

Steering Committee Meeting #5
Guy Boyington Building
857 Commercial Street, Astoria, OR 97103

Printed Name and FULL SIGNATURE	Representing	Phone	Email
David Miller	Clatsop Healthcare District (Clatsop Care)	503-325-0515	admincchr@clatsopcare.org
Dusten Martin	Clatsop Community Action	503-325-1400	dmartin@ccaservices.org
Chris Farrar	Clatsop Soil & Water Conservation District (Clatsop SWCD)	(503) 325-4571	tochrisfarrar@gmail.com
Paula Larson	Columbia Memorial Hospital	(503)680-8442	plarson@columbiamemorial.org
Bruce Jones	Columbia River Maritime Museum (CRMM)	(503) 325-2323	jones@crmm.org
Nancy Ferber	Columbia River Estuary Study Taskforce (CREST)	(503) 325-0435 x213	nferber@columbiaestuary.org
Wayne Carmichael	Elsie-Vinemaple RPFD	(503)755-0711	wayne.carmichael@wright.edu
Erik Meyer	Providence Seaside Hospital	503-717-7501	Erik.Meyer@providence.org
Charlene Larson	Oregon VOAD	(503)791-6207	crl@pacifier.com
Patrick Corcoran	OSU SeaGrant/County Extension	(503)325-8573	patrick.corcoran@oregonstate.edu
DB Lewis	American Red Cross	503-325-0381	db@dblcy.net
Pamela Reber	Oregon DLCD	(503)934-0066	pamela.reber@state.or.us
Meg Reed	OR Coastal Management Program, Oregon DLCD	(541) 574-0811	meg.reed@state.or.us
Lisa Phipps	Oregon DLCD	(503) 842-8222 x4004	lisa.phipps@state.or.us
Maria Ross	OHA	503-347-8704	maria.j.ross@state.or.us
Katie Kopania	OHA	404-594-0924	Kathryn.Kopania@dhsoha.state.or.us
Lisa Phipps	DLCD		

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Tuesday, January 28, 2020
9:00 AM – NOON

Steering Committee Meeting #5
Guy Boyington Building
857 Commercial Street, Astoria, OR 97103

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Charles Dice	Falcon Cove Beach Domestic Water Supply District	(503)436-0146	caddice@gmail.com
Kurt Donaldson	Knappa-Svensen-Burnside Rural Fire Protection District	(503)458-6610	kdonaldson@knappafire.com
Jeff Golightly	Lewis & Clark Rural Fire Protection District	(503)325-4192	lewisclarkfire@gmail.com
Sue Transue	Port of Astoria	(503)741-3337	stransue@portofastoria.com
Gary Kobes	Port of Astoria	(503) 741-3338; (314) 409-8392	gkobes@portofastoria.com
Will Isom	Port of Astoria	(503) 741-3300	wisom@portofastoria.com
Sheila Roley	Seaside School District	(503)738-5591	sroley@seasidek12.org
Chuck Loesch	Seaside School District	(503)791-5190	cloesch@seasidek12.org
Jeff Hazen	Sunset Empire Transportation District	(503)861-5399	jeff@ridethebus.org
Paul Lewicki	Sunset Empire Transportation District	(503)861-5364	paul@ridethebus.org

Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update
Tuesday, January 28, 2020
9:00 AM – NOON

Steering Committee Meeting #5
Guy Boyington Building
857 Commercial Street, Astoria, OR 97103

Printed Name and FULL SIGNATURE	Representing	Phone	Email
Dan Crutchfield Dan Crutchfield	City of Astoria	503-298-2520	dcrutchfield@astoria.or.us
Barbara Fryer	City of Astoria	503 338 5183	bfryer@astoria.or.us

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP) STEERING COMMITTEE 2021 Update Meeting #6

Tuesday, January 19, 2021 **Online**
1:30 PM – 3:30 PM https://global.gotomeeting.com/join/623016237

AGENDA

1:30 PM	**Welcome**	10 minutes
1:40 PM	**Updates** • DOGAMI Report published • Council/Board Plan Adoption • Public comment period & survey	25 minutes
2:05 PM	**Plan Review & Discussion** • Plan Sections Review • Integrated versus addenda • Other considerations	30 minutes
2:35 PM	**Plan Approval** • Motion? Second? • Next meeting?	10 minutes
2:45 PM	**Next Steps** • Final plan content deadline: January 22nd • Final plan submitted: January 25th	15 minutes

Online Meeting Instructions:

Please join my meeting from your computer, tablet or smartphone.
https://global.gotomeeting.com/join/623016237

You can also dial in using your phone.
United States (Toll Free): 1 866 899 4679
United States: +1 (571) 317-3116

Access Code: 623-016-237

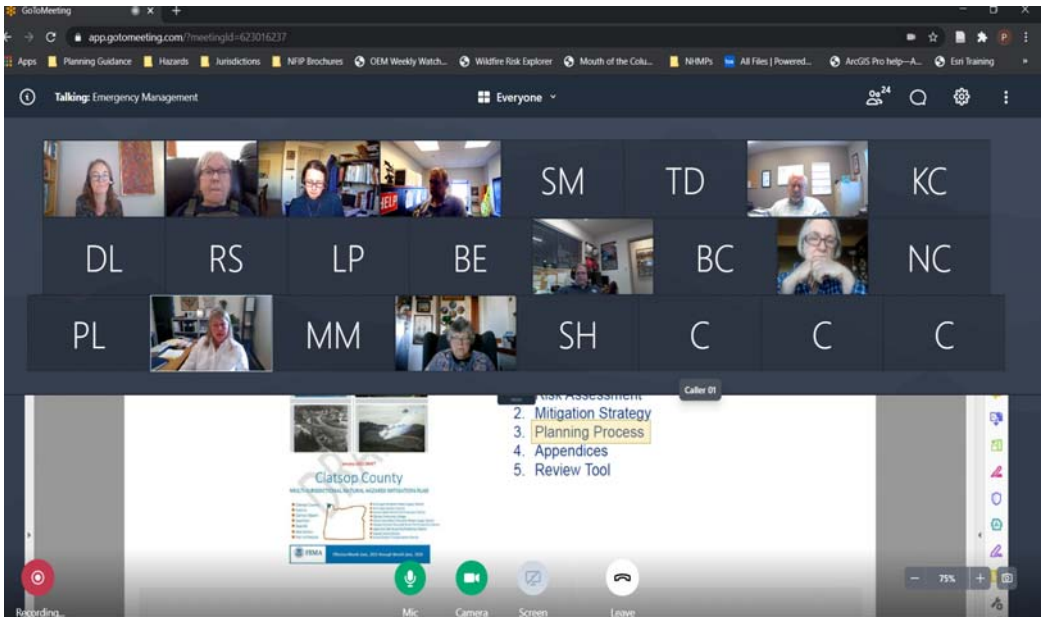


OREGON
Department of Land Conservation & Development

Clatsop NHMP SC Meeting Final Plan Review

January 19, 2021 Online

Pam Reber, Natural Hazard Planner/Plan Update Project Manager
Tiffany Brown, Clatsop County Emergency Manager/ Plan Update Convener



2. Hazard Survey Documentation

Multi-Jurisdictional Natural Hazards Mitigation Plan (MJNHMP) Update

SURVEY

CLATSOP COUNTY MJNHMP 2021 UPDATE PUBLIC ENGAGEMENT

The draft NHMP and surveys are available for public review and comment through Friday, January 15, 2021.

2021-26 Natural Hazards Mitigation Plan Review

The NHMP is a lengthy document, so to avoid feeling overwhelmed by its contents, we recommend starting with the **Table of Contents**, which will give you a feel for how the plan is laid out and which areas are of greatest interest to you. Are you interested in a particular community or jurisdiction? If so, each of the participating entities is featured most comprehensively in the **Community Risk Profiles** section. Click **HERE** to view the 2021 MJNHMP Draft Plan then use the survey or email clatsopemd@co.clatsop.or.us to provide comments and feedback.

Clatsop Community Survey

As part of the review and update process and to ensure a plan that meets the needs of the whole community, we need input from the citizens who live and/or work in Clatsop County. The survey asks the public's opinion on topics such as identified hazards, personal impacts and personal preparedness. Choose one of these methods for completing the survey:

Take the survey online.

Print the survey. Complete it and return to us via mail or email.

Complete a fillable PDF of the survey. Return to us via mail or email.

What is the Hazard Mitigation? Hazard mitigation describes actions taken to help reduce or eliminate long-term risks caused by hazards or disasters, such as flooding, earthquakes, wildfires, landslides, or dam failure. As the costs of disasters continue to rise, governments and citizens must find ways to reduce hazard risks to our communities.

What is the Hazard Mitigation Plan? The Hazard Mitigation Plan is a framework that guides our community in making decisions and developing policies to reduce or eliminate risk to life and property. The plan identifies the types of hazards that threaten our community, evaluates our vulnerability to those threats, and outlines a strategy to reduce or eliminate the risk posed by those threats to break the cycle of repeated destruction by natural hazard events.

In 2018, Clatsop County received FEMA grant assistance through the Department of Land Conservation and Development (DLCD) to prepare a Multi-Jurisdictional Natural Hazard Mitigation Plan (MJNHMP). The MJNHMP presents a strategy for reducing our communities' vulnerability to the impacts of natural hazard events such as earthquakes, flood, and wildfire. We've created this page to educate the community while providing information and resources to those who may have interest in the planning process. Whether interested in participating in

Tsunami
Volcanic Ash
Wildfire
Wind/Winter Storm

Events & Activities
+ Emergency Preparedness
Planning
Committees
+ Volunteers
About CCEM

Contact Information

Clatsop County Emergency Management
Tiffany Brown, Emergency Services Manager

800 Exchange Street, Suite 400
Astoria, OR, 97103

Physical Address:
Camp Rilea, Bldg 7404
Warrenton, OR 97146

Phone: (503) 325-8645
Email:
clatsopemd@co.clatsop.or.us

In 2018, Clatsop County received FEMA grant assistance through the Department of Land Conservation and Development (DLCD) to prepare a Multi-Jurisdictional Natural Hazard Mitigation Plan (MJNHMP). The MJNHMP presents a strategy for reducing our communities' vulnerability to the impacts of natural hazard events such as earthquakes, flood, and wildfire. We've created this page to educate the community while providing information and resources to those who may have interest in the planning process. Whether interested in participating in the process or simply getting information about how to guard against natural hazards, we encourage you to explore this page and the links provided to gain familiarity with the world of hazard mitigation in Clatsop County.

Who participates in the Hazard Mitigation Plan? Hazard mitigation planning is the process used by state, local and tribal leaders to understand risks from natural hazards and develop long-term strategies to reduce the impacts of disasters on people, property, and the environment. In 2015, the Clatsop County and the cities of Astoria, Cannon Beach, Gearhart, Seaside, and Warrenton completed plans for their respective jurisdictions. Since that time, the importance of mitigation planning as it relates to a community's resilience has become a central theme in emergency management; the planholder group for the 2020 Clatsop County MJNHMP includes the former participants as well as 10 new special service districts:

1. Clatsop County
2. City of Astoria
3. City of Cannon Beach
4. City of Gearhart
5. City of Seaside
6. City of Warrenton
7. Port of Astoria
8. Sunset Empire Transportation District
9. Clatsop Community College
10. Seaside School District
11. Cannon Beach Rural Fire Protection District
12. Lewis & Clark Fire Department
13. Knappa-Svensen-Burnside Fire
14. Arch Cape Water District
15. Arch Cape Sanitary District
16. Falcon Cove Beach Domestic Water Supply

Why is the plan important? The Federal Disaster Mitigation Act of 2000 (DMA 2000) requires that a community have an approved hazard mitigation plan in order to be eligible to apply for and receive FEMA hazard mitigation funds. Receipt of these funds can be critical to implementation of identified hazard mitigation programs.

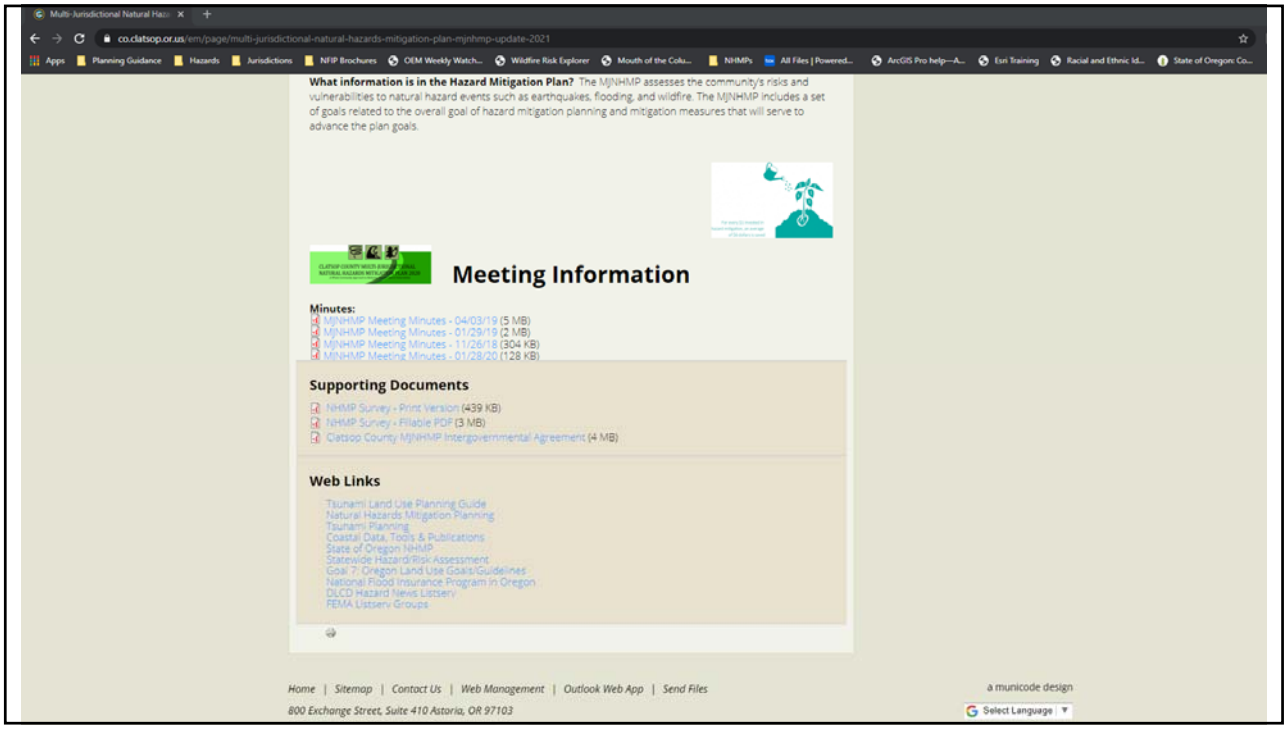
What information is in the Hazard Mitigation Plan? The MJNHMP assesses the community's risks and vulnerabilities to natural hazard events such as earthquakes, flooding, and wildfire. The MJNHMP includes a set of goals related to the overall goal of hazard mitigation planning and mitigation measures that will serve to advance the plan goals.

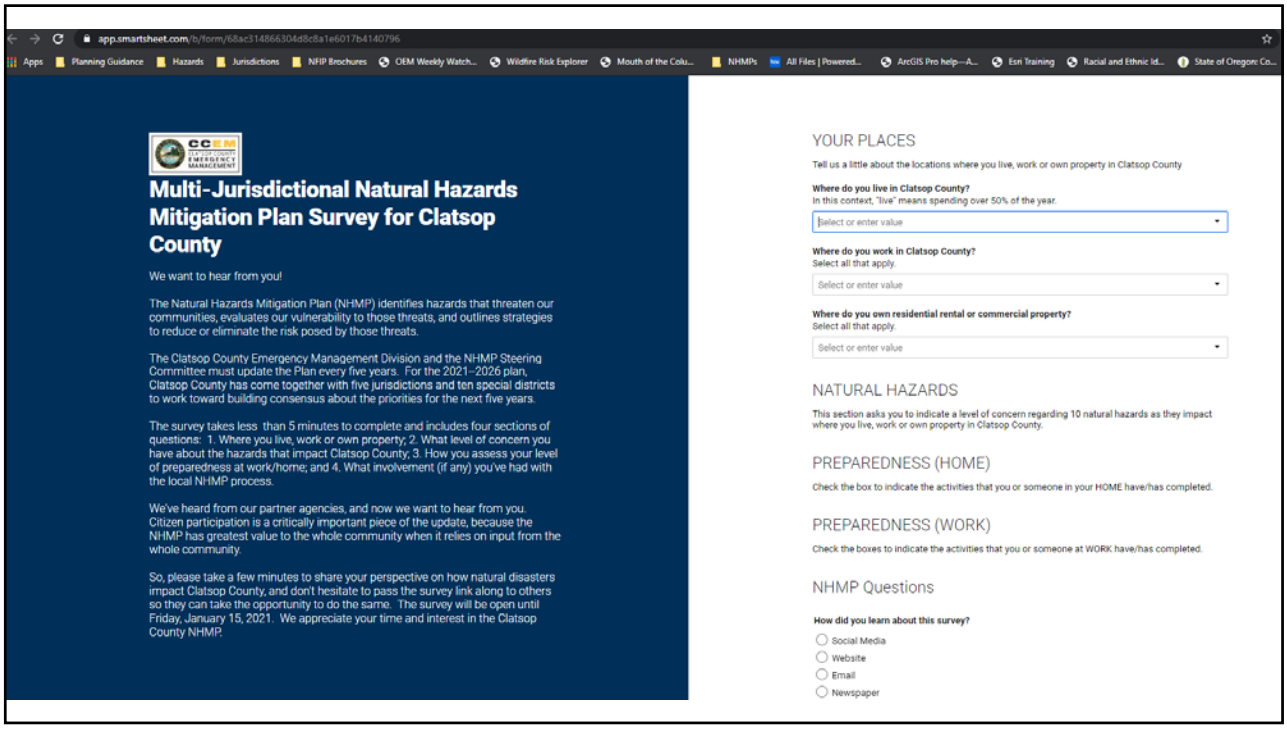
Warrenton, OR 97146

Phone: (503) 325-8645
Email:
clatsopemd@co.clatsop.or.us

Follow us on Facebook

View Full Contact Details


What information is in the Hazard Mitigation Plan? The MJNHMP assesses the community's risks and vulnerabilities to natural hazard events such as earthquakes, flooding, and wildfire. The MJNHMP includes a set of goals related to the overall goal of hazard mitigation planning and mitigation measures that will serve to advance the plan goals.
Meeting Information
Minutes:
MJNHMP Meeting Minutes - 04/03/19 (5 MB)
MJNHMP Meeting Minutes - 01/29/19 (2 MB)
MJNHMP Meeting Minutes - 11/26/18 (304 KB)
MJNHMP Meeting Minutes - 01/28/20 (128 KB)
Supporting Documents
NHMP Survey - Print Version (439 KB)
NHMP Survey - Fillable PDF (3 MB)
Clatsop County MJNHMP Intergovernmental Agreement (4 MB)
Web Links
Tsunami Land Use Planning Guide
Natural Hazards Mitigation Planning
Tsunami Planning
Coastal Data, Tools & Publications
State of Oregon NHMP
Statewide Hazard/Risk Assessment
Goal 7: Oregon Land Use Goals/Guidelines
National Flood Insurance Program in Oregon
DLCD Hazard News Listserv
FEMA Listserv Groups
Home | Sitemap | Contact Us | Web Management | Outlook Web App | Send Files
800 Exchange Street, Suite 410 Astoria, OR 97103
a municode design
Select Language


Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County
We want to hear from you!
The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.
The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.
The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.
We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.
So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.
YOUR PLACES
Tell us a little about the locations where you live, work or own property in Clatsop County
Where do you live in Clatsop County?
In this context, "live" means spending over 50% of the year.
Select or enter value
Where do you work in Clatsop County?
Select all that apply.
Select or enter value
Where do you own residential rental or commercial property?
Select all that apply.
Select or enter value
NATURAL HAZARDS
This section asks you to indicate a level of concern regarding 10 natural hazards as they impact where you live, work or own property in Clatsop County.
PREPAREDNESS (HOME)
Check the box to indicate the activities that you or someone in your HOME have/has completed.
PREPAREDNESS (WORK)
Check the boxes to indicate the activities that you or someone at WORK have/has completed.
NHMP Questions
How did you learn about this survey?
Social Media
Website
Email
Newspaper

Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County

We want to hear from you!

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.

The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.

We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.

So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.

NHMP Questions

How did you learn about this survey?

- ◯ Social Media
- ◯ Website
- ◯ Email
- ◯ Newspaper
- ◯ Word of Mouth
- ◯ Radio
- ◯ Other

Did you participate in the development of the Clatsop County 2008 or 2015 NHMP?
Select all that apply.

Select or enter value

Are you participating in the development of the Clatsop County 2021 Plan Update in any of the following ways?
Select all that apply.

Select or enter value

Please share any other comments, questions, or concerns you would like the Clatsop County NHMP Steering Committee to consider.

Thank You for Participating!

If you want to stay informed, provide your contact information below. Clatsop County and participating jurisdictions will only use this information in order to contact you or to respond to your questions and comments. We will not share this information.

Name

Mailing Address

Email

Phone

☐ Send me a copy of my responses

Submit

Powered by smartsheet

Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County

We want to hear from you!

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.

The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.

We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.

So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.

NATURAL HAZARDS

This section asks you to indicate a level of concern regarding 10 natural hazards as they impact where you live, work or own property in Clatsop County.

COASTAL EROSION
How concerned are you about coastal erosion where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

DROUGHT
How concerned are you about drought where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

EARTHQUAKE
How concerned are you about earthquake where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

FLOOD
How concerned are you about flood where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

LANDSLIDE
How concerned are you about landslide where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

TSUNAMI
How concerned are you about tsunami where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

VOLCANIC ERUPTION
How concerned are you about volcanic eruption where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

WILDFIRE
How concerned are you about wildfire where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

WIND/WINTER STORM
How concerned are you about wind/winter storm where you LIVE?

◯ Very Concerned ◯ Somewhat Concerned ◯ Neutral
◯ Not Very Concerned ◯ Not Concerned

Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County

We want to hear from you!

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.

The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.

We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.

So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.

NATURAL HAZARDS

This section asks you to indicate a level of concern regarding 10 natural hazards as they impact where you live, work or own property in Clatsop County.

How concerned are you about coastal erosion where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about drought where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about earthquake where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about flood where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about landslide where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about tsunami where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about volcanic eruption where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about wildfire where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about wind/winter storm where you WORK?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County

We want to hear from you!

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.

The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.

We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.

So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.

PREPAREDNESS (HOME)

Check the box to indicate the activities that you or someone in your HOME have/has completed.

Attended training or received written information regarding emergency preparedness?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Talked with household members about what to do in case of a natural disaster or emergency?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Developed a "Household Emergency Plan" that identifies what everyone does in a disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a disaster "Go Kit" - one that you can take with you in case of evacuation?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a 3-day supply of water, food, medicine, and other basic essentials for your family/household?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a 14-day supply (or more) for a major disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR) in the last year?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared your home by having smoke and carbon monoxide detectors on each level of the house?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Discussed or created a utility shutoff procedure in the event of a natural disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County

We want to hear from you!

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.

The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.

We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.

So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.

PREPAREDNESS (WORK)

Check the boxes to indicate the activities that you or someone at WORK have/has completed.

Attended training or received written information regarding emergency preparedness?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Talked with coworkers about what to do in case of a natural disaster or emergency?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Developed a "Workplace Emergency Plan" that identifies what everyone does in a disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a disaster "Go Kit" - one that you can take with you in case of evacuation from your workplace?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a 2-day supply of water, food, medicine, and other basic essentials for employees?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a 14-day supply (or more) for employees in case of a major disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Trained one or more employees in First Aid or Cardio-Pulmonary Resuscitation (CPR) in the last year?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared your workplace by having smoke and carbon monoxide detectors in each area of the facility?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Discussed or created a utility shutoff procedure in the event of a natural disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County

We want to hear from you!

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.

The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.

We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.

So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.

NATURAL HAZARDS

This section asks you to indicate a level of concern regarding 10 natural hazards as they impact where you live, work or own property in Clatsop County.

How concerned are you about coastal erosion where you OWN rental or commercial property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about drought where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about earthquake where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about flood where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about landslide where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about tsunami where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about volcanic eruption where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about wildfire where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

How concerned are you about wind/winter storm where you OWN income property?

○ Very Concerned ○ Somewhat Concerned ○ Neutral
○ Not Very Concerned ○ Not Concerned

Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County

We want to hear from you!

The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

The Clatsop County Emergency Management Division and the NHMP Steering Committee must update the Plan every five years. For the 2021–2026 plan, Clatsop County has come together with five jurisdictions and ten special districts to work toward building consensus about the priorities for the next five years.

The survey takes less than 5 minutes to complete and includes four sections of questions: 1. Where you live, work or own property; 2. What level of concern you have about the hazards that impact Clatsop County; 3. How you assess your level of preparedness at work/home; and 4. What involvement (if any) you've had with the local NHMP process.

We've heard from our partner agencies, and now we want to hear from you. Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community.

So, please take a few minutes to share your perspective on how natural disasters impact Clatsop County, and don't hesitate to pass the survey link along to others so they can take the opportunity to do the same. The survey will be open until Friday, January 15, 2021. We appreciate your time and interest in the Clatsop County NHMP.

PREPAREDNESS (WORK)

Check the boxes to indicate the activities that you or someone at WORK have/has completed.

Attended training or received written information regarding emergency preparedness?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Talked with coworkers about what to do in case of a natural disaster or emergency?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Developed a "Workplace Emergency Plan" that identifies what everyone does in a disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a disaster "Go Kit" - one that you can take with you in case of evacuation from your workplace?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a 3-day supply of water, food, medicine, and other basic essentials for employees?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared a 14-day supply (or more) for employees in case of a major disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Trained one or more employees in First Aid or Cardio-Pulmonary Resuscitation (CPR) in the last year?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Prepared your workplace by having smoke and carbon monoxide detectors in each area of the facility?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

Discussed or created a utility shutoff procedure in the event of a natural disaster?

○ Have Done ○ Plan to Do ○ Unable to Do ○ Need Help
○ Not Done ○ Don't Know

CLATSOP COUNTY MULTI-JURISDICTIONAL
NATURAL HAZARDS MITIGATION PLAN 2020
A Whole Community Approach to Reducing Disaster Risk & Vulnerability

Clatsop Community Survey: 2020-25 Natural Hazards Mitigation Plan

The *Natural Hazards Mitigation Plan (NHMP)* identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats. The Clatsop County Emergency Management Division and the NHMP Steering Committee update the Plan every five years. For the 2020-2025 plan, Clatsop County has come together with five jurisdictions and ten special districts and is working to build consensus about the priorities for the next five years.

1. Where do you live in Clatsop County? In this context, 'live' means over 50% of the year.

- ☐ Astoria
- ☐ Arch Cape
- ☐ Cannon Beach
- ☐ Cullaby Lake
- ☐ Elsie-Vinemaple/Jewell
- ☐ Gearhart
- ☐ Hamlet
- ☐ Jeffers Garden/Miles Crossing
- ☐ Knappa/Svensen
- ☐ Lewis & Clark
- ☐ Mist-Birkenfeld
- ☐ Olney-Walluski
- ☐ Seaside
- ☐ Surf Pines
- ☐ Sunset Beach
- ☐ Warrenton
- ☐ Westport
- ☐ I live outside of Clatsop County

2. How concerned are you about the following natural hazards <u>where you live</u>? Please mark an X for your level of concern for each hazard.

	Very Concerned	Somewhat Concerned	Neutral	Not Very Concerned	Not Concerned
COASTAL EROSION					
DROUGHT					
EARTHQUAKE					
FLOOD					
LANDSLIDE					
TSUNAMI					
VOLCANIC ERUPTION					
WILDFIRE					
WIND/ WINTER STORM					

3. **Where do you work in Clatsop County?** ***Select all that apply.***

- ☐ Astoria
- ☐ Arch Cape
- ☐ Cannon Beach
- ☐ Cullaby Lake
- ☐ Elsie-Vinemaple/Jewell
- ☐ Gearhart
- ☐ Hamlet
- ☐ Jeffers Garden/ Miles Crossing
- ☐ Knappa/Svensen
- ☐ Lewis & Clark
- ☐ Mist-Birkenfeld
- ☐ Olney-Walluski
- ☐ Seaside
- ☐ Surf Pines
- ☐ Sunset Beach
- ☐ Warrenton
- ☐ Westport
- ☐ I work outside of Clatsop County

4. **How concerned are you about the following natural hazards <u>where you work</u>? Please mark an X for your level of concern for each hazard listed.**

	Very Concerned	Somewhat Concerned	Neutral	Not Very Concerned	Not Concerned
COASTAL EROSION					
DROUGHT					
EARTHQUAKE					
FLOOD					
LANDSLIDE					
TSUNAMI					
VOLCANIC ERUPTION					
WILDFIRE					
WIND/ WINTER STORM					

5. **Select any locations where you own residential rental or commercial property?**

- ☐ I don't own other property
- ☐ Astoria
- ☐ Arch Cape
- ☐ Cannon Beach
- ☐ Cullaby Lake
- ☐ Elsie-Vinemaple/Jewell
- ☐ Gearhart
- ☐ Hamlet
- ☐ Jeffers Garden/ Miles Crossing
- ☐ Knappa / Svensen
- ☐ Lewis & Clark
- ☐ Mist-Birkenfeld
- ☐ Olney-Walluski
- ☐ Seaside
- ☐ Surf Pines
- ☐ Sunset Beach
- ☐ Warrenton
- ☐ Westport

6. **How concerned are you about the following natural hazards impacting your rental or commercial property?** ***Mark "X" to indicate level of concern for each hazard.***

	Very Concerned	Somewhat Concerned	Neutral	Not Very Concerned	Not Concerned
COASTAL EROSION					
DROUGHT					
EARTHQUAKE					
FLOOD					
LANDSLIDE					
TSUNAMI					
VOLCANIC ERUPTION					

WILDFIRE					
WIND/ WINTER STORM					

7. **Household Preparedness Please check the box that is most accurate to indicate the activities that you or someone in your household has completed.**

	Done	Plan to Do	Unable to Do	Need Help	Not Done
Attended meetings or received written information on natural disasters or emergency preparedness?					
Talked with household members about what to do in case of a natural disaster or emergency?					
Developed a "Household Emergency Plan" that identifies what everyone does in a disaster?					
Prepared a disaster "go" kit—one that you can take with you in case of evacuation?					
Prepared a 3-day supply of water, food, medicine, and other basic essentials for your family/household?					
Prepared a 14-day (or more) supply for a major disaster?					
Been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR) in the last year?					
Prepared your home by having smoke and carbon monoxide detectors on each level of the house?					
Discussed or created a utility shutoff procedure in the event of a natural disaster>					

8. **Workplace Preparedness. Please check the box that is most accurate to indicate the activities that you or someone in your workplace has completed.**

	Have Done	Plan to Do	Unable to Do	Need Help	Not Done	Don't Know
Attended/provided training on natural disasters or emergency preparedness at work?						
Talked with coworkers about what to do in case of a natural disaster or emergency?						
Developed a "Workplace Emergency Plan" that identifies what everyone does in a disaster?						
Prepared a disaster "go" kit—one that you can take with you in case of evacuation from your						
Prepared a 3-day supply of water, food, medicine, and other basic essentials for employees?						
Prepared a 14-day (or more) supply for employees in case of a major disaster?						

Been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR) in the last year?						
Installed smoke and carbon monoxide detectors in each area of the facility?						
Discussed or created a utility shutoff procedure in the event of a natural disaster?						

9. How did you learn about this survey?

- ☐ Social Media
- ☐ Website
- ☐ Newspaper
- ☐ Email
- ☐ Word of mouth
- ☐ Radio
- ☐ Other

10. Did you participate in the development of the Clatsop County 2008 or 2015 NHMP process in any of the following ways? *Select all that apply.*

- ☐ Yes, I was a member of the Hazard Mitigation Planning Committee.
- ☐ Yes, I attended a public meeting.
- ☐ Yes, I commented on the Draft Plan.
- ☐ No, I did not participate but I was aware of the plan and followed development through the news media.
- ☐ No, I did not participate in any way.

11. Are you participating in the development of the Clatsop County 2020 Plan Update in any of the following ways? *Select all that apply.*

- ☐ Yes, I am a member of the Hazard Mitigation Planning Committee.
- ☐ Yes, I attended/want to attend a public meeting.
- ☐ Yes, I will comment on the Draft Plan.
- ☐ No, I have/will not participate but I was aware of the plan and followed development through the news media.
- ☐ No, I have/will not participate in any way.

12. Please share any other comments, questions, or concerns you would like the Clatsop County NHMP Steering Committee to consider.

_____

_____

_____

Thank you for participating. *If you want to stay informed, provide your contact information below. Clatsop County and participating jurisdictions will only use this information in order to contact you or to respond to your questions and comments. We will not share this information.*

Name: _____

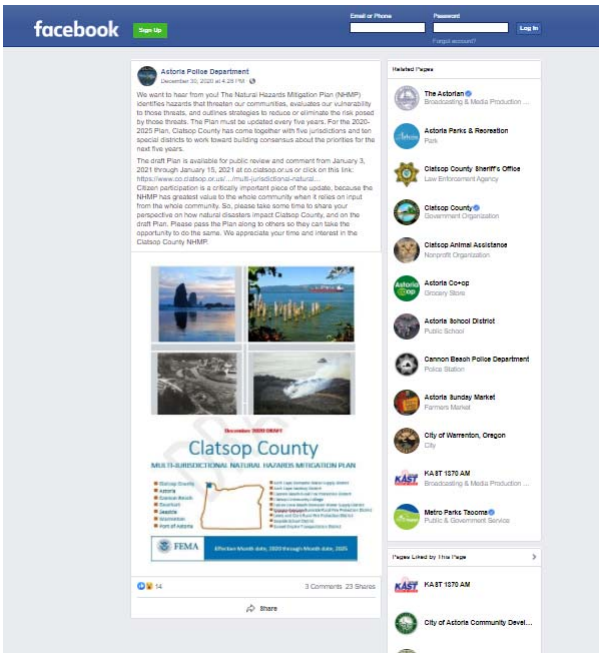
Address: __ _____

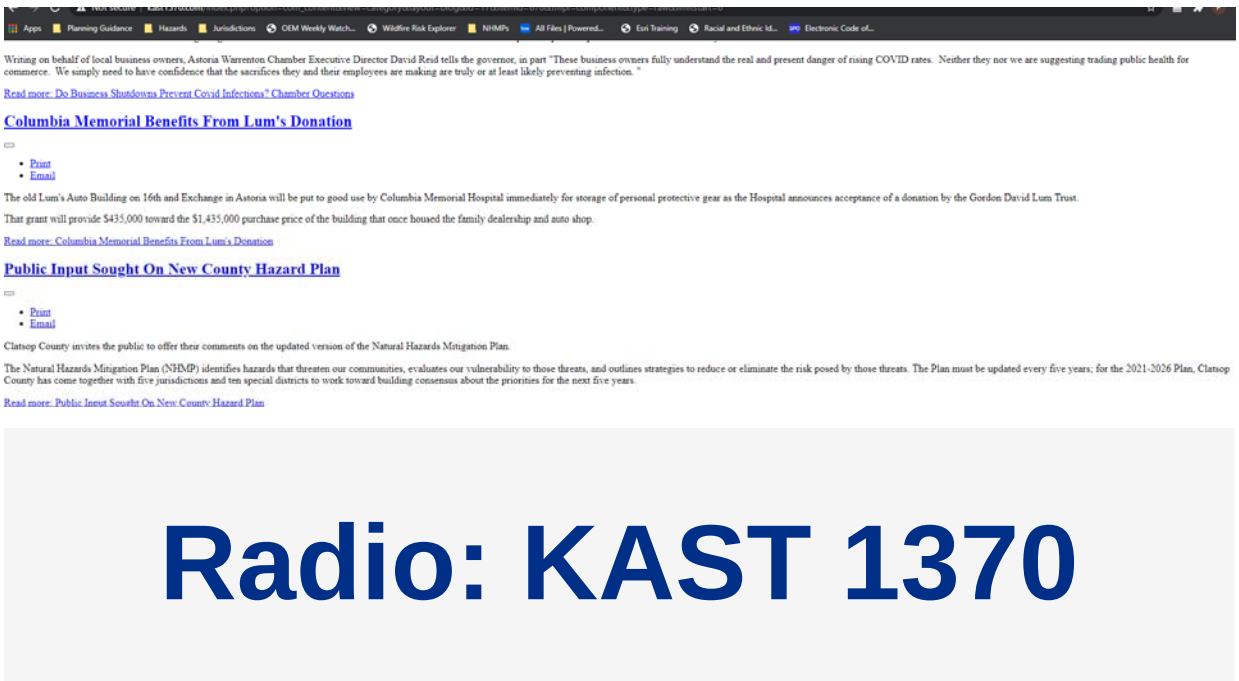
E-mail: _____

Phone: _____

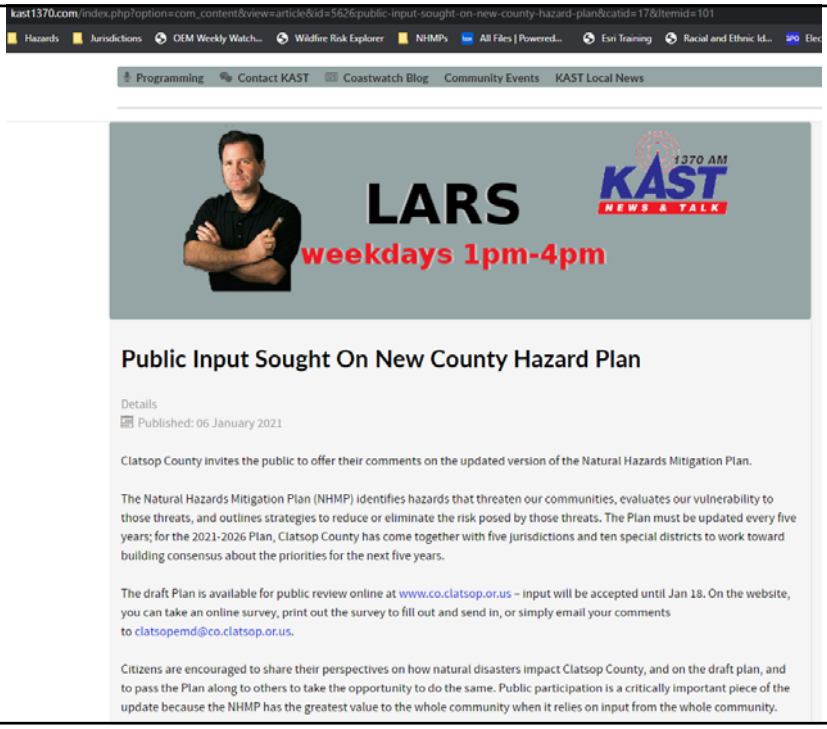
Return completed written surveys to: Clatsop County Emergency Management 800 Exchange Street, Suite 410 Astoria, OR 97103	***Email scanned or electronic surveys to:*** clatsopemd@co.clatsop.or.us
SURVEY MUST BE COMPLETED NO LATER THAN JUNE 30, 2020	

3. Public Information: Web Pages, Notices, Press





Radio: KAST 1370



CLATSOP PLAN JURISDICTION WEBSITES

- 1 County
- 5 Cities
- 10 Special Districts

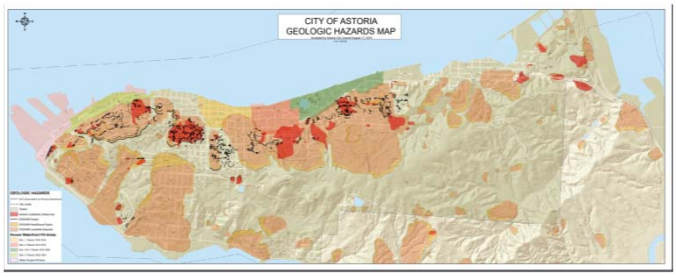
- Arch Cape Domestic Water Supply District
- Arch Cape Sanitary District
- Astoria
- Cannon Beach
- Cannon Beach Rural Fire Protection District
- Clatsop Community College
- Clatsop County
- Falcon Cove Beach Domestic Water Supply District
- Gearhart
- Knappa-Svensen-Burnside Rural Fire Protection District
- Lewis and Clark Rural Fire Protection District
- Port of Astoria
- Seaside
- Seaside School District
- Sunset Empire Transportation District
- Warrenton

https://www.co.clatsop.or.us/em/page/emergency-management-planning

https://www.co.clatsop.or.us/em

Clatsop NHMP Website: Clatsop County

April 2019



1. http://astoria.or.us/Be_Prepared.aspx
2. Geologic & Flood Hazards in Comp Plan
3. Geologic Hazards Map

Clatsop NHMP Website: City of Astoria

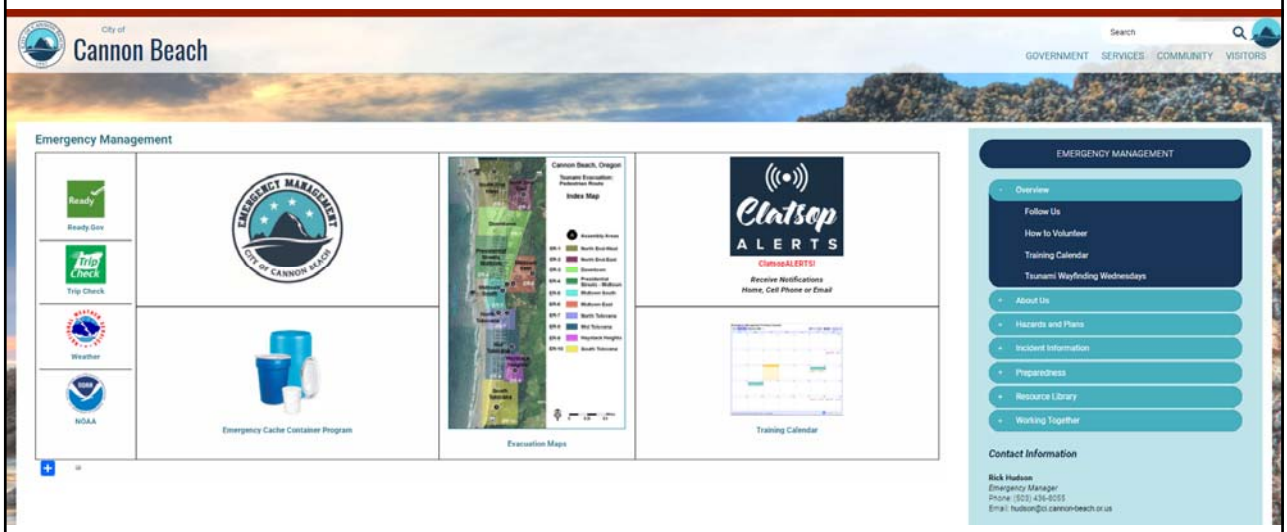
April 2019

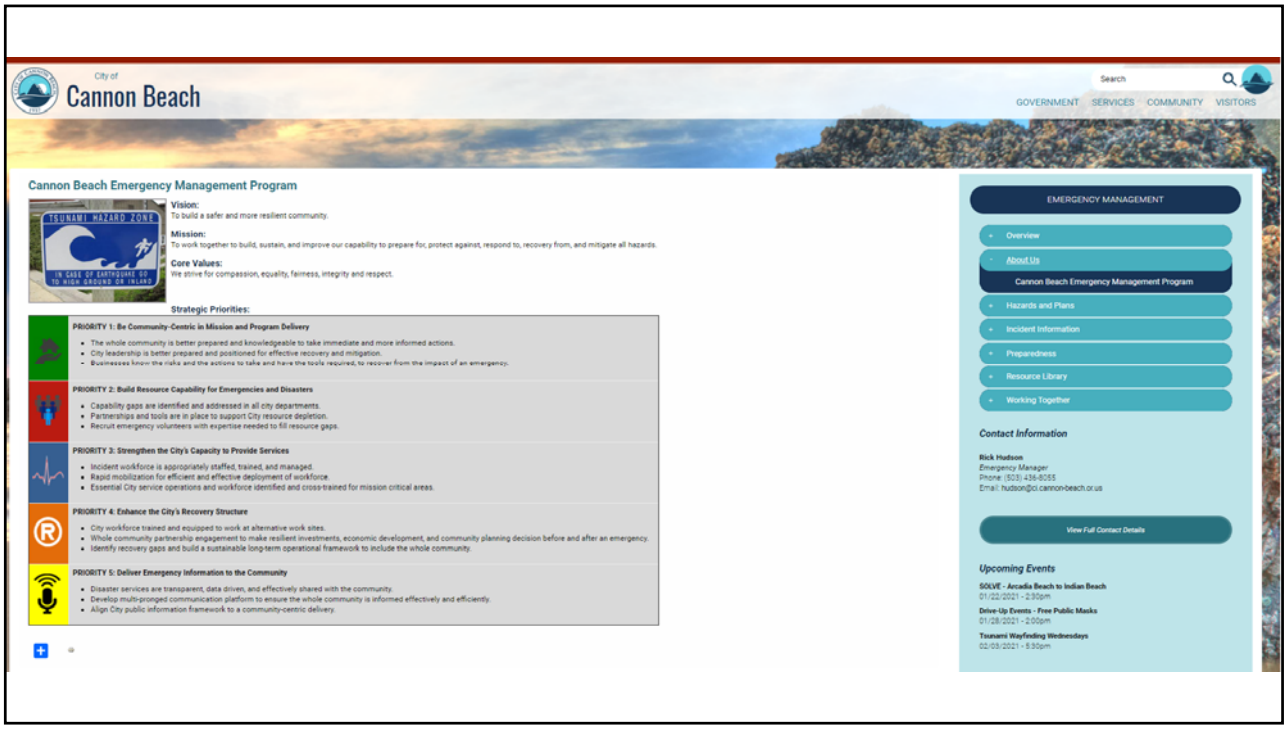
https://www.ci.cannon-beach.or.us/emergencymgmt

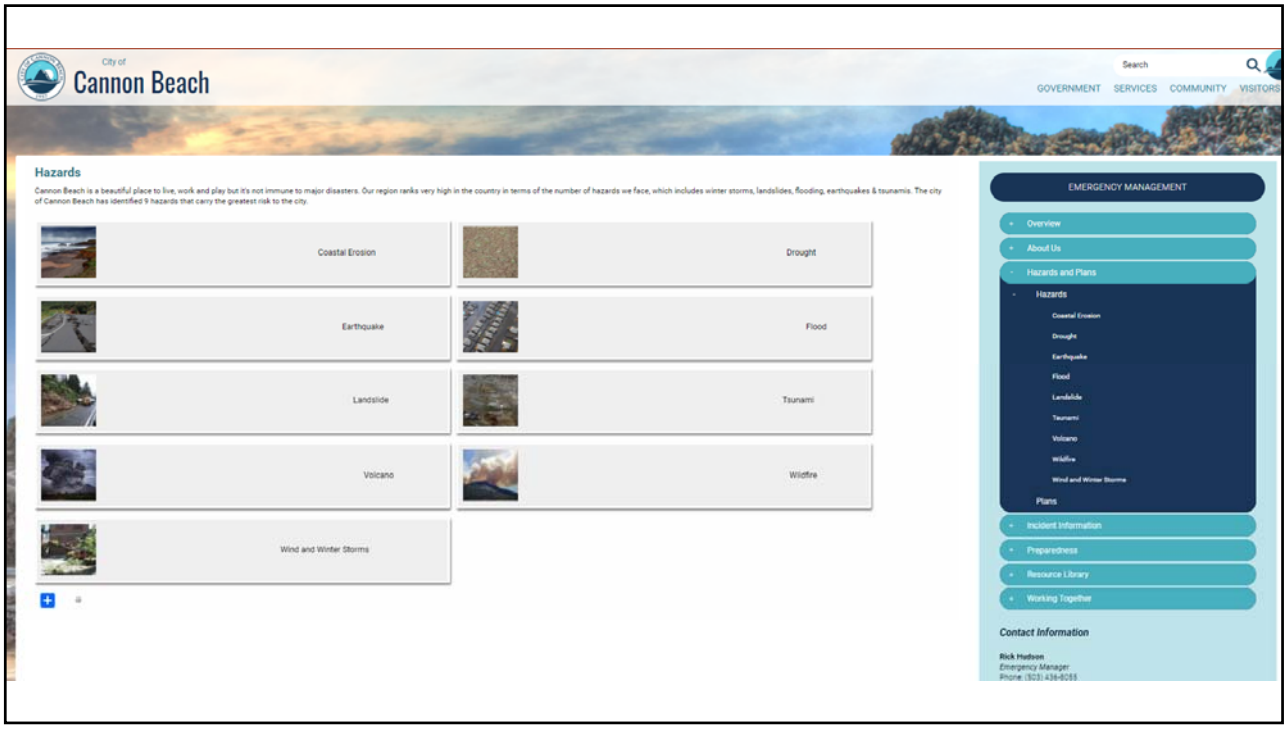
https://www.ci.cannon-beach.or.us/emergencymgmt/page/hazards-and-plans
Tsunami Evacuation Routes & Assembly Areas

Clatsop NHMP Website: City of Cannon Beach

April 2019




City of
Cannon Beach
Search
GOVERNMENT SERVICES COMMUNITY VISITORS
Cannon Beach Emergency Management Program
TSUNAMI HAZARD ZONE
IN CASE OF EARTHQUAKE GO TO HIGH GROUND OR INLAND
Vision:
To build a safer and more resilient community.
Mission:
To work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recovery from, and mitigate all hazards.
Core Values:
We strive for compassion, equality, fairness, integrity and respect.
Strategic Priorities:
PRIORITY 1: Be Community-Centric in Mission and Program Delivery
The whole community is better prepared and knowledgeable to take immediate and more informed actions.
City leadership is better prepared and positioned for effective recovery and mitigation.
Businesses know the risks and the actions to take and have the tools required, to recover from the impact of an emergency.
PRIORITY 2: Build Resource Capability for Emergencies and Disasters
Capability gaps are identified and addressed in all city departments.
Partnerships and tools are in place to support City resource depletion.
Recruit emergency volunteers with expertise needed to fill resource gaps.
PRIORITY 3: Strengthen the City's Capacity to Provide Services
Incident workforce is appropriately staffed, trained, and managed.
Rapid mobilization for efficient and effective deployment of workforce.
Essential City service operations and workforce identified and cross-trained for mission critical areas.
PRIORITY 4: Enhance the City's Recovery Structure
City workforce trained and equipped to work at alternative work sites.
Whole community partnership engagement to make resilient investments, economic development, and community planning decision before and after an emergency.
Identify recovery gaps and build a sustainable long-term operational framework to include the whole community.
PRIORITY 5: Deliver Emergency Information to the Community
Disaster services are transparent, data driven, and effectively shared with the community.
Develop multi-pronged communication platform to ensure the whole community is informed effectively and efficiently.
Align City public information framework to a community-centric delivery.
EMERGENCY MANAGEMENT
Overview
About Us
Cannon Beach Emergency Management Program
Hazards and Plans
Incident Information
Preparedness
Resource Library
Working Together
Contact Information
Rick Hudson
Emergency Manager
Phone: (503) 436-8055
Email: hudson@ci.cannon-beach.or.us
View Full Contact Details
Upcoming Events
SOLVE - Arcadia Beach to Indian Beach
01/22/2021 - 2:30pm
Drive-Up Events - Free Public Masks
01/28/2021 - 2:00pm
Tsunami Wayfinding Wednesdays
02/03/2021 - 5:30pm


City of
Cannon Beach
Search
GOVERNMENT SERVICES COMMUNITY VISITORS
Hazards
Cannon Beach is a beautiful place to live, work and play but it's not immune to major disasters. Our region ranks very high in the country in terms of the number of hazards we face, which includes winter storms, landslides, flooding, earthquakes & tsunamis. The city of Cannon Beach has identified 9 hazards that carry the greatest risk to the city.
Coastal Erosion
Drought
Earthquake
Flood
Landslide
Tsunami
Volcano
Wildfire
Wind and Winter Storms
EMERGENCY MANAGEMENT
Overview
About Us
Hazards and Plans
Hazards
Coastal Erosion
Drought
Earthquake
Flood
Landslide
Tsunami
Volcano
Wildfire
Wind and Winter Storms
Plans
Incident Information
Preparedness
Resource Library
Working Together
Contact Information
Rick Hudson
Emergency Manager
Phone: (503) 436-8055

City of
Cannon Beach

Search

GOVERNMENT SERVICES COMMUNITY VISITORS

Plans

Planning enables a more effective response by laying out an agreed upon approach to how we will respond to incidents. They define our priorities and goals. They also outline how we are going to achieve our goals and what each person is responsible for doing. A good plan will use everyone's talents and stresses working together.

Every disaster is different and because we don't know when an incident will strike or what will happen when it occurs, plans are designed to be flexible and adaptable.

Most planners will tell you that the process of coming up with the plan is probably more valuable than the plan itself. In Cannon Beach, we believe in planning with the community not for them. This means we need everyone to participate in building our plans. By planning together, we gain a better understanding of each other's capabilities and limitations, and we develop relationships and learn to trust those who will be working with us when the disaster occurs.

A plan is not something that gets completed and then goes on a bookshelf until it gets updated. Planning is part of a cycle of preparedness. Plans guide how we organize and equip our responders, conduct training and ensure everyone understands their roles and responsibilities within the plan. Exercises test our plans and identify where improvements are needed. Plans are then updated to incorporate lessons learned. In developing our plans we utilize a number of guides and reflect on best practices developed by others.

- Clatsop County Natural Hazard Mitigation Plan, April 2015
- State of Oregon Natural Hazards Mitigation Plan
- City of Cannon Beach Strategic Plan 2017-2021
- City of Cannon Beach Natural Hazard Mitigation Plan, April 2015

EMERGENCY MANAGEMENT

- Overview
- About Us
- Hazards and Plans
  - Hazards
  - Plans
- Incident Information
- Preparedness
- Resource Library
- Working Together

Contact Information

Rick Hudson
Emergency Manager
Phone: (503) 436-8055
Email: hudson@ci.cannon-beach.or.us

---

ci.cannon-beach.or.us/emergencymgmt/page/2020-clatsop-county-multi-jurisdictional-natural-hazards-mitigation-plan-update

Apps | Planning Guidance | Hazards | Jurisdictions | OEM Weekly Watch... | Wildfire Risk Explorer | NHMPs | All Files | Powered... | Esri Training | Racial and Ethnic Id... | Electronic Code of...

City of
Cannon Beach

Search

GOVERNMENT SERVICES COMMUNITY VISITORS

2020 Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update

Dear NHMP Steering Committee Members & Community Stakeholders,

The kickoff meeting for the 2020 Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update has been set for Tuesday, January 29 from 1-4 p.m. at the Guy Boyington Building at 9th/Exchange Streets in Astoria.

I've attached the minutes from the meeting last week along with an updated public engagement matrix based on the responses we received from participants. Please review both and contact me if you have decided on an public engagement event/method you've not yet indicated and we will add to the list.

Speaking of public engagement, you probably saw our first example last week in the Daily Astorian http://www.dailyastorian.com/Local_News/20181130/a-dire-picture-of-clima... We posted to our Facebook page, and you can start fulfilling your PEP requirements today by simply sharing the link to your local website or FB page. It's a good example of how things can occur organically throughout the process to enhance the public engagement piece.

I'll continue to be in touch with you and your focal contact in the upcoming weeks to assure the cost share program is set up appropriately by the time of the first meeting and to offer any assistance or guidance I'm able regarding IGA approval by your Board. I still have some committee updates rolling in from a few of you as well as from the whole community stakeholders we're in the process of contacting to invite to the process. I expect that we'll have identified and invited all participants by December 21, and will ensure at that time that everyone involved has received the meeting notice. A final reminder will go out at the same time we post the public meeting notice.

We're looking forward to kicking things off in January and to working on this important project together. Until then, please don't hesitate to contact me with any questions or concerns.

Best,

Tiffany Brown

This message has been prepared on resources owned by Clatsop County, Oregon. It is subject to the Internet and Online Services Use Policy and Procedures of Clatsop County.

- Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Steering Committee Meeting Minutes (293 KB)
- Clatsop County Multi-Jurisdictional Natural Hazards Mitigation Plan Update--Public Engagement Plan (257 KB)

EMERGENCY MANAGEMENT

- Overview
- About Us
- Hazards and Plans
- Incident Information
- Preparedness
- Resource Library
- Working Together

Contact Information

Rick Hudson
Emergency Manager
Phone: (503) 436-8055
Email: hudson@ci.cannon-beach.or.us

View Full Contact Details

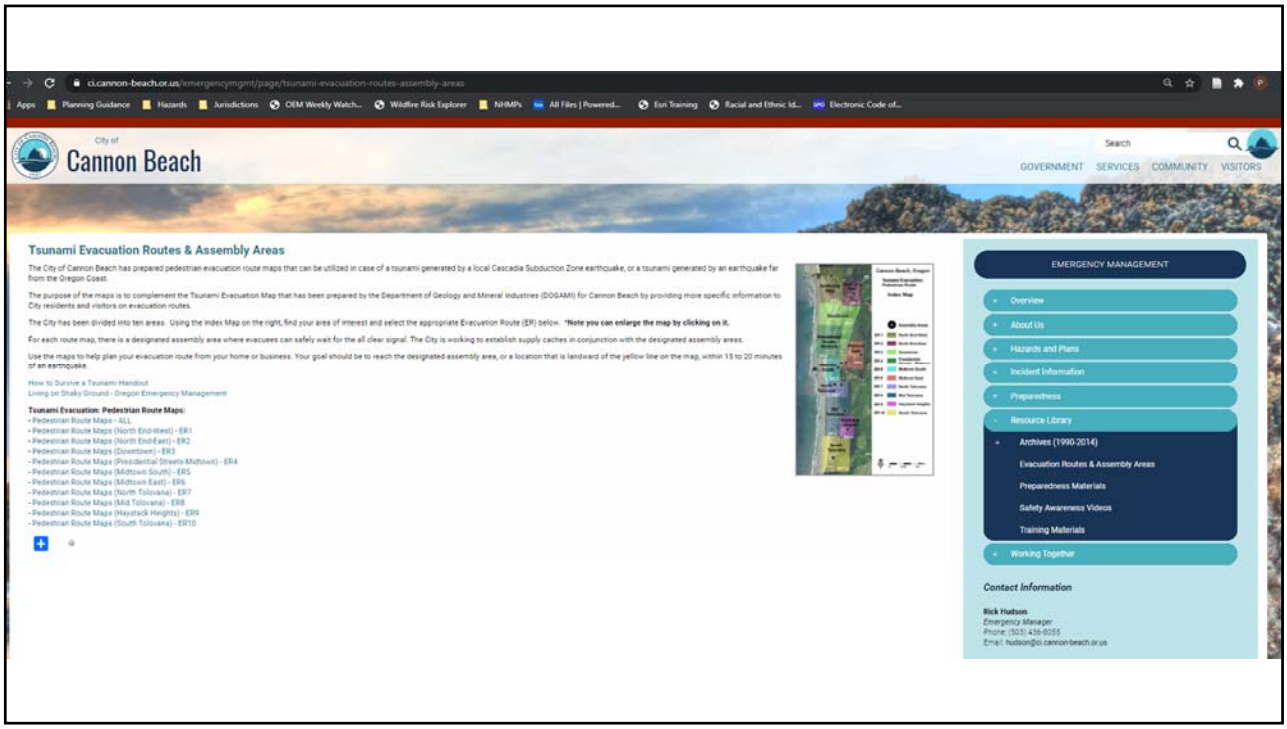
Upcoming Events

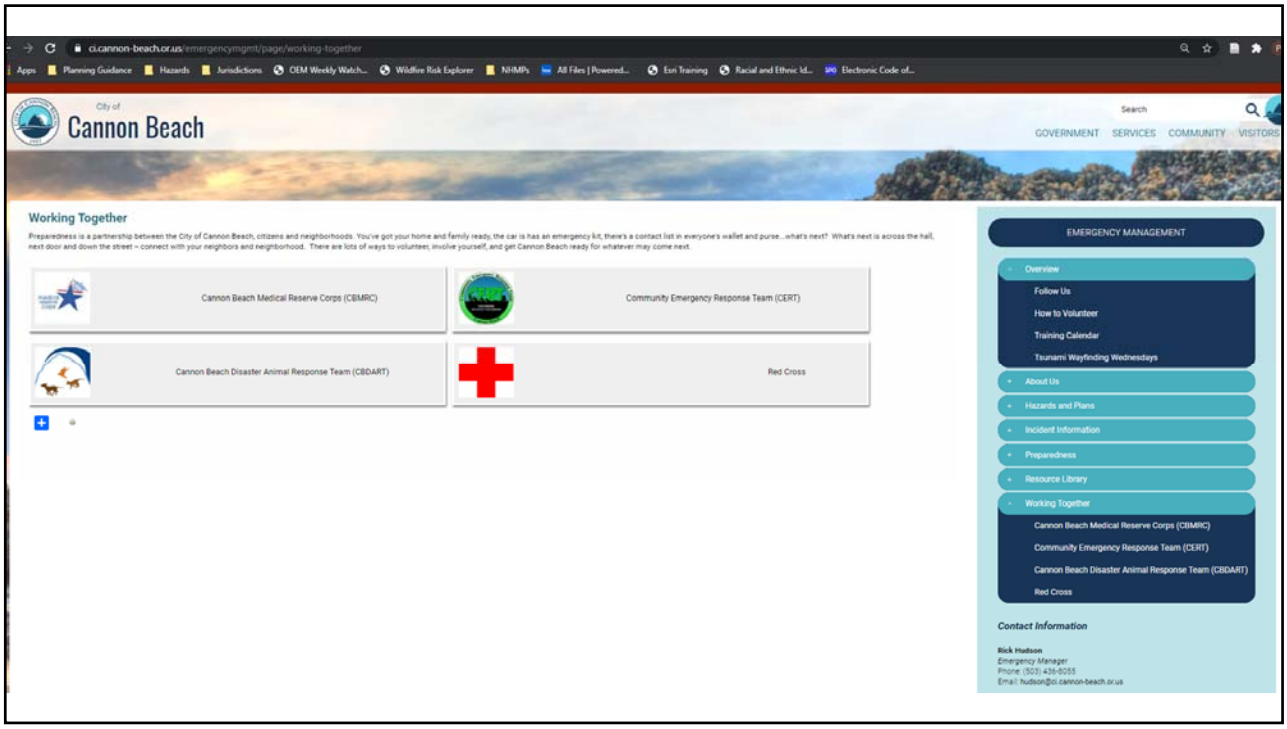
SOLVE - Arcadia Beach to Indian Beach
01/22/2021 - 2:30pm

Drive-Up Events - Free Public Masks
01/28/2021 - 2:00pm

Tsunami Wayfinding Wednesdays
02/03/2021 - 5:30pm

View the Emergency Management Calendar


ci.cannon-beach.or.us/emergencymgmt/page/tsunami-evacuation-routes-assembly-areas
Apps
Planning Guidance
Hazards
Jurisdictions
OEM Weekly Watch...
Wildfire Risk Explorer
NHMPs
All Files | Powered...
Esri Training
Racial and Ethnic Id...
Electronic Code of...
City of
Cannon Beach
Search
GOVERNMENT
SERVICES
COMMUNITY
VISITORS
Tsunami Evacuation Routes & Assembly Areas
The City of Cannon Beach has prepared pedestrian evacuation route maps that can be utilized in case of a tsunami generated by a local Cascadia Subduction Zone earthquake, or a tsunami generated by an earthquake far from the Oregon Coast.
The purpose of the maps is to complement the Tsunami Evacuation Map that has been prepared by the Department of Geology and Mineral Industries (DOGAMI) for Cannon Beach by providing more specific information to City residents and visitors on evacuation routes.
The City has been divided into ten areas. Using the Index Map on the right, find your area of interest and select the appropriate Evacuation Route (ER) below. *Note you can enlarge the map by clicking on it.
For each route map, there is a designated assembly area where evacuees can safely wait for the all clear signal. The City is working to establish supply caches in conjunction with the designated assembly areas.
Use the maps to help plan your evacuation route from your home or business. Your goal should be to reach the designated assembly area, or a location that is landward of the yellow line on the map, within 15 to 20 minutes of an earthquake.
How to Survive a Tsunami Handout
Living on Shaky Ground - Oregon Emergency Management
Tsunami Evacuation: Pedestrian Route Maps:
- Pedestrian Route Maps - ALL
- Pedestrian Route Maps (North End-West) - ER1
- Pedestrian Route Maps (North End-East) - ER2
- Pedestrian Route Maps (Downtown) - ER3
- Pedestrian Route Maps (Presidential Streets-Midtown) - ER4
- Pedestrian Route Maps (Midtown South) - ER5
- Pedestrian Route Maps (Midtown East) - ER6
- Pedestrian Route Maps (North Tolovana) - ER7
- Pedestrian Route Maps (Mid Tolovana) - ER8
- Pedestrian Route Maps (Haystack Heights) - ER9
- Pedestrian Route Maps (South Tolovana) - ER10
EMERGENCY MANAGEMENT
Overview
About Us
Hazards and Plans
Incident Information
Preparedness
Resource Library
Archives (1990-2014)
Evacuation Routes & Assembly Areas
Preparedness Materials
Safety Awareness Videos
Training Materials
Working Together
Contact Information
Rick Hudson
Emergency Manager
Phone: (503) 436-8055
Email: hudson@ci.cannon-beach.or.us


ci.cannon-beach.or.us/emergencymgmt/page/working-together
Apps
Planning Guidance
Hazards
Jurisdictions
OEM Weekly Watch...
Wildfire Risk Explorer
NHMPs
All Files | Powered...
Esri Training
Racial and Ethnic Id...
Electronic Code of...
City of
Cannon Beach
Search
GOVERNMENT
SERVICES
COMMUNITY
VISITORS
Working Together
Preparedness is a partnership between the City of Cannon Beach, citizens and neighborhoods. You've got your home and family ready, the car is has an emergency kit, there's a contact list in everyone's wallet and purse...what's next? What's next is across the hall, next door and down the street – connect with your neighbors and neighborhood. There are lots of ways to volunteer, involve yourself, and get Cannon Beach ready for whatever may come next.
Cannon Beach Medical Reserve Corps (CBMRC)
Community Emergency Response Team (CERT)
Cannon Beach Disaster Animal Response Team (CBDART)
Red Cross
EMERGENCY MANAGEMENT
Overview
Follow Us
How to Volunteer
Training Calendar
Tsunami Wayfinding Wednesdays
About Us
Hazards and Plans
Incident Information
Preparedness
Resource Library
Working Together
Cannon Beach Medical Reserve Corps (CBMRC)
Community Emergency Response Team (CERT)
Cannon Beach Disaster Animal Response Team (CBDART)
Red Cross
Contact Information
Rick Hudson
Emergency Manager
Phone: (503) 436-8055
Email: hudson@ci.cannon-beach.or.us

Gearhart Resilience Town Hall

Location Map

(A) Gearhart Park Station

(B) Pacific Way Station (Current Location)

(C) Highpoint Station

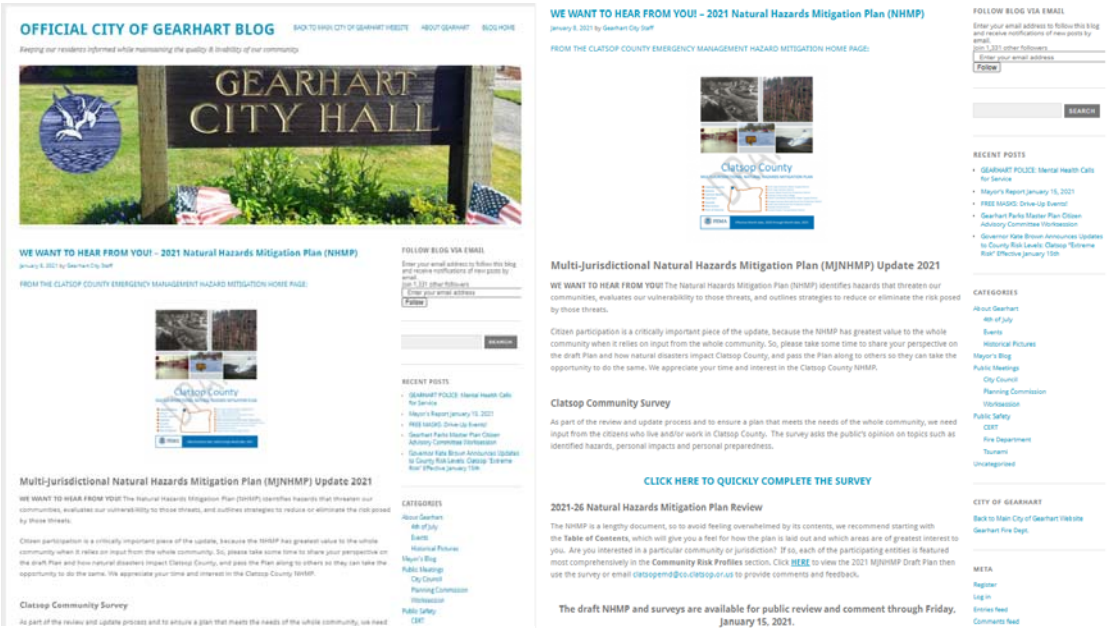
Planning Commission Meeting

In process			
1	x	periodic	Land Use Training
2	x	ongoing	Update Hazard Mitigation Plan

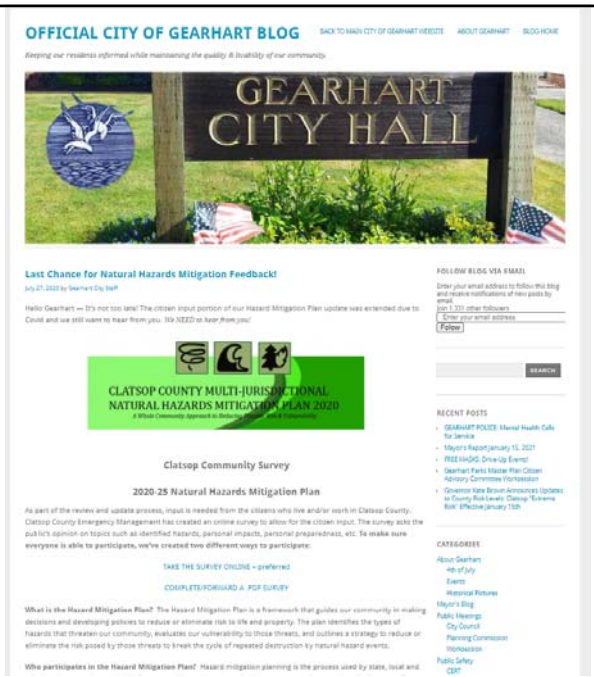
Clatsop NHMP Website: City of Gearhart

April 2019

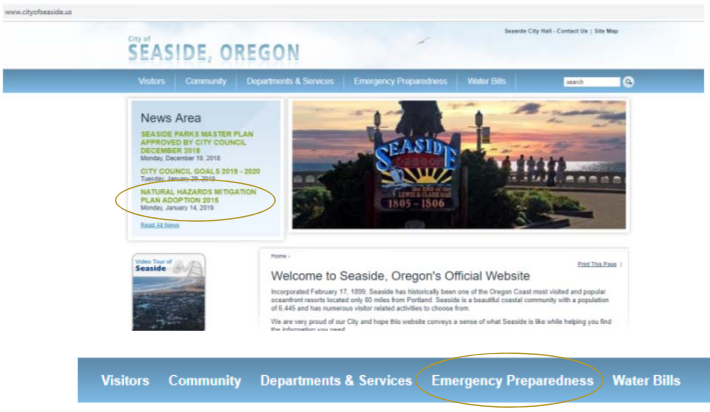
https://www.cityofgearhart.com/general/webform/new-emergency-response-resiliency-station



January 8, 2021: https://cityofgearhart.wordpress.com/2021/01/08/we-want-to-hear-from-you-2021-natural-hazards-mitigation-plan-nhmp/



July 27, 2020: https://cityofgearhart.wordpress.com/2020/07/27/last-chance-for-natural-hazards-mitigation-feedback/

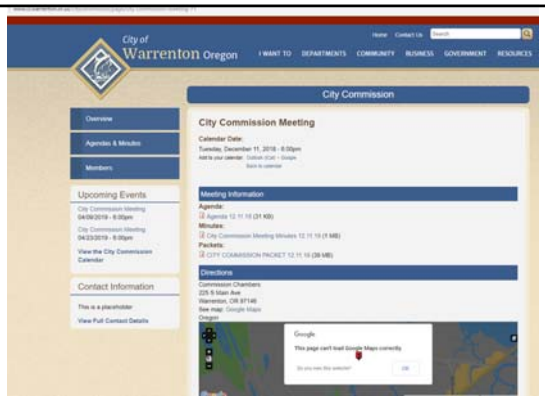


http://www.cityofseaside.us/node/1409

http://www.cityofseaside.us/emergency-preparedness
FOCUS ON TSUNAMI INFORMATION

Clatsop NHMP Website: City of Seaside

April 2019



http://www.ci.warrenton.or.us/

BUSINESS ITEMS

City Manager Engbretson presented an Intergovernmental Agreement for the Clatsop County Natural Hazards Mitigation Plan. She stated it includes special districts, the county and all local jurisdiction cities, to all work together to update the plan, which is required every five years. She noted the IGA does not require any cash match but does require a commitment of staff time. She noted the agreement outlines the work and the partnership and recommends the Commission authorize the Mayor's signature. Brief discussion followed.

Commissioner Dyer made the motion to approve the IGA for the Clatsop County Natural Hazards Multi-Jurisdictional Mitigation Plan Update and authorize the Mayor to execute the IGA. Motion was seconded and passed unanimously.

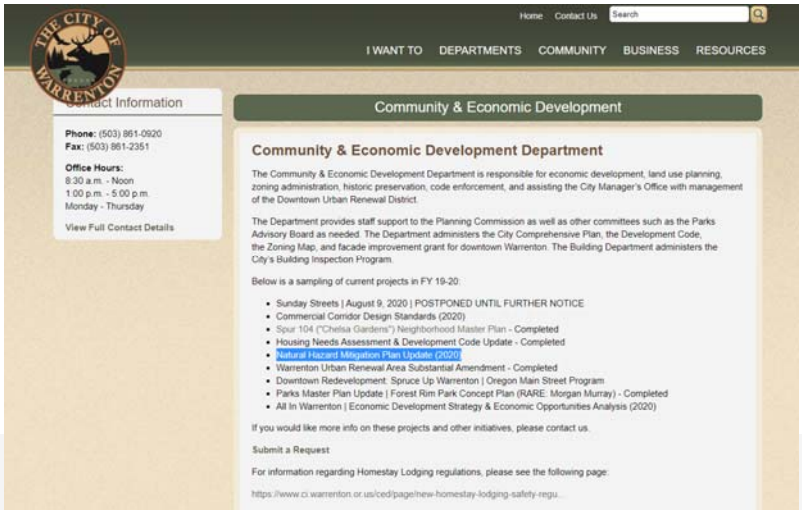
Baldwin – aye; Newton – aye; Dyer – aye; Ackley - aye

Ms. Engbretson noted each jurisdiction will each appoint a steering committee member, and suggested appointing Community Development Director Kevin Cronin, with herself as an alternate.

http://www.ci.warrenton.or.us/sites/default/files/fileattachments/city_commission/meeting/2641/signed_city_commission_minutes_12.11.18.pdf

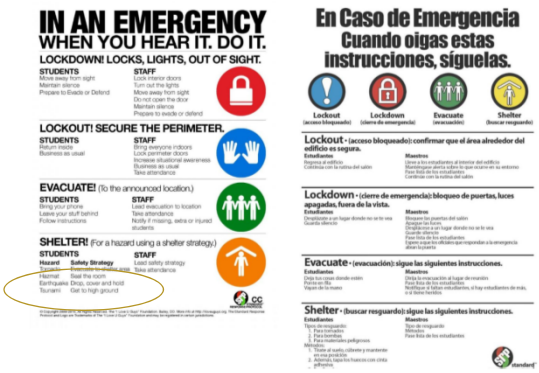
Clatsop NHMP Website: City of Warrenton

April 2019



City of Warrenton January 2021

https://www.ci.warrenton.or.us/ced



https://www.clatsopcc.edu/campus-information/campus-safety/

https://www.clatsopcc.edu/ales-ideas-hosts-mayor-bruce-jones-osu-extensions-pat-corcoran-on-disaster-preparedness/

Clatsop NHMP Website: Clatsop Community College

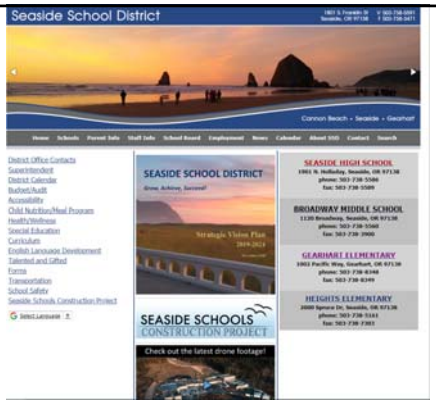
April 2019

https://www.portofastoria.com/FEMA_Repairs.aspx

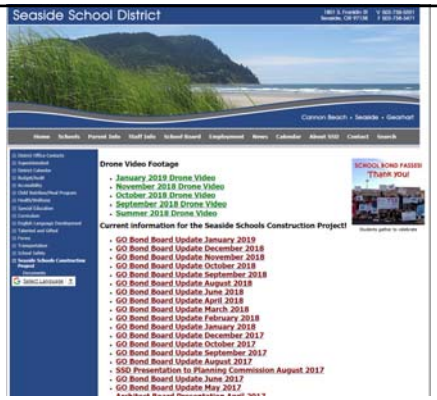
https://www.facebook.com/portofastoria/

Clatsop NHMP Website: Port of Astoria

April 2019



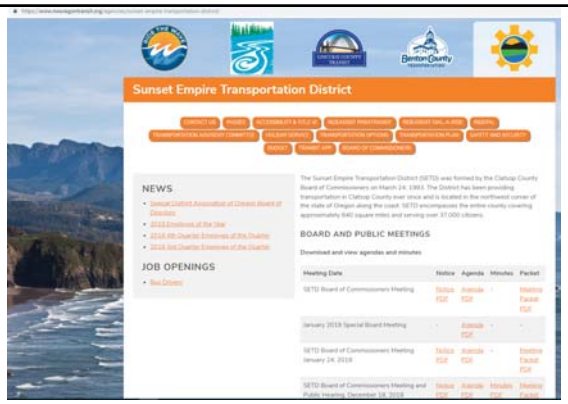
http://www.seaside.k12.or.us/



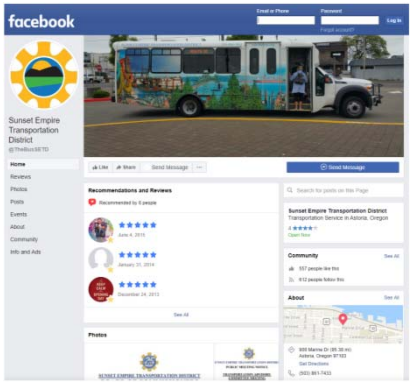
http://www.seaside.k12.or.us/?DivisionID=22431&ToggleSideNav=ShowAll

Clatsop NHMP Website: Seaside School District

April 2019



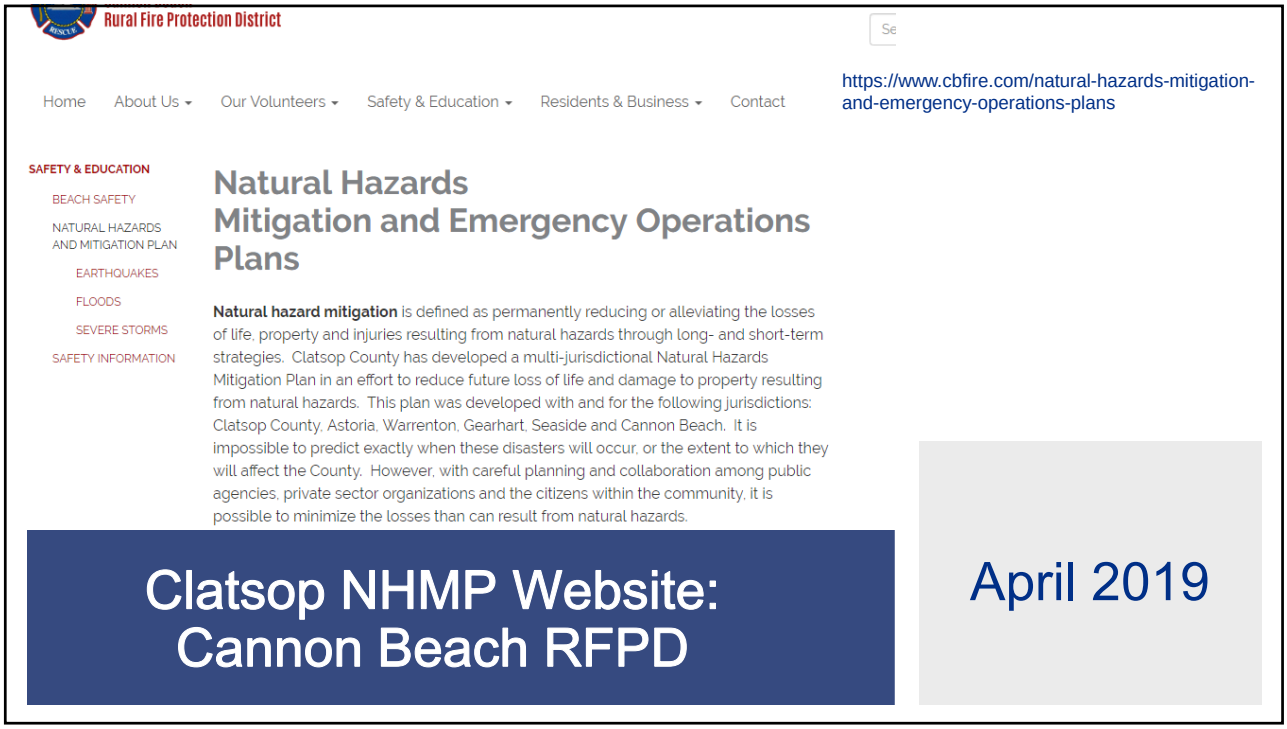
https://www.nworegontransit.org/agencies/sunset-empire-transportation-district/



https://www.facebook.com/TheBusSETD/

Clatsop NHMP Website: Sunset Empire Transit

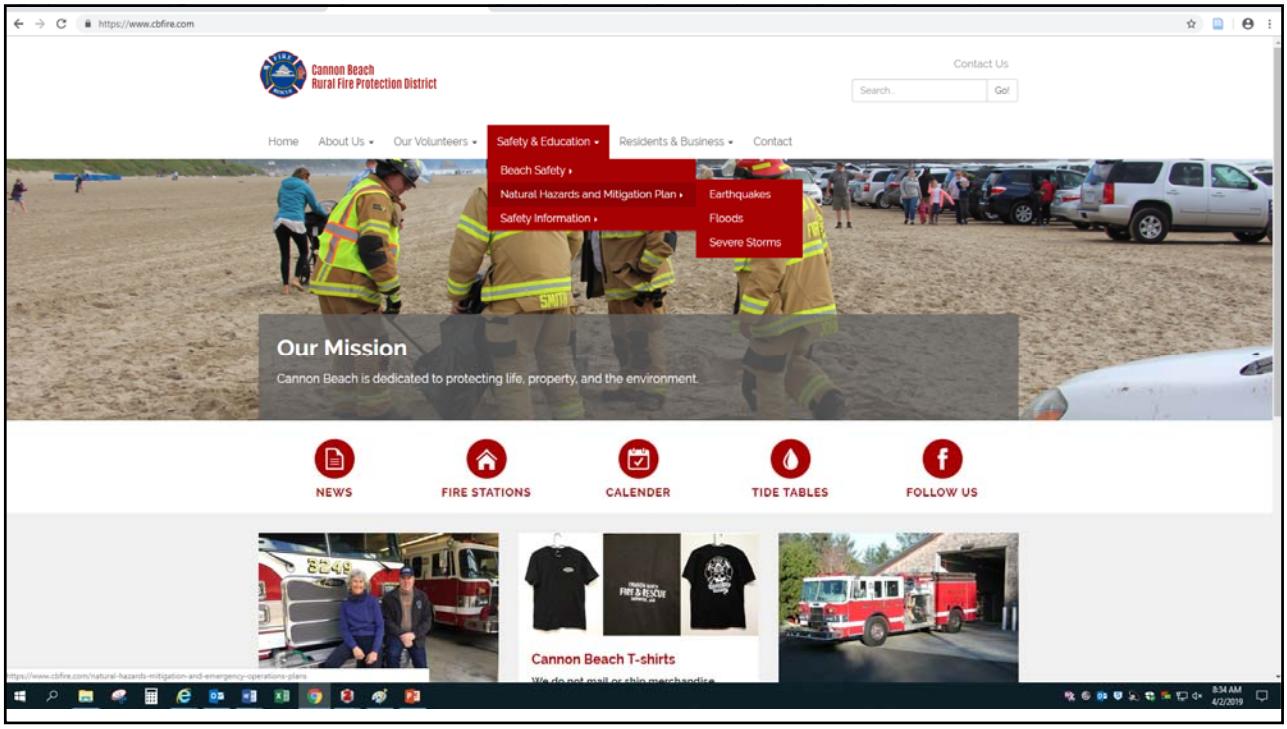
April 2019



https://www.cbfire.com/natural-hazards-mitigation-and-emergency-operations-plans

Clatsop NHMP Website: Cannon Beach RFPD

April 2019



Floods

Flood on Hwy 26 Junction

Earthquakes

Each year 12,000-14,000 earthquakes are reported; that's an average of 35 earthquakes a day. Forty-five states and U.S. territories are at moderate to high risk for earthquakes - these states are located in every region of the country.

Safety basics

When earthquakes strike a populated region, they can cause extensive property damage. Buildings and bridges can collapse, and gas, water, electric and phone service can be disrupted. Earthquakes can also cause serious injuries and fatalities. Scientists cannot predict precisely when or where one will occur. It's important to know what to do before, during, and after an earthquake:

Severe Storms

Clatsop NHMP Website: Cannon Beach RFPD

April 2019

https://www.cbfire.com/earthquakes
https://www.cbfire.com/floods
https://www.cbfire.com/severe-storms

Arch Cape Water and Sanitary Districts
32065 E. Shingle Mill Lane
Arch Cape, Oregon 97102

Regular monthly meetings are normally held on the third Friday of each month: 6:00PM at the Arch Cape Fire Station – 78729 Hwy 101 – public welcome

Waste Water Treatment Plant and Office: (503) 436-2790
Water Treatment Plant: (503) 436-0748
Billing & Invoicing Questions: (503) 436-8565
Emergency Numbers: (503) 739-2248 or (503) 812-7878

***** REMEMBER TO REFRESH YOUR CACHE BY RELOADING PAGE *****

ORDINANCE 18-01 SD Sewer Connections : here
ORDINANCE 18-01 WD Fire Suppression Lines : here

NEW NORTH COAST LAND CONSERVANCY press release - ARCH CAPE COMMUNITY FOREST proposal: here
Arch Cape Community Forest Web Site: here
Water Management and Conservation Plan: here

Osiris Peak Holdings Property Management Plan – Nov 2017 – Public Draft 1: here
Board Room Map : Arch Cape Watershed .pdf Ver 2: here
Customer Confidence Report for 2017 : here

Earthquake Mitigation Steps to take : here
Earthquake Hazard Hunt within the home page 1 : here
Earthquake Hazard Hunt within the home page 2 : here

The Sanitary District serves all of Arch Cape while the Water District operates the water purification facility used by all residents with the exception of those living in the north end of Arch Cape which obtains water service from the Cannon View Park district: here

Web links for phone, garbage, power, satellite and cable may be found : here

List of directors and staff with contact information : here

2018 Budget Committee Membership : here

Materials distributed for monthly meetings may be found : here

Water Leak & Irrigation Report Process : here

Water & Sanitary District Quarterly Rates and Billing Information : here
Historical Rate Review : here
Current Water District Rate Resolution : here
Current Sanitary District Rate Resolution : here

Earthquake Mitigation Steps to take : here
Earthquake Hazard Hunt within the home page 1 : here
Earthquake Hazard Hunt within the home page 2 : here

Clatsop NHMP Website: Arch Cape Water & Sanitary Districts

http://www.archcape.com/ACutility/Documents.html

April 2019

http://tsunamidanger.weebly.com/

https://www.knappafire.com/

Clatsop NHMP Website: Knappa Fire District

April 2019

http://astoria.or.us/Lewis_Clark_RFPD.aspx

https://www.facebook.com/Lewis-Clark-Volunteer-Fire-Dept-142191469145305/

Clatsop NHMP Website: Lewis & Clark RPFD

April 2019

4. Approvable Pending Adoption Letter

5. Signed Resolutions

6. FEMA Final Approval Letters

7. FEMA Final Review Tool