BEFORE THE BOARD OF COUNTY COMMISSIONERS
FOR COLUMBIA COUNTY, OREGON

In the Matter of Adopting the 2020 Columbia County Multi Jurisdiction Natural Hazard Mitigation Plan Update	RESOLUTION NO. 5-2022

WHEREAS, Columbia County first adopted a Natural Hazard Mitigation Plan (the "Plan") in 2005, which outlined the options to reduce overall damage and impact from natural hazards; and

WHEREAS, the Plan was last updated in 2014 through Resolution No. 40-2014, "In the Matter of Adopting the 2014 Columbia County Multi-Jurisdictional Hazard Mitigation Plan Update", which also established the Hazard Mitigation Planning Group and a process for regularly reviewing the Plan; and

WHEREAS, the Plan has been reviewed in accordance with Resolution No. 40-2014, and updates to the Plan are recommended; and

WHEREAS, the 2020 Columbia County Multi Jurisdiction Natural Hazard Mitigation Plan, attached hereto as Exhibit A and incorporated herein by this reference, and the Columbia County Annex to the Plan, attached hereto as Exhibit B and incorporated herein by this reference, contain the recommended updates; and

WHEREAS, through the review process, errors in the estimated values of certain County facilities listed in Table 8 of Exhibit B were identified; however, the Federal Emergency Management Agency ("FEMA") and the Oregon Office of Emergency Management ("OEM") have recently phased out the requirement for estimated values in natural hazard mitigation plans; and

WHEREAS, because the deadline to adopt the 2020 Plan update is quickly approaching, the Board of County Commissioners is prepared to adopt the 2020 Plan update with the expectation that staff will present an amendment to the Plan with estimated values either revised or removed, consistent with the new FEMA and OEM requirements;

NOW, THEREFORE, BE IT RESOLVED that:

1. The 2020 Multi Jurisdiction Natural Hazard Mitigation Plan Update, attached hereto as Exhibit A and incorporated herein by this reference, and the 2020 Columbia County Annex, attached hereto as Exhibit B and incorporated herein by this reference, are hereby adopted as an official plan of Columbia County.

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2. County staff shall prepare an amendment to revise or remove the estimated values in Table 8 of Exhibit B, consistent with new FEMA and OEM requirements for natural hazard mitigation plans.

Dated this 9th day of February, 2022.

BOARD OF COUNTY COMMISSIONERS
FOR COLUMBIA COUNTY, OREGON

By: _____
Henry Heimuller, Chair

By: _____
Casey Garrett, Commissioner

By: _____
Margaret Magruder, Commissioner

EXHIBIT A

Columbia County

Multi Jurisdiction

Natural Hazard Mitigation Plan

2020

Columbia County
Department of
Emergency Management

Contents

Introduction

This Multi-Jurisdiction Hazard Mitigation Plan was prepared for Columbia County Oregon, its incorporated jurisdictions, districts and special districts. The plan assesses the probability of hazard occurrence and local vulnerabilities then establishes goals, objectives, and strategies for natural hazard mitigation. It identifies resources for implementing the mitigation strategies and establishes processes, procedures, and responsibilities for periodically reviewing the plan, evaluating its effectiveness, and making adjustments throughout its five-year life.

Hazard mitigation is defined by 44 CFR 201.2 as any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Hazard mitigation is the responsibility of individuals, private businesses and industries, state and local governments, and the federal government. Engaging in mitigation actions provides the state, counties, cities, businesses, and citizens with several benefits: fewer injuries and deaths; less damage to buildings, critical facilities, and infrastructure; diminished interruption in essential services; reduced economic hardship; minimized environmental harm; and quicker, lower-cost recovery

Structure

This Multi-Jurisdiction Hazard Mitigation Plan consists of three components:

The Basic plan

This section defines the planning area and identifies the plan participants, describes the plan contents, federal regulations, grant programs that require an HMP and a review of the County's mitigation planning history. In addition, the Basic Plan offers a community description and documents the County wide Hazard profile that is used by each Jurisdiction Annex to inform their vulnerability analyses and mitigation strategies.

The Jurisdiction Annexes

The County and each of the cities and districts participating in this plan has its own annex. Each annex is essentially a standalone Hazard Mitigation Plan with a methodology and a detailed county Hazard Profile acting as shared elements from the basic plan. Each Annex will utilize the following layout:

> Prerequisites - This section addresses the prerequisites of plan adoption, which include adoption by the governing body of each participating jurisdiction. Adoption resolutions for each jurisdiction are included in the Appendices.
>
> Community Description - This section provides more detailed history and background of the communities and unincorporated areas of Columbia County,

including historical trends for population and the demographic and economic conditions that have shaped the area.

Planning Process - This section describes the planning process and identifies the Steering Committee members, the meetings held as part of the planning process, and the key stakeholders within the county and surrounding region. In addition, this section documents public outreach activities, public meetings and the review and incorporation of relevant plans, reports, and other appropriate information.

Hazard Analysis - This section provides an opportunity for each jurisdiction to expand on the shared Hazard Profile documented in the Basic Plan, by providing specific recognition of certain hazards and historical events.

Vulnerability Analysis - This section identifies potentially vulnerable assets—people, residential and nonresidential buildings dwelling units, RL properties, critical facilities, and critical infrastructure—in the incorporated cities and unincorporated areas of the county. These data were compiled by assessing the potential impacts from each hazard using Geographic Information System (GIS) and community provided information. The resulting information identifies the full range of hazards that the incorporated cities and unincorporated areas of the county could face and potential impacts, damages, and (where data was available) economic losses.

Mitigation Strategy - The mitigation strategy provides a plan for reducing the potential losses identified in the vulnerability analysis. Each jurisdictions Steering Committee developed a list of mitigation goals and potential actions to address the risks facing Columbia County and the seven incorporated communities. All hazard mitigation actions and strategies include NFIP compliance, preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities. The Steering Committees selected relevant mitigation actions and strategies to implement countywide.

Each section of the Jurisdiction Annexes is prefaced with the federal Planning Requirements and Planning Elements as documented in the FEMA Local Mitigation Plan Review Guide.

Appendices

This section is reserved for the addition of reference documentation, provision of annual review worksheets and a section aggregating the local resolutions adopting the plan.

Hazard Mitigation Assistance

Hazard Mitigation Planning

Hazard mitigation, as defined in Title 44 of the Code of Federal Regulations (CFR), Part 201.2, is "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." Many areas have expanded this definition to include human-caused hazards.

As such, hazard mitigation is any work done to minimize the impacts of any type of hazard event before it occurs. It aims to reduce losses from future disasters. Hazard mitigation is a process in which hazards are identified and profiled, people and facilities at risk are analyzed, and mitigation actions are developed. The implementation of the mitigation actions, which include long-term strategies that may include planning, policy changes, programs, projects, and other activities, is the result of this process.

Local Mitigation Planning Requirements

Local hazard mitigation planning is driven by Federal law. On October 30, 2000, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390) which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Title 42 of the United States Code [USC] 5121 et seq.) by repealing the act's previous mitigation planning section (409) and replacing it with a new mitigation planning section (322). This new section emphasized the need for State, Tribal, and local entities to closely coordinate mitigation planning and implementation efforts. In addition, it provided the legal basis for the Federal Emergency Management Agency's (FEMA) mitigation plan requirements for mitigation grant assistance.

To implement these planning requirements, FEMA published an Interim Final Rule in the *Federal Register* on February 26, 2002 (FEMA 2002a), 44 CFR Part 201 with subsequent updates. The planning requirements for local entities are described in detail in Section 2 and are identified in their appropriate sections throughout this MHMP.

FEMA's October 31, 2007 changes to 44 CFR Part 201 combined and expanded flood mitigation planning requirements with local mitigation plans (44 CFR §201.6). All hazard mitigation assistance program planning requirements for HMGP, PDM, FMA, SRL and potentially RFC programs were combined eliminating duplicated mitigation plan requirements. It also required participating NFIP communities' risk assessments and mitigation strategies to identify and address repetitively flood-damaged properties. Under 44 CFR §201.6. Local mitigation plans now qualified communities for federal Hazard Mitigation Assistance.

44 CFR §201.6 offers additional requirements for participation in the process: The risk assessment must assess each jurisdiction's risk where they may vary from the risks facing the entire planning area, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan, and each jurisdiction requesting approval of the plan must document that is has been formally adopted.

Grant Programs Requiring Hazard Mitigation Plans

All FEMA grant programs provide funding to States, Tribes, and local entities that have a FEMA-approved State or Local Mitigation Plan.

Hazard Mitigation Grant Program

This program is authorized by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (the Stafford Act), Title 42, United States Code (U.S.C.) 5170c. The purpose of HMGP is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration in the areas of the state, tribe, or territory requested by the Governor or Tribal Executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters. FEMA offers a variety of disaster assistance programs with different eligibility requirements. HMGP provides funds to states, tribes, and local communities after a disaster declaration to protect public or private property through various mitigation measures. Hazard mitigation includes long-term efforts to reduce the impact of future events. HMGP recipients (states, Federally-recognized tribes, or territories) have the primary responsibility for prioritizing, selecting, and administering state and local hazard mitigation projects.

Pre-Disaster Mitigation Program

This program is authorized by Section 203 of the Stafford Act, 42 U.S.C. 5133. The PDM program is designed to assist States, Territories, Indian Tribal governments, and local communities to implement a sustained pre-disaster natural hazard mitigation program to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding from future disasters. The program awards planning and project grants and provides opportunities for raising public awareness about reducing future losses before disaster strikes. Mitigation planning is a key process used to break the cycle of disaster damage, reconstruction, and repeated damage. PDM grants are funded annually by Congressional appropriations and are awarded on a nationally competitive basis.

Flood Mitigation Assistance Grant Program

The FMA program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA provides funding to States, Territories, federally-recognized tribes and local communities for projects and planning that reduces or eliminates long-term risk of flood damage to structures insured under the NFIP. FMA funding is also available for management costs. Funding is appropriated by Congress annually. FEMA requires state, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for HMA mitigation projects.

Planning Area Definition and Participating Jurisdictions

This plan has been prepared by Columbia County, Oregon and covers the jurisdictions, governments, and districts located within its boundaries. The Columbia County MJHMP assesses risk in unincorporated Columbia County, the Cities of Scappoose, St. Helens, Columbia City, Rainier, Prescott, Clatskanie, and Vernonia.

For the first time, several special purpose districts are also participating in this Hazard Mitigation Plan update. These districts have substantial administrative and fiscal independence, and their considerable risk to natural hazards allow a valid assessment relative to the other jurisdictions. The districts participating in this update are St. Helens School District, Mist Birkenfeld Rural Fire Protection District, and Scappoose Drainage Improvement District

Columbia County Mitigation Planning Overview

Initial Planning Processes, 1998-2005

In 1997 Columbia County was the first county in Oregon to begin the development of a complete (in 1998) a Hazard Mitigation plan – anticipating the requirement of the Disaster Mitigation Act of 2000 by two years.

In 2005, the Columbia County Director of Emergency Management, under direction from the County Commissioners, expanded the original Steering Committee to include, not only County agencies, but also city agencies, public safety agencies, private organizations, and businesses broadening countywide citizen involvement. The newly expanded Steering Committee collaboratively worked to evaluate and update the 1998 Natural Hazards Mitigation Plan to fulfill newly developed DMA 2000 requirements ultimately adopting it as the 2005 Natural Hazards Mitigation Plan (2005 HMP).

The 2005 HMP Steering Committee consisted of a county level commissioner, emergency management, road department, land development staff, city public works, police, fire and rescue, 911 communications staff, State forestry, fire district personnel and a consultant.

The 2005 HMP formed the basis for the County's All Hazard Mitigation Planning focus -- identifying five far-reaching planning goals with supporting objectives, and corresponding action items. This process refined goal achievement with a matrix to delineate coordinating and partner organizations, timelines, and lists the specific planning goals addressed by each action item.

The plan listed several mitigation actions to reduce or prevent damage and losses from natural hazards. However, limited resources prevented developing specific actions or assigning responsible entities to undertake project development and completion.

2009 Plan Update

The 2009 Columbia County Multi-Jurisdictional Hazard Mitigation Plan update was intended to: include newly identified hazards affecting individual jurisdictions; provide a comprehensive risk assessment and vulnerability analysis; provide community-based mitigation actions; identify funding sources; and include all incorporated jurisdictions within the county as part of the update.

FEMA provided technical assistance to facilitate developing this MHMP. This includes updating the portions of the existing plan for the unincorporated areas within the County as well as

including the incorporated cities (the Cities of Clatskanie, Columbia City, Prescott, Rainier, Scappoose, and Vernonia). The City of Vernonia's portion of this plan also addresses update requirements as part of bringing all of the cities under one Multi-Jurisdictional plan.

The 2009 planning effort was a comprehensive and technical substitution of the county's previous HMP. The plan has served successfully to guide previous and ongoing mitigation efforts in the county and provided the basis for the subsequent hazard mitigation planning effort.

2014 Hazard Mitigation Plan Update

Unlike the 2009 effort this update did not rely on the services of an outside contractor – the entire effort was conducted 'in house'. This decision was made based on the quality of the product that the county adopted in 2009. Resultantly, while that plan forms the template for the 2014 effort, significant changes were made throughout the basic plan and the county and jurisdictional appendices.

2020 Hazard Mitigation Plan Update

The 2020 planning effort demonstrated another evolution of the County's Hazard Mitigation Plan as the former plan has been thoroughly reformatted in the interest of making the process as clear and as simple to attract as many cities and districts to the process as possible. The process that produced this plan was conducted with broad public input for each annex that makes up the plan. Again, this plan update process was conducted "in-house" and did not utilize consultation services to provide technical or staff support for the process.

During this update process individual jurisdictions and districts were invited to participate in the process when they received and responded to the Participation Letter (Appendix B). This process was described in the Update plan that formed the update team and Steering Committee (Appendix A).

Columbia County is dedicated to mitigating potential natural hazards to its population and infrastructure. To fulfill that goal, Columbia County Emergency Management empaneled the Homeland Security Emergency Management Commission (HSEMC) as the steering committee for this NHMP. The HSEMC consists of representatives of agencies, cities, and county departments, and is otherwise ideally composed to identify hazards and develop actions to mitigate damage and life losses from those threats.

Table 1 records the HSEMC/Steering Committee's participant list.

Table 1. Columbia County Update Steering Committee

Name	Agency/Department/Affiliation
Anne Parrott	Columbia County Public Health – PHEP Coordinator
Johnathan Baker	Columbia County Emergency Management

Dan Brown	Columbia County – Community Action Team
Michael Carter	Rainier School District - Superintendent
Sean Clark	Port of Columbia County
Dave Crawford	Mist Birkenfeld RFPD
Della Graham	Columbia County Emergency Management
Diane Dillard	Sacagawea Health Center
Mike Fletcher	Columbia 911 Communications District - Director
Mike Greisen	Columbia River Fire and Rescue - Chief
Doug Hayes	Port of Columbia County – Executive Director
Greg Hinkleman	Clatskanie – City Manager
Pat LaPointe	Citizen Member
Lonny Welter	Columbia County – Roads Department
Margaret Magruder	Columbia County – County Commissioner
Mike McGlothlin	Columbia City – Chief of Police
Michael Paul	Columbia County Public Health - Director
Mike Deroia	City of St. Helens – Building Official
Norm Miller	Scappoose – Chief of Police
Kelly Niles	Chair - Oregon Department of Forestry
Ian O'Connor	Columbia River Fire and Rescue – Division Chief
Bob Perry	Western Oregon Electrical Coop - Director
Shaun Brown	Columbia County Emergency Management
Steve Pegram	Columbia County Emergency Management - Director
Scot Stockwell	St. Helens School District - Superintendent
Todd Meunier	Citizen Member
Jeff VanNatta	Vice – Chair Citizen Member
Casey Wheeler	Columbia County Food bank

Community Description

History and geography

Columbia County, named for the Columbia River, was created in 1854 from the northern half of Washington County. It encompasses 687 square miles and is bounded on the north and east by 62 miles of the Columbia River. It is bordered on the west by Clatsop County and on the south by Washington and Multnomah Counties. Columbia County is Oregon's third smallest county and the sixteenth county to be formed.

Columbia County lies within the marine west coast climate zone. Summers are warm and dry with clear skies, with July averaging 68.4° Fahrenheit (F). Winters can be mild to chilly with January averaging 39°F, and very wet; the rainfall averages 44.6 inches per year. Columbia County averages 155 days of measurable precipitation a year. Snow occurs frequently in the coastal range and the County can experience major snow and ice storms as cold air patterns flow from the Columbia River Gorge. The county's winter snowfall totals range from negligible

to a high of 60.9 inches. The County's lowest temperature was −3°F on February 2, 1950; the highest temperature reached 107°F on July 29, 1965, August 8, 1981, and August 10, 1981.

The Lewis and Clark expedition traveled through Columbia County on its way to the Pacific Ocean. Early fur traders settled the County in 1810 and many settlers came to the heavily forested region as immigrants seeking adventure and lush farmland. Other inhabitants left Washington State because of ongoing Indian wars. These emigrants sought safer locations on the other side of the Columbia River arriving in what is now St. Helens and Columbia City.

The primary industries of private sector employment within Columbia County are manufacturing, retail trade, energy and health services. The county was once covered by old growth timber, which was completely logged over by the 1950s. Now second growth timber provides the raw material for regional lumber and paper mills.

Development

Since the 2008 nationwide financial crisis, development of residential areas of Columbia County and its incorporated cities has been slowly recovering. However, construction levels have not yet returned to their former pace. The result is that relatively little residential development has occurred in the county since the 2009 plan. In this regard, this updated plan has only made minor changes in its hazard and vulnerability assessments regarding new residential development.

The same is not true for industrial developments in the County. While new physical infrastructure construction (factories, refineries, etc.) has been flat, the commodity flow into these areas has increased. In addition, in March of 2014 the Columbia County Board of County Commissioners approved the rezoning of 737 acres adjacent to the Port Westward industrial park. This ordinance re-zoned the area as Rural Industrial Planned Development, though no new construction has been carried out on the area. Despite this the area remains a focus of mitigation planning for the county and the adjacent local jurisdiction.

Demographics

Understanding the population and certain of its characteristics help identify actions that can be taken to reduce the impacts of a disaster before it occurs. The population of Columbia County is located largely in low-lying areas along the Columbia River. The County's population is growing slowly except in the Southeastern corner, closest to the Portland Metropolitan area where significantly increased housing prices are driving working commuters to seek bargains in a rural setting.

Jurisdiction	2010 Census population*	2018 Estimate**	Percent Change
Columbia County	49,351	51,900	+5.1%
Clatskanie	1,737	1765	+1.6%
Columbia City	1,946	1,985	+2.0%

Jurisdiction	2010 Census population*	2018 Estimate**	Percent Change
Rainier	1,895	1,925	+1.5%
St Helens	12,883	13,240	+2.8%
Scappoose	6,592	7,200	+9.2%
Vernonia	2,151	2,065	-4.0%

*US Census Bureau, 2011–2015 American Community Survey (https://factfinder.census.gov/)
**Portland State University, Population Research Center (https://www.pdx.edu/prc/population-reports-estimates)

Hazard Profile

Introduction

A description of Columbia County's Hazard profile has been accomplished by describing hazards in terms of their nature, history, magnitude, frequency, location, and probability. Hazards are identified through the collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area.

The Homeland Security and Emergency Management Commission (HSEMC), which acts as the steering committee for the County Hazard Mitigation Plan Annex (See Columbia County Annex), identified 16 hazards that could affect Columbia County and the participating jurisdictions. They evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard. The table below indicates the HSEMC members determined that 2 hazards pose no risk as they have no historical precedent are unlikely to occur in the future.

Natural Hazards		
Hazard Type	**Included**	**Explanation**
Erosion (Riverine & Tributary)	Yes	Columbia County is located inland and is not subject to coastal erosion. Riverine and tributary erosion occurs throughout the county in localized areas.
Drought	Yes	Along with the entire State of Oregon, Columbia County is subject to impacts associated with drought.
Earthquake	Yes	Columbia County is located within the geographical area bordering the Cascadia Subduction Zone, and its geography contains crustal faults. The county is subject to impacts associated with earthquakes.
El Niño / La Niña	Yes	Historic El Niño / La Niña patterns have been observed affecting weather patterns throughout the state.
Expansive Soils	Yes	Expansive soils occur in Columbia County.
Tornado	Yes	Though there have only been a few incidents of unverified tornadic activity, tornados have been known to occur in neighboring jurisdictions.

Natural Hazards		
Hazard Type	**Included**	**Explanation**
Flood	Yes	Historic flooding has been identified as occurring throughout Columbia County.
Landslide/Debris Flow	Yes	Columbia County is vulnerable to slope instability, especially after prolonged rainfalls.
Volcano	Yes	Columbia County is located in the vicinity of active volcanoes.
Wind	Yes	Columbia County's geography and vegetation, makes it vulnerable to high winds.
Winter Storm	Yes	Winter storms in Columbia County result in several natural hazards – including floods, ice formations, snow, and wind. This hazard is the most frequent cause of large disasters in the county.
Wildland/Urban Fire	Yes	The terrain, vegetation, and weather conditions in the region are favorable for the ignition and rapid spread of wildland fires in Columbia County. Historic downtowns, and dense development in many towns, along with dense forest growth right up to city boundaries, make many cities in the county vulnerable to Wildland/Urban Interface fires.
Dust Storm	No	There are no historical records of dust-storms in the county; there is little risk from this hazard to any portion of the jurisdiction.
Tsunami	No	Columbia county lies inland from the pacific coast of Oregon and thus is not vulnerable to Tsunami risk. It is possible that some localized flooding could occur as a result of seismic energy producing seiching in the Columbia River and Multnomah Channel, but the risk is considered too low or uncertain for mitigation planning.

In addition, the Columbia County Department of Emergency Management produced the following Hazard Analysis Matrix to inform its emergency operations plan.

Columbia County Hazard Analysis Matrix					
Hazard	**Rating Criteria with Weight Factors**				**Total Score**
	History [1] (WF=2)	**Vulnerability [2] (WF=5)**	**Max Threat [3] (WF=10)**	**Probability [4] (WF=7)**	
Rating Factor (High = 10 points; Moderate = 5 points; Low = 1 point) X Weight Factor (WF)					
Earthquake	10	100	100	7	**217**
Wildland/Urban Fire	10	50	10	35	**105**
Flood	20	100	100	70	**290**
Hazardous Materials	10	50	50	70	**180**
Transportation Accident	20	50	50	70	**190**
Severe Weather	20	100	100	35	**255**

Columbia County Hazard Analysis Matrix					
Hazard	Rating Criteria with Weight Factors				Total Score
	History [1] (WF=2)	Vulnerability [2] (WF=5)	Max Threat [3] (WF=10)	Probability [4] (WF=7)	
Rating Factor (High = 10 points; Moderate = 5 points; Low = 1 point) X Weight Factor (WF)					
Multiple Casualty Incident	20	10	10	70	**110**
Public Violence/Terrorism	10	50	100	70	**240**
Volcanic Eruption	2	50	50	7	**109**
Drought	10	10	50	35	**105**

Notes:
1. History addresses the record of previous major emergencies or disasters. Weight Factor is 2. Rating factors: high = 4 or more events in last 100 years; moderate = 3 events in last 100 years; low = 1 or 0 events in last 100 years.
2. Vulnerability addresses the percentage of population or property likely to be affected by a major emergency or disaster. Weight Factor is 5. Rating factors: high = more than 10% affected; moderate = 1%-10% affected; low = less than 1% affected.
3. Maximum Threat addresses the percentage of population or property that could be affected in a worst-case incident. Weight Factor is 10. Rating factors: high = more than 25% could be affected; moderate = 5%-25% could be affected; low = less than 5% could be affected.
4. Probability addresses the likelihood of a future major emergency or disaster within a specified period of time. Weight Factor is 7. Rating factors: high = one incident within a 10-year period; moderate = one incident within a 50-year period; low = one incident within a 100-year period.

Source: Columbia County Emergency Operations Plan 2018

Narrative Hazard Profiles

The narrative hazard profiles are intended to provide a comprehensive assessment on the hazards that can impact Columbia County. They include definitions of the hazards, their history extent and locations within the county, and the probability of future events. This section is meant to support each of the annexes that comprise the jurisdictional nature of this plan. However, additional information is provided in each annex to provide jurisdiction specific examples of the nature and local impact of these hazards.

Flood

A flood is the temporary inundation of water or mud on normally dry land. Heavy or prolonged rain, snowmelt, or dam collapse can cause inundation. In Columbia County floods usually are the result of major weather systems that cause flooding of smaller streams that flow into major rivers. This type of flood and inundation of the natural floodplains of the river system is a part of the natural process. Development in or near the floodplain puts lives and property at risk.

Areal, Urban, and Riverine flooding primarily affect Columbia County.

Areal Flooding - The National Weather Service defines an Areal Flood Warning as; flooding that develops more gradually, usually from prolonged and persistent moderate to heavy rainfall. This results in a gradual ponding or buildup of water in low-lying, flood prone areas, as well as small creeks and streams. The flooding normally occurs more than six hours after the rainfall begins and may cover a large area. However, even though this type of flooding develops more

slowly than flash flooding, it can still be a threat to life and property. This type of flooding is very common in Columbia County.

Urban Flooding - Urban flooding occurs in developed areas where the amount of water generated from rainfall and runoff exceeds the storm water systems' capacity. As land is converted from agricultural and forest to urban uses, it often loses its ability to adsorb rainfall. Rain flows over impervious surfaces such as concrete and asphalt and into nearby storm sewers and streams. This runoff can result in the rapid rise of floodwaters. During urban floods, streets can become inundated, and basements can fill with water. Storm drains often back up because of the volume of water and become blocked by vegetative debris like yard waste, which can cause additional flooding. Development in the floodplain can raise the base flood elevation and cause floodwaters to expand past their historic floodplains.

Riverine Flooding - Riverine or overbank flooding of rivers and streams is the most common type of flood hazard. Riverine flooding most frequently occurs in winter and late spring. Air rises and cools over the Coast Range and its foothills and heavy rainfall develops over high-elevation streams, as storms move from the Pacific across the Oregon Coast. In this region, as much as four to six inches of rain can fall over a 24-hour period. Severe and prolonged storms can raise rivers and streams to their flood stages for three to four days or longer. (State of Oregon 2015)

Flash Flooding - Flash floods were not identified as occurring in Columbia County as part of this planning process as typical incident events do not fulfill scientifically defined flashflood parameters.

These types of flood damage can include:

- Structure inundation
- Erosion of stream banks, road embankments, foundations, footings for bridge piers and other features
- Impact damage from high-velocity flow and from debris
- Additional debris damage from accumulation on or blockage of infrastructure
- Cropland destruction
- Sewage and hazardous or toxic materials releases from damaged pipelines, tanks, and facilities
- Economic loss (local facilities, utilities, communications, agriculture)

History

Several very destructive floods have been recorded in Columbia County, as well as much of western Oregon, throughout the years. Between 1955 and 1999, Oregon ranked eleventh nationally for flood losses, with more than $197 million in annual damages. The county lies between the Coastal Range and the Cascade Range, in topography rich with rivers and tributaries. Because of this topography, melting snow and heavy winter rains can combine to produce devastating flood events. Floods along the Columbia River itself are in many places

limited by the high, steep banks of the river, which contain most floodwaters to a narrow band. However, other waterways exceed their banks more easily. (Columbia County Department of Emergency Management, 2014)

1948 A flood covered eight drainage districts, inundated the industrial port of St. Helens, and much of Clatskanie's central business district.

1964 Nearly every river in the state of Oregon exceeded its flood stages as weather stations set new records for precipitation. Known as the Christmas Flood, the event triggered debris flows, bridge failures and flooding that caused thousands to evacuate and closed airports, railways and hundreds of miles of roads across the state. Ultimately, the event caused more than $157 million in damages and 20 people were killed.

1972, and 1974 the Nehalem River, Scappoose Creek, North Scappoose Creek, Clatskanie River, Conyers Creek, and McNulty Creek were all subject to winter flooding. (Columbia County Department of Emergency Management, 2014)

1987 a major flood of Scappoose Creek inundated many homes in Scappoose. (Columbia County Department of Emergency Management, 2014)

1996 Virtually every county in the state received a disaster declaration due to a combination of warm temperatures, heavy snow pack and four days of record-breaking rain. Many areas had already received above-average rainfall, meaning rivers were at or reaching their capacities and flood stages. Recent logging activities contributed to increased runoff, resulting in atypical sediment and debris, which made conditions ripe for flooding and landslides. Hundreds of homes were destroyed, power outages were widespread, thousands were evacuated to public shelters and five people died. Some estimates of flood-related damages exceeded $1 billion. Later that year, in November, a tropical air mass swept across the state, once again bringing record-breaking precipitation. The stormy weather continued into December and early January as 26 major rivers reached flood stage. Snowmelt and intense rain caused extensive flooding that led to widespread landslides, erosion, power outages, damaged homes and businesses, closed roads and eventually resulted in a Presidential Disaster Declaration. (FEMA 2019a)

In Columbia County, there were widespread road closures due to high water and landslides, including the Scappoose-Vernonia Road and highways 30 and 47 in several places. At the peak of the flood, all major highways were closed and those secondary roads that were open were restricted to emergency vehicles. Road closures isolated Vernonia and Clatskanie. Much of these two communities as well as parts of Scappoose, St. Helens and Rainier had to be evacuated. A boil-water alert was in effect for most of the county, and telecommunications, including some emergency communications, were disrupted. FEMA disbursed repair and response totaling more than $5,000,000 to public entities, and the Oregon Economic Development Department funded nearly $1,000,000 in Disaster Recovery Grants. Damages to private property were estimated at more than $5,000,000. Extensive as the 1996 flood was, much larger floods are possible in Columbia County.

2007 Severe storms, winds, mudslides, landslides, and flooding occurred between December 1 and 17, 2007 shutting down roads and highways including Interstate 5. Public infrastructure, homes, and personal property were damaged. In Oregon, 73,000 residents were without power, and wastewater treatment plants were overwhelmed. A major disaster was declared for the State of Oregon on December 8, 2007 with Columbia County included in the declaration. Coastal river flooding was estimated at or above the 25-year stage and compared to that of the 1964 and 1996 flood events.

The December storm flooded over 750 residences with 340 of those located in the City of Vernonia alone. 220 Vernonia homes were more than 50% damaged, and 34 greater than 70% damaged with an estimated $16.5 million in losses. March 2008 FEMA disaster aid was estimated at approximately $20 million including:

- $6,051,729 in individual assistance approved
- $10,957,500 in low-interest disaster loan assistance approved to homeowners, renters and businesses of all sizes
- $3,157,918 in public assistance obligated
- 3,569 individuals registered for assistance
- 3,864 individuals visited Disaster Recovery Centers
- 2,014 home inspections completed

2015 In December a series of heavy rainfalls only previously saturated ground created flooding conditions in portions of the county. In Vernonia the Nehalem river crested above 13.5 feet as heavy rains continued to fall in the Nehalem drainage just south of Highway 26. Though a large portion of the city was inundated, and some damage was reported, mitigation efforts conducted after the 2007 flood event proved remarkably successful at minimizing impact. In Clatskanie high tide cycles produced flooding along the Clatskanie river as hydrologic damming forced water out of the banks, several properties and a large mobile home community were severely impacted. (Columbia County Department of Emergency Management, 2015)

Location

Columbia County is subject to flooding from river overflow (the Columbia River, Multnomah Channel, rivers such as the Nehalem and Clatskanie rivers) and lesser waterways (including Conyers, McNulty, Milton, Rock, and Scappoose creeks); as well as flooding from local storm water drainage. Between October and April, the county is susceptible to winter rain flooding, while between May and July, snowmelt and runoff can create floods. Typically, the most severe floods are winter rainfall floods in December, January and February.

Flood control storage reservoirs have substantially reduced flood potential along the Columbia River and other major waterways. Upstream of Columbia County, the Columbia River has 22 major reservoirs (representing 40 million acre-feet of flood storage), the Willamette River has 11 major reservoirs (1.7 million acre-feet), and the Cowlitz River, one (360,000 acre-feet). The

Lewis River has three reservoirs (12,420 acre-feet). These reservoirs have reduced, but not eliminated flood potential. (American Rivers, 2017)

Extent

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies often use historical records, such as stream flow gauges, to determine the probability of occurrence for floods of different magnitudes.

FEMA has mapped most of the flood-prone streams in Oregon for 100- and 500-year flood events. A 100-year flood (one percent probability of occurring within any given year) is used as the standard for floodplain management in the United States and is referred to as a base flood. Flood Insurance Rate Maps (FIRMs) prepared by FEMA provide the most readily available source of information for 100-year floods. These maps are used to support the NFIP. FIRMs delineate 100- and 500-year (two percent probability of occurring in a given year) floodplain boundaries for identified flood hazards; these areas are Special Flood Hazard Areas (SFHAs) and provide the basis for flood insurance and floodplain management requirements.

Columbia County contains a total of 82.2 square miles within the 100-year floodplain, and 103.8 square miles within the 500-year floodplain. The 500-year event floodplain generally encompasses slightly more area than a 100-year event. Each watershed has its own water absorption characteristics. Buildings, roads, and parks replace grass and soil with asphalt or other non-absorbing materials, which limit or prevent water absorption. Therefore, 500-year events contain more water, which spreads further throughout the floodplain until the water can be managed by manmade and natural drainage systems. (Columbia County Department of Emergency Management, 2014)

The FEMA-mapped floodplains in Columbia County include, for the most part, only areas along the larger rivers and streams, which also have significant population and/or development. Other areas in the county have flood risk but are not included in the FIRM because of small stream size or low population. Flood hazard evaluation for Columbia County must also consider these localized areas of high flood risk or repetitive flooding which lie outside mapped floodplains.

For Columbia County, there are several dozen FIRMs for cities as well as for communities in the unincorporated portions of the county. These maps are available at the County Courthouse or online at: https://msc.fema.gov/portal/home

Probability of Future Events

Columbia County and the incorporated Cities of St. Helens, Columbia City, Scappoose, Clatskanie, Rainier, Prescott, and Vernonia, participate in the NFIP and are required to regulate floodplain development. Any structure built in the floodplain after 1974 must meet NFIP requirements for elevation and flood proofing. Columbia County and the incorporated jurisdictions use FEMA developed floodplain maps as the basis for implementing floodplain

regulations. FIRMs delineate flood hazard areas where NFIP regulations apply. FIRMS and flood insurance studies assess the probability of flooding at given locations. These maps represent a snapshot in time, and do not account for changes in the floodplains. Development and other natural and artificial changes in floodplains have caused changes to the rivers and streams in Columbia County. For areas not mapped by FIRMS, flood-susceptible areas can be delineated, and flood levels estimated by using historic stream flow records to determine flood frequency and recurrence.

Flood studies use this information to determine the probability of occurrence for floods of different magnitudes. The probability of occurrence is expressed as a percentage indicating the probability of a specific flood event occurring in any given year.

Factors contributing to the frequency and severity of riverine flooding include:

- Rainfall intensity and duration
- Soil saturation
- Watershed conditions, including steepness of terrain, soil types, amount and type of vegetation, and density of development
- The existence of attenuating features in the watershed, including natural features such as swamps and lakes, and human-built features such as dams
- The existence of flood control features, such as levees and flood control channels
- Velocity of flow
- Tide heights
- Availability of sediment for transport, and the likelihood of erosion of the bed and banks of the watercourse

These factors are evaluated using a hydrologic analysis to determine the probability that discharge of a certain size will occur, and to determine the characteristics and depth of the flood resulting from that discharge.

Flooding in western Oregon generally occurs when storms from the Pacific Ocean bring intense or prolonged rainfall to the west coast. Columbia County typically experiences the most severe floods from winter rainfall in December, January, and February. These floods are occasionally exacerbated by frozen snow packs where rain and snow melt combine while the ground is frozen, preventing ground seepage capability. The County is subject to flooding from river overflows; as well as flooding from local storm water drainage. The county is susceptible to winter rain flooding from October through April; while the months between May and July bring snowmelt and runoff floods. Based on previous occurrences, the county is not susceptible to flash floods. However, the county is likely to experience major flood events occurring in and around the county every 2 to 6 years based on recent historic occurrences.

Winter Storm

Winter storms occurring in Columbia County result in several natural hazards – including floods, landslides/debris flows, and wind. Each on its own, or in combination, can completely immobilize emergency response activities, close transportation corridors, and disrupt transportation and utilities. Each of these natural hazards is individually discussed in detail in their respective sections.

Winter storms in Columbia County can bring snow as well as rain or can be followed by rising temperatures that melt newly fallen snow in higher elevations. Either scenario often causes flooding; most floods in western Oregon occur as a result of winter storms. The flood hazard is described in detail in the flood section of this document.

As is the case with flood, wind as a hazard in Columbia County most frequently occurs as part of a winter storm. The nature, history, location, extent, and probability of future events for wind, including winter storm wind, are explored in detail in the wind section of this document.

Nature

Ice and snowstorms, which include freezing rain, sleet, and hail, can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages and personal injury. Ice storms result in the accumulation of ice from freezing rain, which coats every surface it falls on with a glaze of ice. Freezing rain is most commonly found in a narrow band on the cold side of a warm front, where surface temperatures are at or just below freezing. Typically, ice crystals high in the atmosphere grow by collecting water vapor molecules, which are sometimes supplied by evaporating cloud droplets. As the ice crystals fall, the air warms and the particles melt and collapse into raindrops. As the raindrops approach the ground, they encounter a layer of cold air and cool to temperatures below freezing. However, since the cold layer is shallow, the drops themselves do not freeze, but rather are supercooled, that is cooled in a liquid state to below-freezing temperatures. These supercooled raindrops freeze on contact when they strike the ground or other cold surfaces.

Snowstorms happen when a mass of very cold air collides with a mass of warm air. The warm air rises quickly and the cold air cuts underneath it, cooling and condensing as it rises, forming a cloud bank in the process. As the moisture droplets in the cloud cool to a point below freezing, they become ice crystals, which then collide within the cloud and snow is formed. The resulting precipitation falls as snow only when the temperature of the air between the bottom of the cloud and the ground is below 40 degrees Fahrenheit. A higher temperature will cause the snowflakes to melt as they fall through the air, turning them into rain or sleet. Like those of ice storms, the effects of a snowstorm can disturb a community for weeks or even months. The combination of heavy snowfall, high winds and cold temperatures poses danger from prolonged power outages, automobile accidents and transportation delays, dangerous walkways, and through direct damage to buildings, pipes, crops, other vegetation, and livestock. Buildings and trees can also collapse under the weight of heavy snow.

History

The following table summarizes significant ice and snowstorms having occurred in Columbia County since 2000.

Winter Storms Events, 2000 – 2020

Date	Snow Type (Ice, Snow, Sleet)	Details
12/3/2001	Heavy Snow	A powerful Pacific storm dumped very heavy snow in the Cascades again. In the Columbia River Gorge 3 to 4 inches of new snow was reported at Hood River, and both Bonneville Dam and Cascade.
12/17/2001	Heavy Snow	In the Columbia River Gorge, Hood River had 4 inches of snow.
12/27/2001	Winter Storm	In the Columbia River Gorge, Hood River reported 2 inches of snow.
12/30/2001	Winter Storm	In the Columbia River Gorge, Hood River reportedly received sleet, freezing rain, and one inch of snow.
11/17/2003	Winter Storm	Over a three-day period of strong Pacific storms, high winds were brought to the North and Central Oregon coast along with heavy rain and/or snow to the area. Locations in the Central and Southern Willamette Valley reported up to an inch.
1/7/2005	Heavy Snow	Snow fell in the NW Oregon Coast Range, with 8 inches in Buxton, 5 inches west of McMinnville, and 4 inches at Sunset Summit and Wilson River Summit. A cold Pacific storm brought heavy snow to the NW Oregon Coast Range, Northern Oregon Cascades, and Columbia River Gorge.
12/3/2005	Winter Storm	A strong moisture-laden Pacific system brought winter conditions to various regions of northwest Oregon.
3/8/2006	Winter Storm	A strong Pacific storm and associated cold front brought relatively late winter conditions to northwest Oregon. This snow event was one of the latest of the year seen in the Portland area, and forced many school closures around the area.
12/14/2006	Winter Storm and Flooding	A strong low-pressure system combined with existing very cold, shallow air over portions of northwest Oregon brought a wintry mix of precipitation resulting in flooding in eight counties including Columbia County.
12/08/07	Winter Storm	Severe storms resulted in flooding, landslides, and mudslides beginning on December 1, 2007 resulted in a major disaster declaration requiring over 20 million in aid. Five counties in Oregon were included in this disaster. Columbia county and participating jurisdictions were severely impacted by this storm.

Winter Storms Events, 2000 – 2020

Date	Snow Type (Ice, Snow, Sleet)	Details
12/20-26/2008	Snow, Mudslide, Landslide	A severe storm, record and near-record snow, mudslides, and landslides occurred between December 20 and 26, 2008. Said to be the worst snow and ice event to occur in the Willamette Valley in 40 years -- significantly damaged agricultural buildings and equipment. Heavy snow and freezing rain caused ice buildup that resulted in downed trees, limbs and broken branches throughout northwestern Oregon. Roads, infrastructure, and private property were damaged as a result of the storm.
03/01/2012	Winter Storm	An unstable air mass following a Pacific cold front brought widespread snow showers to the North Oregon Cascades and foothills, and the North Oregon Coastal Range. Portions of Columbia County measured 20 inches of new snow.
2/6-10/2014	Snow, ice	Columbia County saw 8 inches to 12 inches of snow, followed by about 0.5 inches to 0.75 inches of ice. This storm resulted in considerable disruption of traffic in many portions of Columbia County.
1/3-23/2017	Snow, ice and freeze	Heavy snow accompanied by a deep freeze produced conditions that allowed following rain and warmer weather to produce flooding conditions as the soil could not absorb the melt and rainfall.

Data from NOAA, 2020 and Columbia County Department of Emergency Management, 2017

Location

All areas of Columbia County and the participating jurisdictions are susceptible to winter storms as cold arctic air breaches the Cascade Range and moves westward. Cold air rarely travels west of the Cascade Range, as the mountains provide a natural barrier separating the Willamette Valley from the cold air to the east. However, the Columbia River Gorge can provide a low-level passage funneling cold air westward. Rain, sleet, and/or snow will fall if moisture-saturated warm air from the Pacific moves into the area colliding with the colder air mass.

Extent

Columbia County is in Climate Zone 2, generally consisting of wet winters and dry summers. Winter storm characteristics are determined by the amount and extent of ice and snow, air temperature, wind speed and wind direction. Winter storms can cause power outages, transportation and economic disruptions, injuries and loss of life. Winter storms can also cause traffic-related accidents and death, hypothermia, and heart attacks from snow shoveling. Emergency response times can be slowed because of icy road conditions. The weight of the snow or ice can cause utility disruption and falling trees and limbs. Snowmelt can cause flooding and landslides.

Probability of Future Events

Historical data shows that the probability for annual winter storm recurrence is high with a one-year recurrence interval. Winter storms combined with other weather events, like El Niño and La Niña cycle; often result in compounded hazards countywide. Winter storms have caused flooding, landslides, debris flows, utility and transportation systems disruptions.

Landslide

Nature

Landslide is a general term for the dislodgment and fall of a mass of soil or rocks along a sloped surface, or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides and slump-earth flows. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation and weather.

Landslides can be triggered by natural events such as seismic tremors and earthquakes, volcanic eruptions, stream erosion, snowmelt, and prolonged or heavy rainfall. Development and other human activities can also provoke landslides. Increased runoff, excavation in hillsides, shocks and vibrations from construction, placement of non-engineered fill, and changes in vegetation from fire, timber harvesting, and land clearing have all led to landslide events. Weathering and decomposition of geologic material, and alterations in flow of surface or ground water can further increase the potential for landslides.

The United States Geological Survey (USGS) identifies six types of landslides, distinguished by the type of material and movement mechanism involved (USGS 2008a):

Slides - The more accurate and restrictive use of the term landslide refers to a mass movement of material, originating from a discrete area of weakness that slides from stable underlying material. A rotational slide occurs when there is movement along a concave surface; and a translational slide originates from movement along a flat surface.

Debris flows - Flows arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslides on steep slopes, then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than 35 miles per hour for several miles. Other types of flows include debris avalanches, mudflows, creeps, earthflows, debris flows, and lahars.

Lateral Spreads This type of landslide generally occurs on gentle slopes or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.

Falls - Falls are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.

Topples - Topples are rocks and boulders that rotate forward and may become falls.

Complex - Any combination of landslide types.

The likelihood of a landslide in any given slide-prone location is largely dependent on the water content of the soil or rock fill. Landslides may happen at any time of the year, especially during rainy months when soils become saturated with water. Earthquakes can add to slope stress and disrupt ground stability, thereby triggering landslides, usually in already slide-prone locations. In addition, unconsolidated deposits of alluvial and glacial outwash materials are subject to accelerated stream bank erosion and landslides.

Landslides often occur in conjunction with other natural hazards, thereby exacerbating conditions, as described below:

- Shaking due to earthquakes can trigger events ranging from rock falls and topples to massive slides.
- Intense or prolonged precipitation that causes flooding can also saturate slopes and cause failures leading to landslides.
- Landslides into a reservoir can indirectly compromise dam safety, and a landslide can even affect the dam itself.
- Wildfires can remove vegetation from hillsides, significantly increasing runoff and landslide potential.

History

Landslides and debris flows are common in Columbia County. Much of the terrain is hilly and susceptible to slides; however, many slides take place in undeveloped areas and are unreported or even unnoticed. A statewide survey of winter storm landslides during 1996 and 1997, conducted by the Oregon Department of Geology and Mineral Industries (DOGAMI), reported 9,582 documented slides. The actual number was estimated to be many times the documented number. (Columbia County Department of Emergency Management, 2014)

Historically, long periods of winter rain and heavy snowfall in the mountains trigger landslides. These landslides affect county roads, Electric distribution and transmission and key emergency transportation routes.

A February 1996 winter storm triggered numerous slides in Columbia County. Slides interrupted transportation routes in dozens of locations, including two emergency transportation routes, the Scappoose-Vernonia Road (19 locations) and Apiary Road (four locations).

The December 2007 winter storm caused 77 landslides and 41 debris flows in Columbia, Clatsop, and Tillamook counties. In northwestern Columbia County, one or more small landslides occurred triggering a debris flow that traveled approximately 1 mile and blocked a drainage near Woodson on Highway 30. This blockage combined with additional rainfall resulted in a temporary lake (30-40 feet deep and 200 feet long). Woodson residents were evacuated, and Highway 30 was closed on December 11th, 2007. A catastrophic debris flow

occurred when the embankment failed and engulfed Highway 30 and Woodson. No fatalities occurred.

During the 2015 flood event numerous landslides effected the county. A major slide near milepost 4 of the Scappoose Vernonia highway cut that road and did extensive damage to the electric distribution grid in that area. In fact, most major feeder roads in the County road system were blocked and badly damaged, in some cases multiple times, isolating the entire western portion of the county. State highway 47, 202 and the critical highway 30 were all closed multiple times at multiple locations for days after the worst of the rains had ended.

Since this latest event small incidents continue to require occasional clean up and indicate that landslides remain a constant hazard for county residents in the future.

Location

In general, the probability of slope failure increases with an increase in slope inclination. However, this is not always the case. Depending on various factors such as soil type and water content, a slope having a relatively low inclination could be at greater risk of failure than another slope having a relatively high inclination. Other factors that influence susceptibility include rock type; vegetative cover and type; slope aspect; permeability and rate of infiltration; proximity to seismic sources; and magnitude of seismic events. In addition, unconsolidated deposits of alluvial and glacial outwash materials are subject to accelerated stream bank erosion and landslides. The possibility of failure also increases in sloped areas in which human influences, such as cutbacks, have occurred.

Extent

The Oregon Department of Forestry (ODF) conducted a 3-year study of the impacts of landslides in Oregon. The ODF study included eight study areas, one of which was in Columbia County, but did not provide a detailed inventory of landslide prone areas in Columbia County, outside of the very small study area. This study concluded that the highest hazard for shallow rapid landslides in western Oregon occurs on slopes of over 70% to 80% steepness (depending on landform and geology). (ODF 2001)

The geographic extent of landslide events is essentially the same as slide location, while the effects depend on what infrastructure is in the way of a slide, as well as the magnitude and force of the slide itself. The extent of effects could be as limited as one building or property, to region-wide effects, as in the case of a major transportation disruption, slide-induced dam failure, or utility outage.

Rapidly moving landslides have the greatest potential to endanger human life or inflict serious injury, especially to those living in or traveling through rapidly moving slide prone areas. Slow moving slides are less likely to inflict serious human injuries but can cause property damage.

Probability of Future Events

Landslides are an annual occurrence in Oregon during the rainy months, October through April. They generally result from intense or prolonged rainfall, particularly during a rain on snow event. Slope alteration and shape can also be a recurrence interval factor. Oregon's Enhanced Natural Hazard Mitigation Plan states that, "Landslide recurrence interval is highly variable" and is terrain dependent. (Oregon, 2015) Recurrence intervals for steep terrain can range from 50-5,000 years, with some debris flow recurrence intervals of less than 10 years.

Wildfires

Columbia County contains vast areas of second and third growth timber reproduction, and wildlands that take advantage of the temperate conditions and significant annual rainfall to produce considerable vegetation among multiple fuel types and sizes. Under certain conditions these areas are vulnerable to the ignition and rapid spread of large and damaging fires.

Nature

Wildfires can be classified as wildland fires, wildland/urban interface fires, urban fires, and prescribed fires. Due to the large amount of forested land in Columbia County, both wildland fires and wildland/urban interface fires are significant hazards.

Wildland fires spread through the consumption of vegetation. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may be visible for miles around. Wildland fires can be caused by human activities such as arson or campfires, or by natural events like lightning. Wildland fires often occur in forests or other areas with ample vegetation. When a wildland fire spreads to developed areas such as suburbs, small communities, or isolated homes, it becomes a wildland/urban interface fire.

The following three factors contribute appreciably to wildland fire behavior and can be used to identify hazards.

Topography - As slope increases, the rate of wildfire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildfire behavior. However, ridge tops can mark the end of a wildfire's spread, since fire spreads more slowly or may even be unable to spread downhill.

Fuel - The type and condition of vegetation plays a significant role in the occurrence and spread of wildfires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. The moisture content of both living and dead plant matter decreases during periods of prolonged drought and greatly increases the risk of fire. The fuel's continuity, both horizontally and vertically, is also an important factor. Forests with strong ladder fuels (understory growth between ground fuels and tree crowns) are more likely to have major fires involving tree crowns. Forests with limited ground fuels and little or no ladder fuels are much more likely to experience minor ground fires than a fire involving tree crowns.

Weather - The most variable factor affecting wildfire behavior is weather. Temperature, humidity, wind and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures coupled with low humidity, can lead to devastating wildfires. Conversely, cool temperatures and higher humidity often signal reduced wildfire occurrence and easier containment of existing fires.

Columbia County contains the topography fuel and weather patterns necessary for the ignition and rapid spread of wildland fire. Wildland fires can be categorized as occurring in the following locations:

Agricultural - Agricultural fires burn in areas where the primary fuels are flammable cultivated crops, such as wheat. This type of fire tends to spread very rapidly but is relatively easy to suppress if adequate resources are available. Structures threatened, if any, are generally those belonging to ranch and farm owners. There can also be significant losses in agricultural products.

Forest - Forest fires are the classic wildland fire. These fires burn fuels composed primarily of timber and associated fuels, such as brush, grass, logging residue and thick stands of replanted trees. Due to variations in fuel and topography, this type of fire may be extremely difficult and costly to suppress.

Wildland-Urban Interface - Fires involving the wildland-urban interface occur in areas where urbanization and the presence of natural vegetation fuels allow a fire to spread rapidly from natural fuels to structures and vice versa. Especially in the early stage of such fires, structural fire suppression resources can be quickly overwhelmed, increasing the number of structures destroyed. Such fires are known for the large number of structures simultaneously exposed to fire. Nationally, wildland interface fires commonly produce widespread losses.

Although thought of as a summer occurrence, wildland fires can, and do, occur during any month of the year. Most wildland fires occur between July and October. Dry spells during the winter months, especially when combined with the factors of winds or dead fuels, result in fires that burn with alarming intensity and rate of spread. Common causes of wildland fire include lightning; equipment use; railroad activity; debris burning; arson; and improperly extinguished cigarettes and campfires.

Wildland fires are part of the natural ecology and natural life cycles of wildlands. Fires create open spaces with different habitats for both plants and animals than existed previously. Fires also reduce fuel loads in areas, which in turn decreases the potential for large catastrophic fires. However, a wildland fire may grow into an emergency or disaster if not promptly controlled. Even a small fire can threaten lives and resources and destroy property, especially in heavily developed interface areas. Wildland fires may also harm livestock and pets. In addition to threatening humans, animals, and infrastructure, wildfires in forested areas have a severe impact on natural resources. Wildland fires strip the land of vegetation and destroy forest resources. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thus increasing

flood potential, harming aquatic life and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards, as discussed in the landslides hazard profile.

History

ODF provided records for all wildland fires in ODF-responsibility lands in Columbia County for recent years. Since 1987 a total of 689 wildland fires occurred on ODF-responsibility lands in Columbia County, or an average of 20 fires per year. Most of these fires were less than one acre, 134 fires were between 1 and 9 acres, and 15 fires were 10 acres or more. The largest fire reported consumed 93 acres. It is important to keep in mind that these data are for ODF-responsibility areas, along with ODF joint responses to fires in areas where the primary responsibility is provided by local fire agencies. However, because ODF-responsibility lands include nearly 80% of the entire county, these data probably represent most of the wildland fires in Columbia County in the last 31 years. The following table shows recent fires in the vicinity of Columbia County.

Recent Large Fires in Columbia County and Vicinity

Fire Name	Location	Size (Acres)	Fuel Type	w/i WUI	Year	Cause Category	Vicinity of Homes
Pebble Creek	South of Vernonia	165	Logging Slash/Timber	Yes	1987	Hunter/Smoking	Yes
Keasey Dam	West of Vernonia	117	Logging Slash Reproduction	No	1989	Recreationist/ Campfire	No
Emerald Forest		37	Logging Slash	No	1994	Equipment/ Logging	Yes
Kerry Road	West of Clatskanie	31	Fell/Buck, Slash, Reproduction			Equipment/ Logging	No
Wolden Road		31	Reproduction	Yes	1999	Debris Burning	Yes
Lost Creek Road		20	Reproduction	Yes	1999	Debris Burning	Yes
Lost Creek Road	West of St. Helens	5	Logging Slash	Yes	1999	Burning	Yes
Scappoose Airport	Scappoose Airport	200	Logging Slash/Timber	Yes	2000	Burning	Yes
Pittsburg Road	South of Liberty Hill	5	Scrub Oak/Grass	Yes	2006	Recreationist/ unknown	Yes
Hwy 30/Jones Rd	Hwy 30/Jones Rd	12	Grass/Brush	Yes	2008	Burning vehicle	Yes
North Fork Unit	Elk Creek	7	Slash	No	2008	Hold Over	No
Flora Road	Flora Road	23	Reproduction	No	2009	Vehicle Sparks	Yes
Pittsburg Road	Pittsburg Road	5	Grass	Yes	2012	Burning Building	Yes
Sunset Grade	N. Fork Wolf Creek	67	Logging Slash	No	2015	Recreationist/shooting	No
Hwy 47, MP 5	Hwy 47, MP 5	30	Logging Slash	No	2017	Vehicle Sparks	No
Chapman Grange Rd. # 1	Chapman Grange Rd.	42	Logging Slash	No	2018	Recreationist/unknown	No

Location

Columbia County is approximately 90% forested; therefore, there is high risk for wildland fires in the county. (Loy 2001) According to a United States Forest Service report identifying wildland/urban interface communities within the vicinity of Federal lands in Oregon that are at high risk from wildfire, every community in Columbia County is at risk for wildland/urban interface fires. (66 Fed. Reg. 43383-43435)

However, the actual fire hazard in these areas may be lower than expected because a high percentage of forest lands in Columbia County are actively managed for timber. Harvested

areas typically have lower fire risk because they are relatively free of dead and downed material that would contribute to the fuel load. Lands under active management are typically served by a network of roads which provides access to fire fighting resources should a fire start. In addition, forests within Columbia County are relatively free of major insect and disease problems that often plague other forests in Oregon. Finally, typical rainfall amounts for Columbia County are "moderately high" to "high", averaging 40 to 60 inches per year.

The fire protection service providers in the county identified areas of special concern for wildland/urban interface fires. These areas are identified in the following table.

Areas of Special Concern for Wildland/Urban Interface Fires

Community	Areas of Special Concern
Clatskanie	Conyers Creek drainage area, area NE of Clatskanie and populated areas in the interface adjoining natural cover and wildland fuels.
Mist-Birkenfeld	Fishhawk Lake area and other rural areas in the interface adjoining natural cover and wildland fuels.
Rainier	Populated areas of the interface adjoining natural cover and wildland areas.
Scappoose	Chapman, Alder Creek, JP West, Mt. View, Callahan, Bonneville, and Wilkinson Roads. Dutch Canyon, Pamarama Terrace and Raymond Creek subdivisions. Populated areas of the interface adjoining natural cover and wildland areas.
St. Helens	Gray Cliffs and surrounding greater St. Helens area. Areas involving oak, brush, and grass fuel types. Populated areas of the interface adjoining natural cover and wildland areas.
Vernonia	Populated areas of the interface adjoining natural cover and wildland areas.

Extent

ODF records of historical fires show that minor wildland fires occur regularly in Columbia County. Fire protection services have generally been able to contain these fires before they exceeded 10 acres. Due to successful fire control, the minor wildland fires that have occurred in Columbia County have damaged relatively few residential areas, scattered buildings, and natural resources in the affected forests. However, if a major wildland fire were to occur, it would have the potential to severely impact residential structures, roads, power lines, and other critical infrastructure in all jurisdictions in the county.

Probability of Future Events

In Oregon, wildland fire season normally begins in late June, peaks in August, and ends in October. However, a combination of above normal-temperatures and drought can increase the length of the traditional fire season. Wildland fire hazards throughout the county would be highest during prolonged periods of drought, especially after periods of below normal rainfall, which would result in a combination of high fuel loads and unusually dry conditions.

Due to historical fire patterns, the probability of a minor wildland fire occurring in any of the jurisdictions is very high. Although Columbia County has never experienced the major fires that

have affected other counties in Oregon, there is a possibility that a major wildland or wildland/urban interface fire could occur in Columbia County in the future.

Earthquake

Nature

An earthquake is a sudden motion or trembling of the earth produced by the rupture of rocks due to stresses beyond the rocks' elastic limits. The point inside the Earth where the rupture takes place is termed the hypocenter. The point on the planet's surface directly above the hypocenter is the epicenter. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning and, after just a few seconds, can cause massive damage and extensive casualties. The most common effect of earthquakes is ground motion, usually felt as shaking and vibrations.

The severity of ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. Ground motion causes waves in the earth's interior, also known as seismic waves, and along the earth's surface, known as surface waves. There are two kinds of seismic waves. P (primary) waves are longitudinal or compression waves similar in character to sound waves, that cause back-and-forth oscillation along the direction of travel (vertical motion). S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side to side (horizontal motion). When P and S waves hit the surface of the Earth, they generate surface waves, which are further categorized into Raleigh waves and Love waves. Slower than seismic waves, and therefore later to hit, surface waves are responsible for most of the damage during an earthquake.

Earthquakes are usually measured in terms of magnitude and intensity. Magnitude is related to the amount of energy released during an event, while intensity refers to the effects on people and structures at a specific place. Small to moderate earthquake magnitude is usually reported according to the standard Richter scale. Larger earthquakes are reported according to the moment-magnitude scale because the standard Richter scale does not adequately represent the energy released by these large events.

Intensity is usually reported using the Modified Mercalli Intensity Scale. This scale has 12 categories ranging from "not felt" to "total destruction." Different values can be recorded at different locations for the same event depending on local circumstances such as distance from the epicenter or building construction practices. Peak ground acceleration (PGA) is also used to measure earthquake intensity. It measures the earthquake's intensity by quantifying how hard the earth shakes in each location. PGA can be measured in g, which is acceleration due to gravity. The following table identifies corresponding intensity and magnitude ratings as well as effects associated with each rating.

Effects of Intensity and Magnitude Ratings			
Magnitude	**MM Intensity**	**PGA (% g)**	**Perceived Shaking**
0 – 4.3	I	<0.17	Not Felt
	II-III	0.17 – 1.4	Weak
4.3 – 4.8	IV	1.4- – 3.9	Light
	V	3.9 – 9.2	Moderate
4.8 – 6.2	VI	9.2 – 18	Strong
	VII	18 – 34	Very Strong
6.2 – 7.3	VIII	34 – 65	Severe
	IX	65 – 124	Violent
	X	124 +	Extreme

In addition to ground motion, several secondary hazards can occur from earthquakes, such as surface faulting. Surface faulting is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (up to 20 feet), as can the length of the surface rupture (up to 200 miles). Surface faulting can cause severe damage to linear structures, such as railways, highways, pipelines, and tunnels.

Earthquake-related ground failure due to liquefaction is another secondary hazard. Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its structure, and causing some of the empty spaces between granules to collapse. Pore-water pressure may also increase sufficiently to cause the soil to briefly become fluid. Liquefaction causes lateral spreads (horizontal movements commonly of 10 to 15 feet, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet, but up to 12 miles) and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.

The most common earthquakes that occur in Oregon are crustal, intraplate or great subduction earthquakes. These are described as follows:

Crustal earthquakes - These generally occur along shallow faults near the earth's surface. Crustal earthquakes make up most earthquakes in the Cascadia area (western Washington, Oregon and northwestern California) and are a result of fault movement in the Earth's surface. These shallow earthquakes are usually less than 7.5 magnitude and strong shaking generally lasts 20 to 60 seconds. Aftershocks, as well as tsunamis and landslides, are anticipated after a crustal event.

Intraplate earthquakes - These occur deeper, at 20 to 40 miles beneath the ground surface. These deep earthquakes are usually less than 7.5 magnitude, and damaging events occur every 10 to 30 years in this region. There are few aftershocks, and tsunamis are generally not anticipated, although landslides can trigger localized tsunamis. Due to the deep earth

movement, an intraplate earthquake is felt over a larger area with less intensity. Damage from this type of event is generally less than with an equally sized crustal earthquake.

Great subduction earthquakes - occur offshore of the Oregon and Washington Coasts along the Cascadia Subduction Zone. This zone is the result of the Juan de Fuca plate being pushed under the North American plate. Earthquakes centered along this zone can be as great as 9.0 magnitude. Geologic evidence demonstrates approximately 500 years between events with the last significant event on January 26, 1700. Aftershocks up to 7.0 magnitude are anticipated to cause additional damage. Liquefaction, tsunamis and landslides are expected as a result of a great subduction earthquake.

History

Approximately 7,000 earthquakes in the Pacific Northwest have been documented over the past 200 years. This documentation has occurred sporadically, with only the most significant events being recorded until recent history. Currently, the University of Washington seismology laboratory records approximately 1,000 earthquakes of magnitude 1.0 or greater annually in Washington and Oregon. While most of these events are barely felt, anywhere from 12 to 24 earthquakes cause enough ground shaking to be recognized as an actual earthquake by area residents. The following table shows significant earthquakes potentially felt in Columbia County since 1949.

Significant Earthquakes, 1949 - 2006		
Date	**Magnitude**	**Location**
April 13, 1949	7.1	Olympia, WA
April 18, 1961	4.5	Albany, OR
November 5, 1962	5.5	Vancouver, WA
March 7, 1963	4.6	Salem, OR
March 25, 1993	5.6	Scotts Mills, OR
February 28, 2001	6.8	Anderson Island, WA
June 29, 2002	4.5	Mt. Hood, OR
June 30, 2004	4.4	Lakeview, OR
July 12, 2004	4.9	Newport, OR
July 22, 2004	4.3	Lakeview, OR
August 18, 2004	4.7	Newport, OR
July 14, 2008	4.2	Maupin, OR

Location

Columbia County is located within the geographical area bordering the Cascadia Subduction Zone. This zone is comprised of an 800-mile sloping fault and several smaller offshore faults located west of the Pacific Coast, from British Columbia to the north and Northern California to the south. The fault system separates the Juan de Fuca and North American plates. Inland,

there are nine faults located within the USGS Quaternary Fault and Fold Database including the Portland Hills Fault, East Bank Fault, and Mount Angel Fault.

Extent

The extent of earthquake effects depends on the nature, magnitude, and location of the quake. An earthquake can range from a tiny tremor affecting only a small, localized area, to a major shake affecting an entire region. For hazard mitigation purposes, it should be considered that the extent of a major event would be greater than countywide.

While Columbia County contains crustal faults which can produce short high intensity earthquakes at a higher frequency than a Cascadia subduction zone earthquake, for planning purposes, the Department of Emergency Management follows the lead of the State of Oregon as identifying the CSZ event as the primary and most severe risk to the people and built environment of the county. A CSZ event, with a predicted magnitude of 9.0 or greater exceeds the MMI scale. Earthquakes with this energy release have occurred in Oregon and happened last in 1700. Columbia County's proximity to the coast means that such an event is anticipated to be the largest and most widespread natural hazard that the county faces.

Probability of Future Events

The evidence for past earthquakes of magnitude 9.0 suggests that they recur on average every 500 years, but the actual intervals between events are far from predictable—such earthquakes have been separated by as many as 1,000 years and as few as 200. The estimates of the sizes of pre-1700 earthquakes demonstrate that 9.0 magnitude earthquakes are possible but not certain. Cascadia has now been building up strain for over 300 years, so the next great earthquake could happen at any time. Reduced to simple odds, the chances that an earthquake as large as magnitude 9.0 will occur along the zone within the next 50 years are about one in ten, odds for an 8.0 or better rise to 4 in ten. (Cascadia Region Earthquake Workshop. 2013)

Volcano

Nature

A volcano is a vent or opening in the earth's crust from which molten lava (magma), pyroclastic materials, and volcanic gases are expelled onto the surface. Volcanoes and other volcanic phenomena can unleash cataclysmic destructive power and can pose serious hazards if they occur in populated and/or cultivated regions. Ashfall and tephra, an eruptive hazard, are of the greatest concern in Columbia County, though lahars (debris flows) can impact shipping in the navigation channel on the Columbia River.

There are four general types of volcanoes found within a short distance of Columbia County:

Lava domes - are domes that are formed when lava erupts and accumulates near the vent.

Cinder cones - are cone-shaped and formed by accumulation of cinders, ash, and other fragmented materials originating from an eruption.

Shield volcanoes - are broad, gently sloping volcanic cones of flat domical shape, usually several tens or hundreds of square miles in extent, built chiefly of overlapping and interfingerling basaltic lava flows.

Composite or stratovolcanoes - are typically steep-sided, symmetrical cones of large dimensions built of alternating layers of lava flows, volcanic ash, cinders, and blocks. Most composite volcanoes have a crater at the summit containing a central vent or clustered group of vents.

Along with the different kinds of volcanoes there are different types of eruptions. The type of eruption is a major determinant of what physical results an event will create, and what hazards it poses. Six main types of volcano hazards exist:

Volcanic gases - are made up of water vapor (steam), carbon dioxide, ammonia, as well as sulfur, chlorine, fluorine, boron, and several other compounds. Wind is the primary source of dispersion for volcanic gases. Life, health, and property can be endangered from volcanic gases within about six miles of a volcano. Acids, ammonia, and other compounds present in volcanic gases can damage eyes and respiratory systems, and heavier-than-air gases, such as carbon dioxide, can accumulate in closed depressions and suffocate humans or animals.

Lahars - are formed when loose masses of unconsolidated, wet debris become mobilized, and are usually created by shield volcanoes and stratovolcanoes. Eruptions may trigger one or more lahar directly by quickly melting snow and ice on a volcano or ejecting water from a crater lake. More often, lahars are formed by intense rainfall during or after an eruption. Rainwater can easily erode loose volcanic rock and soil on hillsides and in river valleys. As a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.

Landslides - are common on stratovolcanoes because their massive cones typically rise thousands of feet above the surrounding terrain and are often weakened by the very process that created the mountain – the rise and eruption of molten rock (magma). If the moving rock debris is large enough and contains a large content of water and soil material, the landslide may transform into a lahar and flow more than 50 miles from the volcano.

Lava flows - are streams of molten rock that erupt from a vent and move down slope. Lava flows destroy everything in their path. However, deaths caused directly by lava flows are uncommon because most move slowly and flows usually do not travel far from the source vent. Lava flows can bury homes and agricultural land under hardened rock, obscuring landmarks and property lines.

Pyroclastic flows - are dense mixtures of hot, dry rock fragments and gases that can reach 50 mph. Most pyroclastic flows include a ground flow composed of coarse fragments and an ash

cloud that can travel by wind. Escape from a pyroclastic flow is unlikely because of the speed at which they move.

Tephra - is a term describing any size of volcanic rock or lava that is expelled from a volcano during an eruption. Large fragments generally fall back close to the erupting vent, while particles of ash can be carried hundreds to thousands of miles away from the source by wind. Ash clouds are common adaptations of tephra.

History

Mount St. Helens has been the most active volcano in the Cascade Range during the past 10,000 years. In Oregon, awareness of the potential for volcanic eruptions was greatly increased by the May 18, 1980 eruption which killed 57 people. The upper portion of the summit collapsed in a massive landslide triggered by volcanic tremors. That portion of the mountain is now a horseshoe-shaped crater partially filled by a lava dome. Early 19th Century settlers in the region witnessed eruptions occurring along the north flank area of the mountain.

As a result of the 1980 eruption and the far-reaching extent of the lateral blast, damage and reconstruction exceeded $1 billion. The coverage area was 230 square miles and reached 17 miles northwest of the crater. Impacts from pyroclastic flows covered six square miles and reached 5 miles north of the crater, and landslides covered 23 square miles. Lahars affected the North and South Forks of the Toutle River, the Green River, and ultimately the Columbia River as far as 70 miles from the volcano.

Mount St Helens' most recent eruption began in October of 2004, with initial steam and ash eruptions giving away to slow-moving lava flows which ceased in January of 2008. Several other minor eruption periods occurred during the last 500 years with some lava flow near the summit. The eruptions created pyroclastic flows and lahars with little ash fall. The other volcanoes in the Pacific Northwest have undergone similar formation and eruption cycles.

Location

The extensive north-south oriented chain of volcanoes known as the Cascadia volcanic arc, or Cascade Range were formed by the Cascadia subduction zone. As the seafloor plate sinks beneath the North American Plate, it heats up and begins to melt, providing a vast reservoir of the heat and molten rock that create the magma chambers that become volcanoes.

Volcanoes near Columbia County include Mount St. Helens, Mt. Hood, Mt. Rainier, and Mt. Adams. The first three are active, and Mt. Adams is potentially active. Columbia County is approximately 40 miles from Mount St. Helens, and further away from the other volcanoes.

Extent

The volcanoes nearest to Columbia County are far enough away that none of the more devastating near source hazards are likely to be experienced. Heavier tephra particles will generally not reach Columbia County.

The major hazard for Columbia County is ashfall – either minor ash falls from an eruption of Mount St. Helens or lesser ash falls from more distant volcanoes. Ashfall deposition is controlled by prevailing wind direction, which in the Cascades is predominately from the west. During previous eruptions, ashfall has drifted to the east of the volcanoes. Volcanic eruptions may impact water bodies, such as the Columbia River at Longview and further downstream. River valleys are susceptible to debris flows, landslides, and lahars; rivers may require dredging to maintain channel depths for navigation.

Mount St. Helens, a stratovolcano, in southwestern Washington is believed to be the volcano with the greatest potential to have a near-term impact on the region because of its activity since the cataclysmic event in 1980. A large eruption of Mount St. Helens is expected to eject tephra to altitudes of 12 to 20 miles, with a deposition area of 40,000 square miles or more. Wind direction and velocity, along with the vigor and duration of the eruption, will control the location, size, and shape of the area affected by tephra fall.

Probability of Future Events

By careful analysis of past activity, geologists can make general forecasts of long-term activity associated with individual volcanoes, but these are on the order of trends and likelihood, rather than specific events or timeline. Short-range forecasts are often possible with greater accuracy. Several signs of increasing activity can indicate that an eruption will follow within weeks or months. Magma moving upward into a volcano often causes a significant increase in small, localized earthquakes, and increased emissions of carbon dioxide and compounds of sulfur and chlorine that can be measured. Shifts in magma depth and location can cause changes in ground level elevation that can be detected through ground instrumentation or remote sensing.

The USGS has identified several other potentially active volcanoes in Washington, Oregon, and California. The effects of volcanic activity from these volcanoes could include landslide avalanches, lahars, tephra, lava, and pyroclastic flows or surges. Activity from one of these volcanoes is highly likely to reoccur.

Wind

Nature

Wind is air flow that travels horizontally with respect to the Earth's surface. High winds are defined as those that last longer than one hour at greater than 39 miles per hour (mph) or for any length of time at greater than 57 mph. Wind speeds vary with individual storms.

In general, the damaging effects of windstorms may extend for distances of 100 to 300 miles from the center of storm activity. Many buildings, utility and transportation systems in open areas, natural grasslands, agricultural, or timberlands are especially vulnerable to wind damage.

Columbia County's most devastating windstorms typically occur from the south.

History

Columbia County has a two-year recurrence interval of sustained winds speed that ranges from 37 to 43 mph. Winds of this velocity may cause significant damage at sites where local wind speeds are higher than this average. Damage is more prevalent in clear-cut areas. The 50-year recurrence interval winds speed range from 56 to 62 mph, which can cause widespread wind damage.

Numerous damaging windstorms have occurred within Columbia County. The following table includes some of the most noteworthy windstorms that brought extensive damage to the region.

Windstorm Events, 1950 – 2008		
Date	**Sustained Wind Speeds**	**Details**
November 10–11, 1951	40 mph	Extensive timber, building, and utility losses and disruption. Damage experienced statewide. Statewide winds 40-80 mph
December 1951	42 mph	Serious damage to buildings and utility system disruption. Statewide winds 40-100 mph
December 21, 1955	60 mph	Extensive damage to buildings, power and telephone lines throughout the state. Statewide winds 55-70 mph
November 1958	51 mph	Extensive timber, building, and utility losses and disruption. At one point, all highways closed at one or more points from fallen trees. Statewide winds 50-75 mph
October 1962	62 mph (90 mph wind gusts)	Downed trees and power lines, utility disruption. The Columbus Day storm was the equivalent of a Category IV hurricane in terms of central pressures and wind speeds. The storm, which started east of the Philippines as Typhoon Freda, measured 1,000 miles long as it hit the West Coast. 38 fatalities, $200M damages statewide. Statewide winds 29-138 mph. Portland wind-116 mph
March 1963	39-68 mph	Widespread destruction. Statewide wind 39-100 mph
October 1967	70 mph	Extensive agricultural, timber, power and telephone utilities, and home losses Statewide 70 - 115 mph, one fatality and 15 injuries
March 1971	58 mph	Extensive roof damage, trees toppled, power line breakage, extensive utility disruption. Statewide wind 40-71 mph
November 1981	57 mph	Strongest windstorm since the 1962 Columbus Day storm. 57 mph winds. 75-92 mph wind along coast, gusts, 11 fatalities, $50M damages statewide
November 1997	52 mph	Trees uprooted

Windstorm Events, 1950 – 2008		
Date	**Sustained Wind Speeds**	**Details**
December 2007	52 mph	Heavy snowfall, rains, rapid temperature warming created widespread flooding, tree blockages, landslides, transportation and utility disruptions, and 5 deaths in Oregon. Statewide wind 50-100 mph $180M damages
November 2009	58 mph	Strong winds were estimated based reports of power outages in communities along the Columbia River in northwest Oregon
November 2011	81 mph	A strong Pacific cold front brought strong southerly winds to the north and central Oregon Coastal range. Strong winds were reported with a gust to 81 mph, and then the sensor stopped reporting.
November 2014	37-42 mph	Strong winds affected the River margin of Columbia County producing power outages and debris blocked roads.

Location

Several Pacific low-pressure centers make landfall on the Northwest each winter. Winds blowing along a north to south axis (parallel to the major mountain ranges) can prove extremely destructive. The windstorm pattern in this area is typically southwesterly, flowing directly into the Pacific Northwest. Severe windstorms have historically impacted all jurisdictions in Columbia County.

The National Weather Service's extensive ENSO website delineates information explaining these weather patterns as they affect various US locations. They describe the Pacific Northwest's late fall and early winter El Niño effects as warmer than normal temperatures with decreased precipitation, while La Niña patterns exhibit increased storminess, precipitation, and cold. These patterns and trends appear in Oregon's historical weather events listing.

Extent

The low-pressure centers bring sustained winds (40-60 mph) strong enough to topple power lines and trees. These prolonged windstorms are likely to last an average of three to six hours before moving on. All areas of Columbia County are subject to strong and damaging wind events.

Probability of Future Events

Windstorms producing winds gusting up to 70 mph or greater occur 1- 2 times every 10 years, with high winds events being relatively common and usually occur during October through April. Destructive windstorms occur with frequency but not always rising to the l of the basic plano evel of a major disaster. Tornadoes have been documented in Columbia County and nearby counties; two tornadoes have been documented in Columbia County (NOAA 2019); one

in August of 1978 near Scappoose, and the other in November of 1965 at Rainier. The nearby counties of Clatsop, Cowlitz, and Multnomah have experienced several tornado events. (Columbia County Department of Emergency Management, 2014). Despite these examples, climate and weather conditions in Columbia County make the occurrence of major tornadoes unlikely.

Erosion

Nature

Erosion is a process that involves the gradual wearing away, transport, and movement of land. However, not all erosion is gradual. It can occur quite quickly as the result of a flash flood, coastal storm, or other event. Most of the geomorphic change that occurs in a river system is in response to a peak flow event. It is a natural process, but its effects can be exacerbated by human activity.

Erosion is a problem in developed areas where the disappearing land threatens development and infrastructure. There are three main types of erosion that affect human activity in Oregon.

Coastal erosion is the wearing of land and loss of beach, shoreline, or dune material because of natural activity or man-made influences. It can occur gradually or suddenly. Usually erosion is a long-term process, but it can also happen quickly during storm events.

Wind erosion occurs when wind removes, moves, and redeposits soil. It can cause a loss of topsoil, hindering agricultural production. Blowing dust can also reduce visibility and have a negative effect on air quality.

Riverine erosion results from the force of flowing water in, and adjacent to, river, creek, and tributary channels. This erosion affects the bed and banks of the channel and can alter or preclude any channel navigation or embankment development. In less stable braided channel reaches, erosion and material deposition are a constant issue. In more stable meandering channels, episodes of erosion may only occur occasionally.

Riverine and wind erosion threaten various communities along the rivers, creeks, and tributaries in Columbia County. Erosion of any type rarely causes death or injury. However, erosion can cause significant destruction to property and infrastructure. The Columbia River is subject to tidal influences along the length of the county's coastline. Additionally, a major river reclamation project has taken away part of the natural floodplain north of Clatskanie. This combination of a high tide and reduced floodplain exacerbates flooding damages as these two conditions limit where excess Clatskanie River water can flow during a high-flow flood event. Flooding and erosion scour result from these two conditions.

Generally, erosion within the Columbia River occurs when the flow of the river changes and is directed towards the banks or mid-Channel Islands. These changes can be caused by surface

wind stress and gravity waves during storm events (primarily severe winter storms), transporting sediment by bottom currents. The reduction in peak river-flows due to the construction of dams and reservoirs have reduced the amount of sand reaching the lower river as well as reducing nearshore sediment movement in many areas of the Columbia River.

Rivers constantly alter their courses, changing shape and depth, trying to find a balance between the sediment transport capacity of the water and the sediment supply. This process is usually seen as the wearing away of the water course's banks and beds over a long time period.

Riverine erosion is often initiated by failure of an embankment causing high sediment loads, or by heavy rainfall. This generates high volume and velocity run-off, which will concentrate in the lower drainages within a river's catchment area. When the stress applied by these flows exceeds the resistance of the embankment material, erosion will occur. As the sediment load increases, fast-flowing waters will erode their banks downstream. Eventually, the river, creek, or tributary becomes overloaded or velocity is reduced, leading to the deposition of sediment further downstream or in dams and reservoirs. The deposition may eventually lead to the watercourse developing a new channel.

While all rivers change in the long-term, short-term rates of change vary significantly. All rivers can be categorized based on their ability to adjust their shape and gradient as either bedrock or alluvial channels. Within Columbia County, the Columbia River is an alluvial channel. (Tetra Tech 1992)

History

Erosion loss has historically occurred in Columbia County from landslides, stream bank failures, and agricultural activities. All rivers and creeks are subject to erosion. Columbia County has over 200 rivers and creeks.

A series of dams were constructed along the Columbia River and its major tributaries from 1912 through the 1970s; the US Army Corps of Engineers dredged the Clatskanie River to accommodate navigational concerns in 1924 and lowered the channel depth to -7.5 feet. Periodic dredging occurred until 1968 to maintain the channel depth, and again in 1998 by the City of Clatskanie. The combination of dam construction, dredging, flow training device construction, and bank stabilization projects has affected river velocities and sediment transport. Only limited major alterations have occurred since 1970 to the lower river system.

The following descriptions provide a brief overview of historic erosion events in Columbia County.

- Sand Island, located east of the City of St. Helens in the Columbia River, has experienced annual erosion loss.
- The shoreline at the Nehalem Street Bridge on the Clatskanie River lost 1.25 feet of depth between 1981 and 1996.
- A small side drainage coming into Conyer's Creek from the west caused road culvert damage.

- In 2019 a strong winter rain event created high flow conditions on Fox creek in Rainier. This produced the undercutting of a parking lot near the confluence of the creek and the Columbia River.

Location

Columbia County has experienced erosion loss in several localized areas. Rivers, creeks, and tributaries within the county are subject to the effects of erosion include the Columbia, Clatskanie, and Nehalem Rivers, Beaver Creek, Conyer's Creek, Fox Creek, Nice Creek, Owl Creek, Rock Creek, and Bear Creek and several unidentified tributaries. The County experiences annual rain and wind events which assail river shorelines combined with landslides and debris flows within the watersheds, loss of plant cover in riparian areas, and river traffic induced erosion, particularly during severe storm events.

Historic Erosion Hazard Areas within Columbia County	
Community	**Description of Location**
City of Clatskanie	A number of locations within the Clatskanie River Basin (City of Clatskanie and upstream) occur where portions of the stream bank are unstable • Nehalem Street Bridge • Dirt road along Conyer's Creek • 25-75% of the Beaver Creek shoreline, which enters northeast of the City is subject to stream bank erosion.
Columbia City	North of Columbia City at McBride Creek and Columbia River.
City of Rainier	Nice Creek and Fox Creek as well as 25-75% of the Beaver Creek shoreline.
City of St. Helens	Sand Island and Columbia River shoreline along city boundary
City of Scappoose	Scappoose Creek (main and North and South areas as well as forks of Alder Creek and Coal Creek)
City of Vernonia	Nehalem River, Rock Creek, Knickerson Creek, Sheely Creek, and Bear Creek

Extent

A variety of natural and human-induced factors influence the erosion process. For example, embankment orientation and exposure to prevailing winds (which can be altered by human development) all influence erosion rates. Other factors that may influence riverine erosion include:

- Geomorphology (composition)
- Structure types along the river embankments

- Development density
- Amount of encroachment in the high hazard zone
- Proximity of erosion-inducing structures
- Nature of the shoreline topography
- Embankment elevation
- Embankment wind exposure

The erosion rate depends on the sediment supply and amount of run-off reaching the watercourse. These variables are affected by many factors including earthquakes, floods, climatic changes, loss of bank vegetation, urbanization, and the construction of civil works in the waterway.

Erosion along the banks of the rivers and streams in Columbia County is generally caused by a combination of factors:

- The natural process of a watercourse to find the path of least resistance.
- Debris flows within the watershed.
- Loss of plant cover in of riparian areas.
- Logging.
- Increased boat traffic close to river embankments.
- Runoff from rainfall.

While erosion has been identified as occurring within the county, only one event was reported to result in damage (City of Clatskanie culvert at Conyer's Creek). Additionally, the Clatskanie River is reported to have lost 1.25 feet of depth over a 15-year period. Based on past events and the lack of development in proximity to erosion hazard areas, the magnitude and severity of erosion impacts in Columbia County are considered minor, though isolated areas are subject to higher risk.

Probability of Future Events

Based on historic events it is possible that structures located near the shoreline of the Columbia, Clatskanie, and Nehalem Rivers, and numerous creeks and tributaries are vulnerable to erosion. Erosion data is limited to localized geographic areas within the County.

El Niño/Southern Oscillation

ENSO comprise two weather phenomena known as El Niño and La Niña. While ENSO activities are not a hazard itself, it can lead to severe weather events and large-scale damage throughout the jurisdictions in Columbia County. Direct correlations have been found linking ENSO events to severe weather across the Pacific Northwest, particularly drought, flooding, and severe winter storms. (State of Oregon 2015) Therefore, increased awareness and understanding of the impacts of ENSO events on regional weather are important.

For more detailed discussions on drought, flood, and winter storms, please refer to their respective sections in this chapter.

Nature

ENSO weather patterns portray periodic warming and cooling of the central Pacific Ocean. This warming and cooling cycle has global implications as normal weather patterns are altered over vast areas of the world, causing changes in temperature and precipitation from Chile to Indonesia to the Pacific Northwest.

During El Niño periods, alterations in atmospheric pressure in equatorial regions yield an increase in the surface temperature off the west coast of South America. This gradual warming sets off a chain reaction affecting major air and water currents throughout the Pacific Ocean. In the North Pacific, the Jet Stream is pushed north, carrying moisture laden air up and away from its normal landfall along the Pacific Northwest coast. In Oregon, this shift results in reduced precipitation and warmer temperatures, normally experienced several months after the initial onset of the El Niño. These periods tend to last nine to twelve months, after which surface temperatures begin to trend back towards the long-term average.

La Niña periods ensue when surface temperatures increase past the long-term average. Typical weather patterns throughout the Pacific Ocean are strengthened, yielding stormier than normal weather throughout the Pacific Northwest. Above average precipitation and colder temperatures are experienced across Oregon during these periods, with the potential for severe snow storms increasing. These periods generally last longer than El Niño events, taking anywhere from one to three years to dissipate.

Both El Niño and La Niña periods tend to develop between March and June, and peak from December to April.

History

An examination of past ENSO patterns show El Niño and La Niña events are regularly observed in Oregon. Direct correlations have been found linking precipitation, temperature, and snowfall with ENSO across Oregon, including Columbia County (Taylor 2008). In general, El Niño periods result in warmer temperatures and lower precipitation, while La Niña periods are colder and wetter.

Strong El Niños of 1982 and 1997 were observed throughout the state, and the El Niño in 1994 resulted in widespread drought conditions. Alternatively, severe flooding caused by the heavy snow and intense rain in the winters of 1995-1996 and 1998-1999 were due to La Niñas.

Location

ENSO weather pattern effects are experienced on a global scale. Any local climate changes experienced in Columbia County will be reflective of a much broader trend impacting the entire Pacific Northwest. Hazards resulting from one of these periods will most likely be spread across large regions of the state, with adjoining counties experiencing similar conditions.

Extent

Columbia County has a climate generally consisting of wet winters and dry summers. During El Niño years, decreased precipitation and increased temperatures throughout the winter can lead to drought. Alternatively, increased precipitation and decreased temperatures associated with La Niña periods can result in widespread flooding and severe winter storms.

Probability of Future Events

As climate scientists continue to unravel the oceanic and atmospheric relationships governing ENSO, predictive powers are growing. 1997 marked the first time an El Niño was accurately forecasted, and as more studies detail how ENSO impacts the Pacific Northwest, and Oregon in particular, hazard mitigation agencies will benefit from increased warning time. ENSO generally follows a two to seven-year cycle, with El Niño or La Niña periods occurring every three to five years. However, the cycle is highly irregular, and no set pattern exists. Furthermore, variations are likely to continue, and not all droughts and floods are related to El Niño or La Niña events.

Expansive Soils

Nature

The addition of moisture to any soil will cause a change in volume, which is referred to as a shrink-swell characteristic. Expansive soils are typically comprised of clay minerals that, under some conditions, can increase in volume when moisture is added. Clay soils consist of mineral particles that are less than 0.002 millimeters in diameter.

Linear extensibility is used to determine the shrink-swell potential of soils. Linear extensibility refers to the change in soil volume as the moisture content is decreased from a moist to a dry state. The amount and type of clay minerals in the soil influence volume change. The volume change is described as a percentage value change for the soil being tested. A low shrink-swell potential is considered less than a 3% change in soil volume; whereas a high shrink-swell potential is greater than 6% change in soil volume:

Expansive Soil Criteria Based on Shrink-Swell Potential	
Shrink-Swell Potential	**Linear Extensibility (%)**
Low	< 3
Moderate	3 - 6
High	6 - 9
Very High	> 9

Source: NRCS National Cooperative Soil Survey

Soil expansion may be caused by changes in soil moisture, variations in thickness and composition of the expansive foundation soil, non-uniform structural loads, and the geometry

of the structure. Potential sources of moisture changes are variation in precipitation, poor gutter or water drainage, vegetation changes over time (such as root growth of nearby trees), and plumbing leaks. By affecting the relative moisture of soils underlying foundations, uneven movement such as localized heave can occur, causing shifting and non-uniform foundation movements, thus impacting the structures above.

However, many sources of soil moisture change can be avoided, minimized, or mitigated through planning and structure maintenance. Some signs of possible soil expansion include separation of joints and trim; cracks in walls, floors, or concrete; and bowed or non-vertical walls. Some possible mitigation measures are maintaining separation between structures and runoff, using compact fill to shed water, not absorb it, and planting trees a distance equal to their mature height away from buildings to reduce root interference.

Several different types of soil expansion related to structures and infrastructure exist, which can include but are not limited to:

- Doming heave - upward, long-term, dome-shaped foundation movement that develops over many years,
- Cyclic heave - shrink and swell associated with seasonal or water leak events,
- Edge heave - damaging edge or dish-shaped heaving, and
- Lateral movement – lateral thrust of expansive soils.

History

In 1982, expansive soils were documented as the costliest natural hazard in the US, causing more damage than all other natural hazards combined, including earthquakes, floods, tornadoes and hurricanes. Annual losses nationwide have been estimated between $2 billion and $9 billion. While expansive soils occur in Columbia County, there have been no historic damages reported.

Location

In Columbia County, approximately 18,925 acres contain soils with "moderate" to "high" rated shrink-swell potential, concentrated mainly in the northern portion of the county and along the Columbia River.

Potential damages to structures from expansive soils in Columbia County include cracks in grade beams, walls, and drilled shafts; distortion and cracking of pavements and on-grade floor slabs; failure of steel or concrete blocks supporting grade beams; jammed or misaligned doors and windows; and buckling of basement and retaining walls due to lateral forces. Extensive damage can potentially result in the condemnation of structures.

Extent

The geographic extent of expansive soil events is directly dependent on the extent of clay-based expansive soil types and the size and type of moisture event that triggers the soil

expansion. Another dependent factor for the extent is the amount and type of infrastructure that exists at the expansive soil location and near proximity, as well as the percentage volume change of the swelling or shrinking soil. The extent of expansive soil effects could be very local and limited to a single structure (i.e. resulting from a plumbing leak), or more landscape in nature due to a large area of soil moisture change (i.e. resulting from a large flood or storm event).

Probability of Future Events

Expansive soil events are difficult to predict because the location and time when water is available to the soil could happen at various periods in the life of a structure. Most soil expansion and associated structural damage has been shown to occur within five to eight years following construction. However, the effects of heave may also not be observed for many years until some change occurs in the foundation conditions to disrupt the moisture regime. The probability of damages increases for structures on expansive soils if the climate, effects of construction, and effects of occupancy promote moisture changes in the soil.

Drought

Nature

Drought is variously defined as a period of abnormally dry weather creating hydrologic imbalance, shortage of precipitation adversely affecting crops, or a period of below-average water in streams and lakes, reservoirs, aquifers, and soils. There is no universal measure of precipitation or dryness that signifies drought. Historically, droughts have been unpredictable and unavoidable events. Climate fluctuations occur everywhere, and periods of low precipitation are a normal, recurrent feature of climate.

Drought is commonly referenced in terms of its effects on agriculture, with crop damage or failure used to measure its effects. Other direct environmental effects of drought include livestock death or decreased production, wildland fire, impaired productivity of forest land, damage to fish habitat, loss of wetlands, and air quality effects. Indirect effects to society are measured by the economic and physical hardships brought on by drought and by the increased stress on residents of a drought-stricken area. The economic impact of drought is estimated between $6 and $8 billion annually in the United States. These costs primarily affect agricultural, forestry, fisheries, recreation and tourism, transportation and energy sectors. Drought is also associated with insect infestation, disease, and wind erosion.

Drought is usually thought of as a meteorological phenomenon, resulting from abnormally low precipitation. It can also be an institutional phenomenon, resulting from poor management of water supply and reserves – an imbalance in supply and demand – and is often due to a combination of these factors. Understanding drought as a recurring climate cycle is a first step toward creating management practices that effectively mitigate its effects.

Drought is difficult to measure, due to its diverse geographical and temporal nature, and its operation on many scales. Despite that difficulty, various indices for measuring and characterizing drought can be useful. The Palmer Drought Indices and the Standardized Precipitation Index are most commonly used. Palmer's indices describe water balance—looking at water supply (precipitation), demand (transpiration), and loss (runoff)—on three scales; weekly during growing season, long-term cumulative measured by month, and another long-term scale that considers hydrological factors such as reservoir and groundwater levels. These are the Crop Moisture Index, the Palmer Drought Severity Index, and the Palmer Hydrological Drought Index, respectively. The Standardized Precipitation Index considers precipitation alone, comparing the probability of a region's receiving a given amount of precipitation (based on historical levels) in a given time period with precipitation recorded. (NOAA 2015)

There are four types of drought: meteorological, agricultural, hydrological and socioeconomic. Meteorological drought is based on the degree of dryness. Agricultural drought focuses the amount of soil moisture versus the needs of the crops. Hydrological drought is associated with shortfalls of surface and subsurface water supply. Socioeconomic drought refers to physical water shortages and its human effect and occurs when the need for water exceeds the supply resulting in a shortfall.

History

Drought occurs in all parts of Oregon and has had profound effects in the past on the state's economy, particularly the agricultural and hydro-power sectors. Environmental consequences have included insect infestations in forests, insufficient stream flows to support endangered fish species, and increased susceptibility to fire.

The following past drought events were recorded for Columbia County:

- 1928-1941 – Statewide prolonged drought caused major agricultural problems
- 1976-1981 – Stream flows were low for western Oregon; 1976 and 1977 were the driest years of the century.
- 1985- 1994 – Ten consecutive years of drought cause problems statewide; fires were common, and insects attacked trees; a drought emergency was declared in 1992.
- 1999 – Drought reduced spring and summer agriculture yields and delayed planting of winter wheat.
- 2000-2001 – Severe drought conditions; October 2000 to February 2001 was the second driest period of record in Washington and Oregon.
- 2005 – February 2005 was the driest since 1977.
- 2015-2016 a severe and widespread drought affected all of Oregon with 1005 of the state experiencing D2 severe drought or higher.

Location

Droughts occur in every climate zone and can vary from region to region. Drought occurs in all parts of Oregon, and has had profound effects on the state's economy, particularly the

agricultural and hydro-power sectors. All jurisdictions in Columbia County are susceptible to drought.

Extent

Drought is often associated with El Niño events affecting the polar and subtropical jet streams. The polar jet stream dips southward causing the northwest to be drier than average. The severity of drought depends on the degree of moisture deficiency, duration, and size of the affected area. The agricultural sector is usually the first to feel the impacts of drought because of its dependence on soil moisture. Those reliant on surface and groundwater sources are usually the last to feel the effects of drought.

Probability of Future Events

As part of a statewide HMP process, county emergency management program managers conducted risk analyses to determine probability of, and vulnerability to, severe drought occurrence in each county. Oregon's Partnership for Disaster Resilience assesses Columbia County as having an "average risk" for drought; a future drought affecting the planning area is likely.

Drought appears to be a cyclic part of the climate of Oregon, occurring in both summer and winter, with an average recurrence interval between 8 and 12 years. Short-term, seasonal events are more frequent, while the less frequent, long-term events have ranged from 3 to 12 years in length.

Estimating drought probability and frequency is difficult but understanding cyclic climate variations and other variables that contribute to weather behavior is advancing. Understanding ENSO weather systems are helping scientists to better predict weather changes in the Pacific Northwest.

Participating Jurisdictions

This is a multi-jurisdiction Hazard Mitigation Plan. In this update to the county plan all the incorporated cities participated. In addition, for the first time, several districts participated in the planning process, contributing their own annexes to the plan. The list below includes each of the jurisdictions that contributed annexes to this plan:

Columbia County

Cities

City of St. Helens

City of Scappoose

City of Columbia City

City of Clatskanie

City of Rainier

City of Vernonia

City of Prescott

Districts

Mist-Birkenfeld Rural Fire Protection District

Greater St. Helens Aquatic District

Scappoose Drainage Improvement District

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Appendix A – MJHMP Update Plan

Columbia County

Multi Jurisdiction Hazard Mitigation Plan

2019 Update Plan

Mitigation Planning Requirements

DMA 2000 (Public Law 106-390) provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and Indian Tribal entities to closely coordinate mitigation planning and implementation efforts. DMA 2000 establishes the requirement for local mitigation plans.

HMP updates are also required under the Disaster Mitigation Act of 2000 (DMA 2000). DMA 2000 requirements *must* be addressed in the update, and DMA 2000 recommendations *should* be addressed. Requirements, but not recommendations, must be adequately addressed before FEMA can approve an updated HMP. Multi-jurisdictional HMPs must include information for all local jurisdictions covered in the updated HMP. For this update, this includes special districts. In October 2008, FEMA added requirements for flood mitigation planning, including: an assessment of the vulnerability of Repetitive Loss (RL) properties to flooding, and; Identification and analysis of mitigation actions, including compliance with the National Flood Insurance Program (NFIP).

FEMA requires state, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. Jurisdictions must update their hazard mitigation plans and re-submit them for FEMA approval every five years to maintain eligibility. The table below summarizes how FEMA's mitigation plan requirement applies to States and Federally-recognized tribal governments applying directly to FEMA for assistance as applicants, and to local or tribal governments (Federally-recognized or non-Federally-recognized) applying for FEMA assistance through a state as sub applicants.

Mitigation Plan Requirement for State, Tribal, and Local Governments Applying for Certain FEMA Grants			
Enabling Legislation	FEMA Assistance Program	Is a Mitigation Plan Required?	
		State / Tribal Applicant	Tribal / Local Subapplicant
Stafford Act	Individual Assistance (IA)	No	No
	Public Assistance (PA) Categories A and B (e.g., debris removal, emergency protective measures)	No	No
	Public Assistance (PA) Categories C through G (e.g., repairs to damaged infrastructure, publicly owned buildings)	Yes	No
	Fire Mitigation Assistance Grants (FMAG)	Yes	No
	Hazard Mitigation Grant Program (HMGP)planning grant	Yes[+]	No
	Hazard Mitigation Grant Program (HMGP) project grant	Yes[+]	Yes[++]
	Pre-Disaster Mitigation (PDM) planning grant	No	No
	Pre-Disaster Mitigation (PDM) project grant	Yes[*]	Yes[**]
National Flood Insurance Act	Flood Mitigation Assistance (FMA) planning grant	Yes[*]	No
	Flood Mitigation Assistance (FMA) project grant	Yes[*]	Yes[**]
Notes	[+] At the time of the Presidential major disaster declaration and at the time of obligation of HMGP grant funds. [++] At the time of obligation of HMGP grant funds for mitigation projects.		

	* By the application deadline and at the time of obligation of the PDM or FMA award. ** By the application deadline and at the time of obligation of PDM or FMA grant funds for mitigation projects.

https://www.fema.gov/hazard-mitigation-plan-requirement

Columbia County Update History

The last update to the Columbia County plan was promulgated on August 27th, 2014 and approved by FEMA on October 6th, 2014. **The current plan therefore, is set to expire on October 6th, 2019.**

2009 Update

The 2009 Columbia County Multi-Jurisdictional Hazard Mitigation Plan update was intended to include newly identified hazards affecting individual jurisdictions, provide a comprehensive risk assessment and vulnerability analysis, provide community-based mitigation actions, identify funding sources, and include all incorporated jurisdictions within the county as part of the update.

To this end, Columbia County sought and received funding to retain the services of a consultant. URS Inc. was selected in the following RFP process, and served as plan facilitator and update coordinator, as well as providing research services for the plan. FEMA Region X also provided technical assistance to facilitate developing this MHMP. This update was a massive undertaking and produced a robust and comprehensive HMP that served as the foundation for the 2014 update. It is likely that this plan can continue to provide some valuable guidance for this 2019 update.

2014 Update

The previous update of the county's Multi-Jurisdiction Hazard Mitigation Plan was undertaken without grant or consultant assistance and faced a considerably small nine-month window for preparation, approval and adoption. The plan updates largely followed the methodology, text, and critical infrastructure inventory supplied by the 2009 plan, and may form the basic outline for the current update.

In this update all seven of the incorporated cities participated along with the county to maintain the multi-jurisdiction nature of the plan. The State (OEM and DLCD) and FEMA Region X provided technical support for the update, and workgroups composed of citizen volunteers, city officials and county department officials providing input on the process.

Specific feedback provided by both the State and FEMA on this process was the need to consistently improve the application of whole community planning principles in the update process. This recommendation should drive the 2019 planning process.

FEMA Guidance

Local Mitigation Planning Handbook

The *Local Mitigation Planning Handbook, March 2013* provides the most current guidance to local governments on developing or updating hazard mitigation plans to meet the requirements of 44 CFR §201.6 for FEMA approval and eligibility to apply for FEMA Hazard Mitigation Assistance grant programs. It also offers practical approaches and examples for how communities can engage in effective planning to reduce long-term risk from natural hazards and disasters.

https://www.fema.gov/media-library/assets/documents/31598

Local Mitigation Plan Review Guide

The Local Mitigation Plan Review Guide is intended to help Federal and State officials assess Local Mitigation Plans in a fair and consistent manner, and to ensure approved Local Mitigation Plans meet the requirements of the Stafford Act and Title 44 Code of Federal Regulations (CFR) §201.6.1

The target audience for the *Local Mitigation Plan Review Guide* is Federal and State officials that complete Local Mitigation Plan reviews, though it may be used in tandem by plan reviewers and developers so that communities understand the technical requirements. FEMA supports, coordinates and reviews local plans to:

- Foster federal, State, and local partnerships for hazard mitigation;
- Promote more resilient and sustainable communities; and
- Reduce the costs associated with disaster response and recovery by promoting hazard mitigation activities.

This Local Mitigation Plan Review Guide, as interpretation and explanation for the Mitigation Planning regulation in 44 CFR Part 201, is the Federal Emergency Management Agency's (FEMA) official source for defining the requirements of original and updated Local Mitigation Plans. The Guide represents FEMA's interpretation of a statutory or regulatory requirement. By itself, the Guide does not impose legally enforceable rights and obligations, but sets forth a standard operating procedure or agency practice that FEMA employees follow to be consistent, fair, and equitable in the implementation of the agency's authorities. The Guide includes references to specific language in 44 CFR §201.6 and descriptions of the relevant requirement to meet the Mitigation Planning regulation.

https://www.fema.gov/media-library/assets/documents/23194

Mitigation Planning How-To-Series

These How-To guides provide practical suggestions regarding mitigation planning and implementation process. There are twelve documents in total but Mitigation Planning How-To Guide #8, (FEMA 386-8), provides the most focused recommendations for this update. As it provides suggestions to local governments for preparing multi-jurisdictional hazard mitigation plans.

https://www.fema.gov/media-library/resources-documents/collections/6

Disaster Mitigation Act of 2000

Full text of DMA 2000 for reference:

https://www.fema.gov/media-library/assets/documents/4596

2019 Update Features

Any update of a Multi-Jurisdiction Hazard Mitigation Plan requires careful planning, however, there are two special factors to consider for this update. The first is that special districts are now required to have HMP's of their own to retain access to the HMA grant programs. This requirement is new and based on a new interpretation of Oregon Law by FEMA. The second factor is that the previous plan consisted of 446 pages. While this is an improvement over the 2009 plan (768 pages) the size makes it difficult to use and review and will require significant effort to update in the allotted time.

Special District Planning

It will be important to determine at the outset the strategy for soliciting participation for the districts in this process. Special Districts that are members of HSEMC may be more likely to join the multi-jurisdiction planning effort. Though these districts have some familiarity with EM processes they will still require a great deal of technical assistance to meet the 15-month deadline. However, districts that don't normally participate in EM proceedings will perhaps be more difficult to contact and may not have the staff or resources to collaborate effectively. It is also necessary to determine at the outset which of these districts really *require* access to the HMA programs. Diking Districts for example, are often staffed with volunteers and may not have the capacity to apply for or administer HMA grants, yet they may face the highest risk (flooding). Other Districts, like 4-H may have absolutely no need to join the MJHMP.

Critical to the success of the update will be determining which districts Emergency Management wishes to assist with drafting an MJHMP. The number of special districts in the county that are eligible for HMA grants (with an updated HMP) is very large. The Assesor's office shows the number of districts by category (a full list with contact information is located at the end of this plan):

Special Districts	10
Fire Districts	6

Education Districts	7
Drainage Districts	14
Total	**37**

Plan Size

The task of adding special districts to the plan will probably defeat any effort to reduce the size of the MJHMP. However, it is still desirable for the basic plan, and its attendant annexes to eliminate duplication as often as possible and provide as concise a methodology as possible. The idea then is to create a basic plan that covers, as thoroughly as possible, the shared elements of all the annexes. This is particularly true for the Pre-requisites section, the Community Profile, and the Hazard Profile.

This strategy will help us to minimize the size of the planning template provided to each District/Jurisdiction and ease the work requirements of the local committees. However, we will need to work with FEMA and the State to predetermine that minimalist plan templates will be acceptable.

Plan Framework

The Columbia County MJHMP consists of four parts:

1. **The Basic Plan** – this section lays out the basic methodology and shared features of each annex. Certain sections in the Basic Plan, like the Hazard Analysis can incorporate all the information for the entire County and will not need duplication in each annex. The basic plan includes the following:
    a. **Prerequisites** - This section addresses the prerequisites of plan adoption, which include adoption by the governing body of each participating jurisdiction, including Special Districts.
    b. **Community Profile** - This section provides a general history and background of the communities and unincorporated areas of Columbia County, including historical trends for population and the demographic and economic conditions.
    c. **Planning Process** - This section describes the planning process and identifies Steering Committee members in each jurisdiction, the meetings held as part of the planning process, and the key stakeholders within the county and surrounding region. In addition, this section documents public outreach activities.
    d. **Hazard Analysis** - The hazard analysis profiles the nature, history, location, extent, and probability of future events for each hazard.
    e. **Vulnerability Analysis** - This section identifies potentially vulnerable assets—people, residential and nonresidential buildings dwelling units, Repetitive Loss

properties, critical facilities, and critical infrastructure—in the incorporated cities and unincorporated areas of the county.

f. **Mitigation Strategy** - The mitigation strategy provides a plan for reducing the potential losses identified in the vulnerability analysis.

2. **The County Annex** – this annex provides the county's mitigation strategy for all the unincorporated areas of Columbia County. This includes territory where special districts may operate, but not the cities or city assets/infrastructure. All of the annexes follow the methodology laid out in the Basic plan, but should not duplicate information found there. Additions, or information specific to the jurisdiction, can be added under the appropriate section.
3. **The City Annexes** – these include each of the seven incorporated cities of Columbia County.
4. **The Special District Annexes** – Those districts that have agreed to be a part of the planning process.

Whole Community Planning

"Federal regulation for mitigation plan approval requires that stakeholders and the general public are given opportunities to be involved during the planning process and in the plan's maintenance and implementation. Community members can therefore provide input that can affect the content and outcomes of the mitigation plan." -Local Mitigation Handbook.

The pervious statement aligns with FEMA's commitment to their Whole Community Planning strategy. For local mitigation planners this means that FEMA wants to see planning elements that collect and utilize data from stakeholders and the general public. In the previous update, this element was severely underestimated and held back the approval process. FEMA Region X plan reviewers will be looking very carefully at our outreach efforts.

Scope of Work

Initial Drafting Phase – Completed by end of the year

During the initial drafting phase, a series of products need to be drafted. These products will all be based on the 2014 plan but will significantly update the text and minimize the formatting. The products are:

- **Updated basic plan** – I don't expect needing to change the fundamental methodology, the Community and Hazard profiles however, will require significant research and some re-drafting. This work can be undertaken immediately, the sooner it is completed the better as the basic plan will set the methodology for all of the jurisdictional and district annexes.
- **Updates County annex** – This product can be accomplished entirely in house with data available in the 2014 plan.

- **Updated Jurisdictional annexes** – in the 2014 plan these were the only products other than the County plan that were required. It would be best for the cities to receive plan "templates" that are as close to complete as possible, requiring as little additional work for the cities as possible. This will not only fulfill HSEMC commitments but will speed the process.
- **Special District Template** – This template can be produced immediately. It will not be a completed document but will instead be available for any special district that agrees to participate in the plan. If assistance is requested and approved for the district, then planning staff can begin the task of filling in the template with district specific information.

Local and District HMP Committee input – Completed by March

Committees will need to be formed to review and provide input for all plan annexes. This includes:

- **Basic Plan Committee – HSEMC September meeting (also fulfills EMPG requirements).**
- **County Annex Committee – composed of department heads and/or sme's from county departments.**
- **City HMP committees – some jurisdictions have standing committees in place (Vernonia and Columbia City), other jurisdictions may not have the capacity to form a committee (Prescott).**
- **District Committees – Most districts will probably defer this requirement to their boards.**

Whole Community Planning elements – Ongoing throughout Update

The best strategies to demonstrate our own commitment to whole community planning will be a program of public outreach including:

- Questionnaire program
- Social Media Campaign
- Advertised Public Meetings for the County and City committees
- Making HMP a feature in all subsequent Preparedness presentations.

Review Period – to begin in April

FEMA requires 45 days to complete an MJHMP review, the state requires 30 days for review. Since the reviews can require modifications to the plan, sometimes significant modifications, ample time should be planned for this period as a contingency.

Proposed Update Calendar

2018

Month	Task	Notes
July	Update Plan	The Update Plan should include a strategy for determining which special districts should participate.
August	• Update Launch • Basic Plan	• Initial email invitation to determine jurisdiction and special district participation. • Begin re-write of basic plan elements.
September	Outreach Strategy Launch	Coinciding with preparedness month activities, whole community planning strategy should begin.
October	Drafting	Continue Basic Plan updating, begin production of district templates
November	Form committees	County, City and District HMP committees must be populated
December	Drafting complete	Draft of all products completed

2019

Month	Task	Notes
January	All Committee inputs begin	County, City and District HMP committees begin meeting schedule established
February	Commitment deadline	All jurisdictions commit to participating or opt out
March	Public meeting Process	Jurisdiction annex drafting Attend/Facilitate public meetings and continue revisions
April	State Review	30 days for OEM review
May	FEMA Review	45 days for FEMA review
June	Review and Final Revisions	Review Contingency, and revision
July	• BOCC Promulgation • District/Jurisdiction promulgation	Promulgation occurs after the plan has been reviewed by FEMA but before final *approval* is awarded.
August	FEMA Approval	Submit to FEMA for Final Approval

September	FEMA Approval	Monitor for Final Approval Letter from FEMA
October	Plan Update Due	FEMA Approval required by October 6, 2019

Proposed Distribution of Assignments (Update Team)

Shaun Brown – Update Coordinator

Shaun will handle official interactions with the State and FEMA on the update, and will provide supervision of the rest of the Update Team. Shaun's main focus will be to

- **Coordinate communications**
- **Facilitate update meetings, the**
- **Facilitate the formation of committees**
- **Schedule planning meetings**

Della Fawcett – HMP Outreach

Della will coordinate the collection and distribution of whole community planning update materials and will include HMP update information in all subsequent outreach presentations.

- Coordinate Questionnaire distribution and collection
- Prepare HMP presentation (others may give these presentations)
- Coordinate distribution of Social Media HMP posts (with Karen Kane)

Anne Parrott – HMP Outreach

It is possible that some of Anne's PHEP work plan can be satisfied by the outreach portion of the plan update process. In that case Anne may be able to assist Della with some of the outreach work, and include HMP materials in her own preparedness program.

Vincent Aarts – Planning Support

This position will be doing the greatest portion of the drafting of the plan elements. It will also require extremely close coordination with the update coordinator in order to capture jurisdiction, district and public input into the plan elements. This position will also provide the technical guidance and will be heavily involved in the state and federal review and approval process.

- Update and draft all plan elements including the Basic Plan, the county, jurisdiction and district annexes and the new district template.
- Design and Format new plan

- Provide significant input on the outreach strategy
- Attend necessary committee meetings
- Guide the plan through review, promulgation and approval

Special District Participation

The number of taxing districts in Columbia County that will need to have the requirements of the HMA program explained and an invitation made to participate in the update is large (38). We will want to check the requirements with Joseph Murray at OEM to determine if all these districts require individual plans. It is likely that not all the districts will need to, or will want to participate in the MJ-HMP, but to honor the spirit of the HSEMC we will want to be sure to provide invitation and technical guidance to all of them, even if only to explain the extremely low probability that they will ever opt to access the HMA program.

According to the Assessor's Department webpage the special districts in Columbia County are:

Fire Districts

Clatskanie Rural Fire Protection District

- Situs Address: **280 SE Third Street, Clatskanie, Oregon**
- Mailing Address: **PO Box 807, Clatskanie, OR 97016**
- Phone Number: **503-728-2131**
- Email: **info@clatskaniefire.org**
- Website: www.clatskaniefire.org

Columbia River Fire & Rescue

- Situs Address: **270 Columbia Blvd, Saint Helens, Oregon**
- Mailing Address: **270 Columbia Blvd, Saint Helens, OR 97051**
- Contact Person: **Mark Kreutzer**
- Phone Number: **503-397-2990**
- Email: **kreutzem@crfr.com**
- Website: www.crfr.com

Mist-Birkenfeld Rural Fire Protection District

- Situs Address: **12525 Hwy 202, Mist, Oregon**
- Mailing Address: **12525 Hwy 202, Mist, OR 97016**
- Contact Person: **Joe Kaczenski**
- Phone Number: **503-755-2710**
- Email: **C46kaczenski@yahoo.com**
- Website www.mistbirkenfeldrfpd.org

Sauvie Island Volunteer Rural Fire Protection District #30

- Situs Address: **18342 NW Sauvie Island Rd, Portland, Oregon**
- Mailing Address: **18342 NW Sauvie Island Rd, Portland, OR 97231**

- Contact Person: **David J Kunkel**
- Phone Number: **503-621-1242**
- Email: **dave@sifire.org**
- Website: www.sifire.org

Scappoose Fire District

- Situs Address: **52751 Columbia River Hwy, Scappoose, Oregon**
- Mailing Address: **PO Box 625, Scappoose, OR 97056**
- Contact Person: **Chief Mike Greisen or Finance Administrator Janine Salisbury**
- Phone Number: **503-543-5026**
- Email: **mgreisen@srfd.us or jsalisbury@srfd.us**
- Website: **www.srfd.us**

Vernonia Rural Fire Protection District

- Situs Address: **555 E Bridge St, Vernonia, Oregon**
- Mailing Address: **555 E Bridge St, Vernonia, OR 97064**
- Contact Person: **Office Manager Karin Goodman or Deputy Chief Earl Dean Smith**
- Phone Number: **503-429-8252**
- Email: **karin_goodman@hotmail.com or dc4502@yahoo.com**
- Website: www.vernoniafire.us

Special Districts

Clatskanie Library District

- Situs Address: **111 NE Lillich Street, Clatskanie, Oregon**
- Mailing Address: **PO Box 577, Clatskanie, OR 97016**
- Contact Person: **Cyndi Warren**
- Phone Number: **503-728-2038**
- Email: **Cyndi@dconnercpa.com**

Clatskanie Park & Recreation District

- Situs Address: **300 Park Street, Clatskanie, Oregon**
- Mailing Address: **PO Box 737, Clatskanie, OR 97016**
- Contact Person: **Cyndi Warren**
- Phone Number: **503-728-2038**
- Email: **Cyndi@dconnercpa.com**

Columbia 9-1-1 Communications District

- Situs Address: **58611 McNulty Way, Saint Helens, Oregon**
- Mailing Address: **PO Box 998, Saint Helens, OR 97051**
- Contact Person: **Nancy Edwards**
- Phone Number: **503-397-7255 Ext. 2225**

- Email: **nedwards@columbia911.com**
- Website: www.columbia911.com

Columbia County 4-H & Extension Service

- Situs Address: **505 N Columbia River Hwy, Saint Helens, Oregon**
- Mailing Address: **505 N Columbia River Hwy, Saint Helens, OR 97051**
- Contact Person: **Chip Bubl**
- Phone Number: **503-397-3462**
- Website: http://extension.oregonstate.edu/columbia/

Columbia Drainage Vector Control District

- Situs Address: **58443 Old Portland Road, Saint Helens, Oregon**
- Mailing Address: **PO Box 717, Saint Helens, OR 97051**
- Contact Person: **Mike Roberts, Director**
- Phone Number: **503-397-2898**
- Email: **mikeroberts@cdvcd.org**
- Website: www.cdvcd.org

Columbia Soil & Water Conservation District

- Situs Address: **35285 Millard Road, Saint Helens, Oregon**
- Mailing Address: **35285 Millard Road, Saint Helens, OR 97051**
- Contact Person: **Kari Hollander, District Manager**
- Phone Number: **503-397-4555 ext 102**
- Email: **kari.hollander@columbiaswcd.com**
- Website: www.columbiaswcd.com

Greater Saint Helens Park and Recreation

- Situs Address: **1070 Eisenschmidt Lane, Saint Helens, Oregon**
- Mailing Address: **1070 Eisenschmidt Lane, Saint Helens, OR 97051**
- Contact Person: **Anne Collson**
- Phone Number: **503-397-2283**
- Email: **epool@gshprd.com**
- Website: www.sthelenspool.com

Port of Saint Helens

- Mailing Address: **PO Box 190, Columbia City, OR 97018**
- Phone Number: **503-397-2888**
- Email: **portsh@portsh.org**
- Website: www.portsh.org

Rainier Cemetery District

- Situs Address: **75900 Larson Road, Rainier, Oregon**
- Mailing Address: **PO Box 307, Clatskanie, OR 97016**
- Contact Person: **Cyndi Warren**
- Phone Number: **503-728-2038**
- Email: **Cyndi@dconnercpa.com**
- Website: www.rainiercemeterydistrict.com

Scappoose Public Library District

- Situs Address: **52469 SE Second St, Scappoose, Oregon**
- Mailing Address: **PO Box 400, Scappoose, OR 97056**
- Contact Person: **Dan White, Director**
- Phone Number: **503-543-7123**
- Email: **scappl@scappooselibrary.org**
- Website: www.scappooselibrary.org

West Multnomah Soil & Water Conservation District

- Situs Address: **2701 NW Vaughn St, Ste 450, Portland, Oregon**
- Mailing Address: **2701 NW Vaughn St, Ste 450, Portland, OR 97210**
- Contact Person: **Jim Cathcart or Carolyn Myers Lindberg**
- Phone Number: **503-238-4775**
- Email: **info@wmswcd.org**
- Website: www.wmswcd.org

Educational Districts

Clatskanie School District #6J

- Situs Address: **471 SW Bel Air Drive, Clatskanie, Oregon**
- Mailing Address: **NW Regional ESD, 5825 SE Ray Circle, Hillsboro, OR 97124**
- Contact Person: **Janice Essenberg, CFO**
- Phone Number: **503-614-1253**
- Email: **jessenberg@nwresd.k12.or.us**
- Website: www.csd.k12.or.us

Northwest Regional Education Service District

- Situs Address: **5825 SE Ray Circle, Hillsboro, Oregon**
- Mailing Address: **5825 SE Ray Circle, Hillsboro, OR 97124**
- Contact Person: **Janice Essenberg, CFO**
- Phone Number: **503-614-1253**
- Email: **jessenberg@nwresd.k12.or.us**
- Website: www.nwresd.k12.or.us

Portland Community College

- Situs Address: **722 SW 2nd Ave, Portland, Oregon**
- Mailing Address: **PO Box 19000 - DC2, Portland, OR 97280**
- Contact Person: **James Langstraat**
- Phone Number: **971-722-2911**
- Email: **jim.langstraat@pcc.edu**
- Website: www.pcc.edu

Rainier School District #13

- Situs Address: **28168 Old Rainier Road, Rainier, Oregon**
- Mailing Address **28168 Old Rainier, Road, Rainier, OR 97048**
- Contact Person: **Elisabeth Guisinger, Business Manager**
- Phone Number: **503-556-3777 ext 265**
- Email: **lil_guisinger@rsd.k12.or.us**
- Website: www.rainier.k12.or.us

Saint Helens School District #502

- Situs Address: **474 N 16th Street, Saint Helens, Oregon**
- Mailing Address: **474 N 16th Street, Saint Helens, OR 97051**
- Contact Person: **Jessica Pickett**
- Phone Number: **503-366-7225**
- Email: **jessicapi@sthelens.k12.or.us**
- Website: www.sthelens.k12.or.us

Scappoose School District

- Situs Address: **33589 SE High School Way, Scappoose, Oregon**
- Mailing Address: **33589 SE High School Way, Scappoose, OR 97056**
- Contact Person: **Mitch Neilson, Business Manager**
- Email: **mneilson@scappoose.k12.or.us**
- Website: www.scappoose.k12.or.us

Vernonia School District 47J

- Situs Address: **1201 Texas Ave, Vernonia, Oregon**
- Mailing Address: **1201 Texas Ave, Vernonia, OR 97064**
- Contact Person: **Aaron Miller, Superintendent**
- Phone Number: **503-429-5891**
- Email: **amiller@vernonia.k12.or.us**
- Website: www.vernonia.k12.or.us

Drainage Improvement Districts

Beaver Improvement

- Contact Person: **Angela Velke**
- Phone Number: **360-751-8778**

Clatskanie Drainage District

- Contact Person: **Angela Velke**
- Phone Number: **360-751-8778**

Clatsop Improvement Co

- Contact Person: **Angela Velke**
- Phone Number: **360-751-8778**

Columbia County Drainage District #1

- Mailing Address: **18330 NW Sauvie Island Rd, Portland, OR 97231**
- Contact Person: **Mark Nebeker**
- Phone Number: **503-621-3488 ext 225**
- Email: Mark.A.Nebeker@state.or.us

Deer Island Improvement

- Contact Person: **David Williamson**
- Phone Number: **503-397-2141**

John Drainage Improvement Company

- Mailing Address: **20787 Johns District Road, Clatskanie, OR 97016**
- Contact Person: **Marc Lever**
- Phone Number: **503-728-3677**

Magruder Drainage Improvement Corp

- Mailing Address: **15604 Luxford Road, Clatskanie, OR 97016**
- Contact Person: **Art Johnson**
- Phone Number: **503-728-2548**

Marshland Drainage Improvement Company

- Mailing Address: **12589 Hwy 30, Clatskanie, OR 97016**
- Contact Person: **Margaret Magruder**
- Phone Number: **503-728-2945**
- Email: magruder@clatskanie.com

Midland Improvement

- Contact Person: **Kit Strandberg**

- Phone Number: **971-533-7033**

Rainier Drainage Improvement Company

- Mailing Address: **PO Box 521, Rainier, OR 97048**
- Contact Person: **Terry Deaton, Secretary**
- Phone Number: **503-369-2245**

Sauvie Island Drainage Improvement Co

- Mailing Address: **34856 E Columbia Ave, Scappoose, OR 97056**
- Contact Person: **Tim Couch, Manager**
- Phone Number: **503-621-3397**
- Email: **tim@sidrainage.org**
- Website: www.sidrainage.org

Scappoose Drainage Improvement Company

- Mailing Address: **53466 E Honeyman Road, Scappoose, OR 97056**
- Contact Person: **Karen Vaughan, Secretary**
- Phone Number: **971-409-1110**
- Email: **Scappoosedrainage@hotmail.com**
- Website: Scappoose Drainage Improvement Company/City of Scappoose

Westland Drainage Improvement District

- Contact Person: **Angela Velke**
- Phone Number: **360-751-8778**

Woodson Drainage Improvement District

- Mailing Address: **PO Box 1016, Clatskanie, OR 97016**
- Contact Person: **Gerald Carver, Director**
- Phone Number: **360-751-1982**

Appendix B – Participation Letter

To: County Departments, HSEMC Partners, Municipalities, and Districts
From: Columbia County Emergency Management
Date: August 12, 2018
RE: Multi-Jurisdiction Hazard Mitigation Plan – Required Update

Hazard Mitigation Planning Requirement:

For the last nine years Columbia County has maintained a Multi Jurisdiction Hazard Mitigation Plan, which combines the planning efforts of the County and all seven of the incorporated Cities. The Disaster Mitigation Act of 2000 (Public Law 106-390) provides the legal basis for FEMA mitigation planning requirements for State, Local and Indian Tribal governments. Among these requirements is the obligation to update Hazard Mitigation Plans every five years. In 2014 Columbia County produced its last full update of the County's Multi-jurisdiction Hazard Mitigation Plan; therefore, the next State and FEMA approved update must be completed by October 6, 2019.

Grant Eligibility:

DMA 2000 requires state, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of *non-emergency* disaster assistance (section 404), including funding for mitigation projects. Currently, FEMA administers three programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages. The three programs are:

- Hazard Mitigation Grant Program: assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. HMGP funding is generally 15% of the total amount of Federal assistance provided to a State, Territory, or federally-recognized tribe following a major disaster declaration. This grant program was critical to the mitigation projects in Vernonia after the 2007 flooding incident.
- Pre Disaster Mitigation: provides funds for hazard mitigation planning and projects on an annual basis. PDM funding depends on the amount congress appropriates each year for this program.
- Flood Mitigation Assistance: provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National

Flood Insurance Program (NFIP) on an annual basis. FMA funding depends on the amount congress appropriates each year for this program.

Participation:

A recent FEMA interpretation of Oregon Revised Statutes has concluded that all Oregon Districts are considered local government and are therefore required to maintain a Hazard Mitigation Plan to retain eligibility with these grant programs. It is important to note that the lack of an HMP does not disqualify districts from post-disaster public assistance funding (section 406 programs), which provides 75% of costs for rebuilding projects. However, funding for mitigation specific efforts (section 404 described above) now require participation by *any* jurisdictions deemed to have a government function, has taxing authority, or maintains an elected board.

In practical terms this means that in the aftermath of a presidentially declared disaster, money will be available for immediate repairs to public infrastructure in your district or jurisdiction. However, without an approved mitigation plan grant, dollars will not be available to rebuild infrastructure with designs intended to reduce future impacts, or to move infrastructure away from impact areas. In the end the best way to ensure access to federal funding for *all* recovery projects is to participate in this planning effort. It is highly recommended that Cities, and districts consider doing so.

What this means for your jurisdiction/what will be required:

This letter is intended as an invitation to for all County Departments, Cities and Districts to participate in the 2019 planning process. During this process the Columbia County Emergency Management Department will act as the lead agency and will provide technical guidance, direct planning support, and will assemble, publish and escort the county wide plan through the State and FEMA approval process.

Emergency Management has already begun the update process and is currently working to produce several products which will significantly aid your efforts, should you choose to participate. Currently the department is at work updating the Basic plan, which will provide a shared hazard profile, and planning methodology for each of the jurisdictional and district annexes. Along with producing a plan template for those jurisdictions that

have not previously had a mitigation plan, these actions should seriously reduce the work load for those organizations interested in participating.

However, participation in the plan does require a significant commitment, and the department anticipates that not all eligible organizations will have the desire or the capability to write a plan regardless of the amount of support available. Organizations should carefully weigh the likelihood or need to seek mitigation specific funding post disaster, with their capacity to author and maintain a mitigation plan. It should be noted that considering the frequency of natural disasters in Columbia County, the Department of Emergency Management cannot fail to deliver an updated plan for promulgation and State and FEMA approval at the required time. This means that if any participating jurisdiction or district fails to meet the deadlines outlined below their annex will not be included in the final plan.

Schedule:

Though it may seem that this invitation is coming early, the fact is that with the number of jurisdictions that may agree to enter in the planning process, it will require the full fourteen-month period for Emergency Management to meet the requirements of this update. The table below provides an abbreviated schedule for the project,

2018		
Month	**Task**	**Notes**
August	Update Launch and review Basic Plan	Invite participation from County jurisdictions and districts and begin re-write of basic plan elements.
September	Outreach Strategy Launch	Coinciding with preparedness month activities, whole community planning strategy should begin.
November	Form committees	County, City and District HMP committees must be identified and begin work on local plans and public meetings.
2019		
Month	**Task**	**Notes**
March	Final Drafts due	All public participation and revisions complete, final drafts due to Emergency Management.
April	Approval process	State and FEMA approval process beginning, revisions

		made to all plans.
July	Promulgation	Board, City and County promulgation of provisional plan.
August	Final Approval	Submit and receive final approval from FEMA on promulgated plans.
September	Contingency	This is a one-month buffer to ensure completion of the project

Conclusion:

Columbia County is prone to natural disasters and has participated in several major disaster declarations in the past. The access to mitigation grant programs that the MJ-HMP provides the county and cities has provided many millions of dollars of Federal mitigation funding in the wake of those disasters. The Department of Emergency Management along with its Homeland Security and Emergency Management Commission partners urges the jurisdictions and districts of the County to participate in this effort to prepare for future events.

We look forward to hearing from you. Please respond to this memo with an email to:

Shaun Brown
Deputy Director – Emergency Management
Shaun.brown@co.columbia.or.us

EXHIBIT B

Columbia County

Hazard Mitigation Plan

Annex

2020 Update
Columbia County
Multi-Jurisdiction Hazard Mitigation Plan

Contents

Columbia County Annex

Introduction

This Annex contains information specific to the Columbia County and its unincorporated areas to support the Columbia County 2020 Multi-Jurisdictional Natural Hazard Mitigation Plan. This section further supports the County's planning process by summarizing the review and incorporation of existing plans, studies, and reports used to develop this NHMP. This annex is an addition to Columbia County's Hazard Mitigation Plan and shares attributes of that plan.

Planning Process and Capability Assessment

The following section includes a detailed capability assessment that describes the resources available to support this plan. The goal of this assessment is not to identify all capabilities the organization may have, but only those that are currently used or could be used to support mitigation efforts. Capabilities are arranged in tables by type and fall under the explicit authority of the jurisdiction/district.

DMA 2000 Requirements: Planning Process	
Planning Requirements	
§201.6(b)	An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
§201.6(b)(1)	(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
§201.6(b)(2)	(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
§201.6(b)(3)	(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
§201.6(c)(1)	[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.
§201.6(c)(4)(i)	[The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
§201.6(c)(4)(iii)	[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
Planning Elements	
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? *44 CFR 201.6(c)(1)*	

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? *44 CFR 201.6(b)(2)*

A3. Does the Plan document how the public was involved in the planning process during the drafting stage? *44 CFR 201.6(b)(1) and 201.6(c)(1)*

A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? *44 CFR 201.6(b)(3)*

A5. Is there discussion on how the communities will continue public participation in the plan maintenance process? *44 CFR 201.6(c)(4)(iii)*

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)? *44 CFR 201.6(c)(4)(i)*

Plan Development Methodology

Update of this hazard mitigation plan included seven phases. These phases do not describe an exactly linear process and many of them were worked upon simultaneously and overlapped others. Each phase produced results that are evident in the final drafts of the Basic Plan and the County, Jurisdictional, and Agency Annexes.

Phase 1 - Organize resources: Under this phase, county general funding was secured to provide staffing for this effort, the Homeland Security and Emergency Management Commission (HSEMC) was informed of the scope of the project and agreed to act as a panel of whole community partners to oversee development of the plan. Also, under this phase were coordination with local, state, and federal agencies and a comprehensive review of existing programs that may support or enhance hazard mitigation.

Phase 2 – Develop an update plan: The Department of Emergency Management along with the HSEMC identified an Update Coordinator who then produced a fully detailed plan for the update including the remainder of these phases. The Update coordinator, developed timetables, produced a common schedule with deadlines, and produced and distributed a plan template along with historic information to participating jurisdictions.

Phase 3 - Assess risk: Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. During this process, the Update Coordinator worked with the HSEMC, partner jurisdictions and agencies on the following tasks:

- Identify new hazards and update hazard profiles.
- Determine the impact of hazards on physical, social and economic assets.
- Estimate the cost of damage or costs that can be avoided through mitigation.

The outcome of this phase of the planning produced a shared hazard profile for each of the participating jurisdictions to use, though additional and specific risk assessment elements were produced for each participating member as well.

Phase 4 – Determine public involvement and provide opportunities: Under this phase, a public involvement strategy was developed that utilized public events outreach events,

public questionnaires, media opportunities and public meetings of the HSEMC for public input. The strategy focused on three primary objectives:

- Assess the public's perception of Natural Hazard risk in the County.
- Assess the public's perception of vulnerability to those risks.
- Identify mitigation strategies that will be supported by the public.

Phase 5 - Identify goals, objectives, and actions: Under this phase, the goals and objectives were reviewed and updated, as well as a range of potential mitigation actions for each natural hazard identified *by each participating member of the planning process*. A process was created under this phase for prioritizing, implementing, and administering action items based in part on a review of project benefits versus project costs.

Phase 6 - Assemble the plan: During this phase, the Update Coordinator along with other Emergency Management Department staff gathered the multiple annexes included in this pan and engaged in a review process that provided feedback and sought additions to the plans. After it was determined that that plans met the requirements of the update plan, the annex template, and with attention paid to FEMA requirements, the annexes were assembled, along with the Basic Plan and the Appendixes and forwarded to the state for review.

Phase 7 - Implement and adopt the plan: Once pre-adoption approval has been granted by the Oregon Office of Emergency Management and FEMA, the final adoption phase begins, with each planning partner required to adopt the plan according to its own protocols.

Homeland Security and Emergency Management Commission (HSEMC) and Regional cooperation

The Homeland Security and Emergency Management Commission (HSEMC) is a body comprised of local Jurisdictions, Districts and Agencies, which have formed a partnership with Columbia County to produce a collaborative, mutually supportive emergency management effort. In the context of Hazard Mitigation planning the HSEMC acts as a permanent, whole community and public meeting space for Mitigation Plan reviews, additions and new ideas and considerations. In addition, the commission works extremely closely with the county Emergency Management Department (the only permanent EM program in the county), to offer and partake in regional planning efforts with agencies, jurisdictions and other similar commissions in the Greater Metropolitan urban area. Columbia County is identified as one of the five Metros counties for Urban Area Securities Initiative grant applications and is a member of the Regional Disaster Preparedness Organization. Either directly, or through the county EM Department or the HSEMC, Columbia County jurisdictions and districts have significant opportunity for involvement, and collaboration with a wide array of similar organizations on the topic of Hazard Mitigation.

Plan Integration

Each participant of the Columbia County MJHMP will be responsible for ensuring that plan goals and objectives are incorporated into applicable revisions of each participant's adopted comprehensive plan and any new planning projects undertaken by the participant. The plan may be adopted as part of each participant's comprehensive development plan. This would enable the mitigation component of the comprehensive plan to be consistently revisited and reviewed. In addition, the plan should also take into account any changes in the comprehensive plan and incorporate the information accordingly during its next update. Participants should look for ways to incorporate their mitigation strategies into their respective comprehensive plans and capital facilities plans, emergency management plans, and budget documents. The participating agencies should identify other planning documents or mechanisms to incorporate and focus on their hazard mitigation strategies (ex. emergency management plans, master plans).

Steering Committee Participants

Columbia County is dedicated to mitigating potential natural hazards to its population and infrastructure. To fulfill that goal, Columbia County Emergency Management empaneled the Homeland Security Emergency Management Commission (HSEMC) as the steering committee for this NHMP. The HSEMC consists of representatives of agencies, cities, and county departments, and is otherwise ideally composed to identify hazards and develop actions to mitigate damage and life losses from those threats.

Table 1 records the HSEMC/Steering Committee's participant list.

Table 1. Columbia County Update Steering Committee

Name	Agency/Department/Affiliation
Anne Parrott	Columbia County Public Health – PHEP Coordinator
Johnathan Baker	Columbia County Emergency Management
Dan Brown	Columbia County – Community Action Team
Michael Carter	Rainier School District - Superintendent
Sean Clark	Port of Columbia County
Dave Crawford	Mist Birkenfeld RFPD
Della Graham	Columbia County Emergency Management
Diane Dillard	Sacagawea Health Center
Mike Fletcher	Columbia 911 Communications District - Director
Mike Greisen	Columbia River Fire and Rescue - Chief
Doug Hayes	Port of Columbia County – Executive Director
Greg Hinkleman	Clatskanie – City Manager
Pat LaPointe	Citizen Member
Lonny Welter	Columbia County – Roads Department
Margaret Magruder	Columbia County – County Commissioner
Mike McGlothlin	Columbia City – Chief of Police
Michael Paul	Columbia County Public Health - Director

Mike Deroia	City of St. Helens – Building Official
Norm Miller	Scappoose – Chief of Police
Kelly Niles	Chair - Oregon Department of Forestry
Ian O'Connor	Columbia River Fire and Rescue – Division Chief
Bob Perry	Western Oregon Electrical Coop - Director
Shaun Brown	Columbia County Emergency Management
Steve Pegram	Columbia County Emergency Management - Director
Scot Stockwell	St. Helens School District - Superintendent
Todd Meunier	Citizen Member
Jeff VanNatta	Vice – Chair Citizen Member
Casey Wheeler	Columbia County Food bank

Public Participation

As defined by FEMA, Whole Community Planning is; a means by which residents, emergency management practitioners, organizational and community leaders, and government officials can collectively understand and assess the needs of their respective communities and determine the best ways to organize and strengthen their assets, capacities, and interests. By doing so, a more effective path to societal security and resilience is built.

Public participation during the drafting of this update was encouraged in several ways. The first is through the HSEMC described earlier. Each Bi-Monthly meeting of the commission is open to the public, and during each meeting, Public commentary is encouraged. Appeals to the public to present information, and feedback to the HSEMC for consideration in the Hazard Mitigation Plan was ongoing throughout the two years of the planning process and continues as HSEMC prepares to enter plan maintenance mode after this update cycle.

In addition, the community was encouraged to provide feedback during the drafting office by filling out surveys intended to identify risks and specific hazards of greatest interest. These surveys were made available at every outreach event, public meeting, and preparedness effort in each jurisdiction and district in the county for the last several years. Upon completion the surveys were gathered, and result incorporated into the planning process of each jurisdiction. Like the opportunity for public testimony

This Hazard Mitigation Plan was conducted with opportunities for the public to participate to try and meet the goals of whole community planning. Table 2 highlights these efforts.

Table 2. Public Involvement Mechanisms	
Date	**Description**
2014	

Table 2. Public Involvement Mechanisms	
Date	**Description**
7/19/2014	Columbia Emergency Preparedness Association EXPO – Large emergency management event covering all topics (preparedness, fire, law, mitigation, response).
9/20/2014	Columbia City Preparedness Fair - Engaged locals and visitors on topics like preparedness, and mitigation planning.
10/4/2014	Vernonia Salmon Festival - Engaged locals and visitors on topics like preparedness, and mitigation planning.
11/11/2014	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted.
2015	
5/12/2015	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted.
9/19/2015	Columbia City Preparedness Fair – Engaged locals and visitors on topics like preparedness, and mitigation planning.
11/10/2015	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted.
2016	
4/2/2016	KOHI Radio Preparedness Talk – Radio talk show for Columbia County, topics "specifically included preparing for the next flood event".
4/3/2016	CERT Preparedness Meet-up – Locals interested in public volunteerism met with St. Helens CERT.
5/10/2016	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted.
5/24/2016	Neighborhood Association Meeting Talk – Presentation to local HOA.
6/4/2016	Ford Family Foundation Preparedness Fair - County wide event to promote preparedness and mitigation in cooperation with the Ford Family Foundation. All cities participated.

Table 2. Public Involvement Mechanisms	
Date	**Description**
6/9/2016	Geologic Hazards presentation – Presentation by local Geologic Hazards Coordinator in Clatskanie.
7/23/2016	Columbia Emergency Preparedness Association EXPO – Large emergency management event covering all topics (preparedness, fire, law, mitigation, response).
9/17/2016	Columbia City Preparedness Fair – Engaged locals and visitors on topics like preparedness, and mitigation planning.
9/22/2016	Columbia County Soil and Water Conservation District – Event hosted by SWCD on preparedness and flood mitigation efforts.
11/15/2016	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted.
2017	
2/16/2017	Kiwanis Presentation – Preparedness Presentation on CSZ risk.
4/4/2017	Paradise Moorage Presentation – topics included homeowner action to prepare for CSZ and mitigate against seiches in the Multnomah Channel.
5/9/2017	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted.
9/16/2017	Columbia City Preparedness Fair - Engaged locals and visitors on topics like preparedness, and mitigation planning.
9/23/2017	Clatskanie Safety and Preparedness Fair - Engaged locals and visitors on topics like preparedness, and mitigation planning.
11/14/2017	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted.
11/29/2017	Unprepared showing – St. Helens - presentation of OPB documentary regarding CSZ earthquake and tsunami.
12/8/2017	Fishhawk Lake - Presentation to local HOA
2018	
1/19/2018	Preparedness to Vets Group – Presentation to Veterans regarding personal preparedness and flood mitigation.

Table 2. Public Involvement Mechanisms	
Date	**Description**
1/29/2018	Unprepared showing – Mist/Birkenfeld – presentation of OPB documentary regarding CSZ earthquake and tsunami.
5/8/2018	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual NHMP meeting, plan review was conducted and plans for plan update discussed.
9/13/18	Family Preparedness event – Family specific information for preparing for a disaster.
10/14/18	South County Chamber - Preparedness Presentation on CSZ risk.
10/15/18	Columbia City Preparedness Fair - Engaged locals and visitors on topics like preparedness, and mitigation planning.
11/13/2018	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual County-wide Hazard Mitigation meeting. Work Session on Hazard Mitigation Plan update conducted.
11/27/2018	Pints and Preparedness – various topics including Hazard mitigation, and individual preparedness.
2019	
1/22/2019	Pints and Preparedness – various topics including Hazard mitigation, and individual preparedness.
2/20/2019	St. Helens Mitigation – Public meetings with presentations regarding mitigation planning.
3/26/2019	Drainage Districts Mitigation – Public meetings with presentations regarding mitigation planning.
3/26/2019	Pints and Preparedness – various topics including Hazard mitigation, and individual preparedness.
5/7/2019	HSEMC – Columbia County's Homeland Security and Emergency Management Commission is recognized by the Board of County Commissioners as the cornerstones of a whole community approach to emergency management planning. All jurisdictions are members of the commission. Semi Annual County-wide Hazard Mitigation meeting. Work Session on Hazard Mitigation Plan update conducted.
4/16/2019	Drainage Districts Mitigation – Public meetings with presentations regarding mitigation planning.
4/23/2019	Pints and Preparedness – various topics including Hazard mitigation, and individual preparedness.
9/7/2019	Preparedness for Scouts – Presentation on preparedness for all hazards.

Table 2. Public Involvement Mechanisms	
Date	**Description**
9/14/2019	Columbia City Preparedness Fair - Engaged locals and visitors on topics like preparedness, and mitigation planning.
9/28/2019	Clatskanie Safety Fair - Engaged locals and visitors on topics like preparedness, and mitigation planning.

Capability Assessment

Table 3, 4, and 5 contain the Columbia County resources used to support planning activities, including the reports and studies reviewed as part of the update process.

Table 3. Columbia County Legal and Regulatory Resources Available for Hazard Mitigation		
Regulatory Tool	**Name**	**Effect on Hazard Mitigation**
Plans	2009/2014 Columbia County Multi-Jurisdictional Hazard Mitigation Plan	The primary objectives of the Mitigation plan are to reduce the negative impacts of future disasters on the community: to save lives and reduce injuries, minimize damage to buildings and infrastructure (especially critical facilities), and minimize economic losses. The Mitigation Plan is a planning document, not a regulatory document.
	Transportation System Plan	The Comprehensive Plan contains public policy concerning the development and conservation of the County's resources, and provision of public facilities and services. The policies and objectives of the plan must be consistent with the Statewide Planning Goals and Guidelines and Administrative Rules. 1) The plan emphasizes natural resources including land, air, and water and how they are to be preserved, conserved, managed, or utilized. 2) Constraints on development, such as resource limitations as well as the physical limitations of the public and private sectors in providing necessary services. 3) The locations for various types of land and water uses and activities in an area, such as agricultural, forestry, residential, commercial, public, and industrial. 4) The utilities, services, and facilities needed to support current and contemplated uses and activities. 5) Considerations deriving from special values and needs of the area, such as housing, energy supplies, recreational facilities, and scenic areas.

Table 3. Columbia County Legal and Regulatory Resources Available for Hazard Mitigation		
Regulatory Tool	**Name**	**Effect on Hazard Mitigation**
		The plan is a document upon which public agencies, private firms, and individuals must be able to rely so that their decisions are consistent with land use policies as well as Statewide Goals and Guidelines. The plan is implemented by zoning and subdivision regulations, which must be consistent with the overall Policies and Objectives reflected in the plan.
	Emergency Operations Plan (EOP)	The Transportation System Plan (TSP) for Columbia County provides the framework to guide development of the transportation system into the twenty-first century. It addresses the needs, funding resources, and implementation requirements to respond to future growth in population and employment. All modes of transportation are considered, including vehicular and freight movement, public transit, walking and bicycling, service for the transportation disadvantaged, railroad, air, water, and pipeline transportation. This plan provides for transportation development in the rural areas of Columbia County. In a separate process, TSP documents have been previously completed for most incorporated cities within the County.
	Columbia County Debris Management Plan	This plan describes the roles and responsibilities of the departments and certain other agencies (including Special Districts) during major emergencies or disasters. The plan sets forth a strategy and operating guidelines using the National Incident Management System's (NIMS) Incident Support Model, adopted by the County for managing its response and recovery activities during emergencies and disasters. It is the intent of the County to integrate all emergency response systems into a program for comprehensive emergency management.
	Columbia County Community Wildfire Protection Plan (CWPP)	To facilitate and coordinate the removal, collection, and disposal of debris following a disaster, to mitigate against any potential threat to the health, safety, and welfare of the impacted citizens, and expedite recovery efforts in the impacted area, and address any threat of significant damage to improved public or private property.
	National Flood Insurance Program (NFIP)	Document serves as a resource for the wildland urban interface fire threat mitigation through community education and awareness, prioritized hazard and risk reduction, and community action partnerships. The Columbia County Community Wildfire Protection Plan (CWPP) is a strategic planning document that forms a foundation for a realistic assessment of wildfire risks in our county and develops plans or action statements of

Table 3. Columbia County Legal and Regulatory Resources Available for Hazard Mitigation		
Regulatory Tool	**Name**	**Effect on Hazard Mitigation**
		what we can do as a community to mitigate wildfire threats to life, property, and natural resources.
Programs	Community Rating System (CRS) Rating	Makes affordable flood insurance available to homeowners, business owners, and renters in participating communities. In exchange, those communities must adopt and enforce minimum floodplain management regulations to reduce the risk of damage from future floods.
	Zoning and Land Use Ordinances	This rating demonstrates the County's commitment to floodplain mitigation. The County has incorporated programs, which surpasses the basic NFIP requirements and have subsequently earned a rating, which reduces their NFIP policyholder's insurance premiums.
Policies	Columbia County Storm Water and Erosion Control Ordinance	Flood Overlay Zone Regulations – Flood Plain Ordinance regulates development within the floodplain.
	State of Oregon Uniform Building Codes	The purpose of this ordinance is to: •Prevent water quality degradation of the county's water resources; •Prevent damage to property from increased runoff rates and volumes; •Protect the quality of waters for drinking water supply, contact recreation, fisheries, irrigation, and other beneficial uses; •Establish sound development policies which protect and preserve the county's water and land resources; •Protect County roads and right-of-ways from damage due to inadequately controlled runoff and erosion; •Protect the health, safety, and welfare of the inhabitants of the County; •Maintain existing stream flows; and •Preserve and enhance the aesthetic quality of the County's water resources.
	Emergency Services and Communications Statute (ORS 401)	The Building Codes Division (BCD) provides code development, administration, inspection, plan review, licensing, and permit services to the construction industry. These are integral to the safe and effective construction of structures in Oregon and are administered by the County. The division was added to the newly formed Department of Consumer & Business Services in 1993.
	Emergency Services and Communications Statute (ORS 401)	(1) The general purpose of ORS 401.015 to 401.107, 401.257 to 401.325 and 401.355 to 401.584 is to reduce the vulnerability of the State of Oregon to loss of life, injury to persons or property, and human suffering and

Table 3. Columbia County Legal and Regulatory Resources Available for Hazard Mitigation		
Regulatory Tool	**Name**	**Effect on Hazard Mitigation**
		financial loss resulting from emergencies, and to provide for recovery and relief assistance for the victims of such occurrences. (2) It is the declared policy and intent of the Legislative Assembly that preparations for emergencies and governmental responsibility for responding to emergencies be placed at the local government level. The state shall prepare for emergencies but shall not assume authority or responsibility for responding to such an event unless the appropriate response is beyond the capability of the County and county in which it occurs, the County or county fails to act, or the emergency involves two or more counties.
	Subdivision and Partitioning Ordinance	The purpose of this ordinance is to establish standards and procedures for the partitioning of land in the County outside the incorporated cities' boundaries. These regulations are necessary in order to provide uniform procedures and standards for the subdivision of land, to assure adequate width of streets, to coordinate proposed development with plans for utilities and other public facilities, to avoid undue congestion of population, to assure adequate sanitation and water supply, to provide for the protection, conservation, and proper use of land and to protect in other ways the public's health, safety, and welfare. This ordinance is supplemental to the provisions of the Columbia County Zoning Ordinance of 1985. Where conflicts exist with the provisions of the Zoning Ordinance, this ordinance will take precedence.

Table 4. Columbia County Administrative and Technical Resources for Hazard Mitigation	
Staff/Personnel Resources	**Department/Division Position**
Planner(s) or engineer(s) with knowledge of land development and land management practices	Land Development Services / Planning Division
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Land Development Services / Building Division and County Road Department
Planner(s) or engineer(s) with an understanding of manmade or natural hazards	Emergency Management, Staff and Director
Floodplain manager	Land Development Services / Planning Division
Personnel skilled in GIS and/or HAZUS-MH	Assessment and Taxation / County Cartographer (GIS Only)
Emergency Services	Emergency Management, Director
Finance (grant writers, purchasing)	County Finance Department
Public Information Officers	Board of County Commissioners / Public Information Officer

Table 5. Columbia County Financial Resources for Hazard Mitigation	
Financial Resources	**Effect on Hazard Mitigation**
General funds	Yes
Authority to levy taxes for specific purposes	yes, with voter approval
Incur debt through general obligation bonds	yes, with voter approval
Incur debt through special tax and revenue bonds	yes, with voter approval
Incur debt through private activity bonds	No
Hazard Mitigation Grant Program (HMGP)	FEMA funding which is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.
Pre-Disaster Mitigation (PDM) grant program	FEMA funding which is available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only.
Flood Mitigation Assistance (FMA) grant program	FEMA funding which is available on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures.

Table 5. Columbia County Financial Resources for Hazard Mitigation	
Financial Resources	**Effect on Hazard Mitigation**
United States Fire Administration (USFA) Grants	The purpose of these grants is to assist state, regional, national or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors and firefighters.
Fire Mitigation Fees	Used to finance future fire protection facilities' construction and other fire capital expenditures to protect new development. The County Council or Fire District may charge fire mitigation fees to ensure new development pays their fair share of constructing these improvements.

Hazard Identification and Risk Assessment

DMA 2000 Requirements: Hazard Identification and Risk Assessment	
Planning Requirements	
§201.6(c)(2)(i)	The risk assessment shall include a] description of the type, location and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
§201.6(c)(2)(ii)	The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:
§201.6(c)(2)(ii)(A)	(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
§201.6(c)(2)(ii)(B)	(B) An estimate of the potential dollar losses to vulnerable structures identified in ... this section and a description of the methodology used to prepare the estimate.
§201.6(c)(2)(ii)(C)	(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
§201.6(c)(2)(iii)	For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.
Planning Elements	
B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and 44 CFR201.6(c)(2)(iii)	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)	
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? 44 CFR 201.6(c)(2)(ii)	
B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods? 44 CFR 201.6(c)(2)(ii)	

Hazard Identification

In the Basic Plan of this Natural Hazard Mitigation Plan, a detailed hazard profile was developed for the entire county. This was done with the intent of providing a shared overview for the participating jurisdictions and districts in this plan, while allowing them to add location specific notes, experiences, and additional data in their annexes as desired. However, the shared hazard profile provides all the information necessary for hazard identification for the purposes of the County annex. Therefore, no additional information will be presented in this section. Please

refer to pages 8-44 in the Basic Plan for a detailed discussion of Columbia County's Hazard Profile

Values at Risk

Population Analysis

Population data listed in Table 6 were obtained from the 2010 U.S. Census and Portland State University. It comprises census block level data and estimates from university conducted community research.

Table 6. Population

2010 Census*	2018 Estimate*	Percent Change
49,351	51,900	+5.1%

*US Census Bureau, 2011–2015 American Community Survey (https://factfinder.census.gov/)
**Portland State University, Population Research Center (https://www.pdx.edu/prc/population-reports-estimates)

Asset Inventory

The Asset Inventory describes the physical values; the public facilities, and infrastructure within Columbia County that may be affected by hazard events. These values are described in Tables 7 and 8.

Columbia County seeks to protect its population by supporting Columbia County and Oregon State initiatives, ordinances, building codes, and development regulations. One of the most important initiatives is to prohibit or not allow future development of buildings, infrastructure and critical facilities in identified high hazard areas. Any essential infrastructure component will undergo stringent review to ensure potential hazard risk will be mitigated.

Table 7. Residential Buildings

Total Building Count	Total Value of Buildings ($)
17,572	2,648,100,400

Critical Facilities and Infrastructure

A critical facility is defined as a local (non-State or Federal) facility in either the public or private sector that provides essential products and services to the general public, such as preserving life in Columbia County and fulfilling essential public safety, emergency response, and disaster recovery functions. The critical facilities profiled in this plan are provided in Table 8.

Table 8. Critical Facilities and Infrastructure			
Facility Type	**Name / Number**	**Address**	**Value[1]**
Government	County Courthouse and Administrative Offices	230 Strand Street., St. Helens, OR 97051	$32,960.00
	Old County Courthouse	230 Strand Street., St. Helens, OR 97051	$9,350,433.32
	Jail – Men's Transitional House	280 Strand Street, St. Helens, OR 97051	$5,042,656.25
	Jail - Women's Transitional House	901 Port Avenue., St. Helens OR 97051	$265,842.00
	County Road Department	901 Port Avenue, St. Helens, OR 97051	$213,330.00
	Road Department Building	1004 Oregon Street, St. Helens, OR 97051	$1,411,391.28
	Animal Control	1054 Oregon Street, St. Helens, OR 97051	$790,760.70
	Columbia County Fair Grounds	2084 Oregon Street, St. Helens, OR 97051	$735,396.65
	Clatskanie Shop Bldg (Road Dept)	58892 Saulser Road, St. Helens, OR 97051	$3,916,329.64
	Rainier Shop Equipment Shed (Road Dept)	5th Street, Clatskanie, OR 97016	$339,532.75
	Vernonia Shop Bldg (Road Dept)	30526 Brownlee Road, Rainier, OR 97048	$464,930.31
Emergency Response	Sheriff's Office / Jail Community Corrections	901 Port Avenue, St. Helens, OR 97051	$16,183,948.97
	Emergency Operations Center	58595 McNulty Way, St. Helens, OR 97051	$639,246.08
	Columbia 911 Communications District	58688 McNulty Way, St. Helens, OR 97051	$830,346.88 office building $2,351,200.00 Contents and tower
	Microwave Relay Stations	Various locations	$2,065,544.20
	Clatskanie Rural Fire (CRF)– Main	230 SE 3Rd· Clatskanie, OR	$1,278,886.00
	CRF – Substation 1	76015 Atkins Road, Rainier, OR	$260,372.00

Table 8. Critical Facilities and Infrastructure			
Facility Type	**Name / Number**	**Address**	**Value[1]**
	Columbia River Fire and Rescue (CRF&R) Administrative Office	270 Columbia Blvd, St. Helens, OR	$616,665.92
	CRF&R Columbia County Station	400 G Street, Columbia County, OR	$28,444.00
	CRF&R Fairgrounds Station	58798 Sausler Road, St. Helens, OR	$380,580.72
	CRF&R Rainier Station	211 W 2nd Street, Rainier, OR	$1,872,175.33
	CRF&R St. Helens Station	105 S 12th Street, St. Helens, OR	$3,041,144.96
	CRF&R Maintenance Shop	58555 McNulty Way, St. Helens, OR	$476,984.00
	CRF&R Garage – Goble	69321 Nicolai Road, Goble, OR	$82,487.60
	CRF&R Garage – Rainier	73667 Neer County Road, Rainier, OR	$16,410.00
	CRF&R Fire Station – Deer Island	33701 Canaan Road, Deer Island, OR	$380,580.72
	CRF&R Fire Station – Fernhill	73153 Doan Road, Rainier, OR	$375,460.80
	CRF&R Fire Station – Goble	69321 Nicolai Road, Goble, OR	$375,460.80
	Mist-Birkenfeld Rural Fire Protection District – Main Station	12525 Highway 202, Mist, OR	$1,349,996.00 Building $170,664.00 Contents
	Mist-Birkenfeld Rural Fire Protection District – Sager Sub Station # 2	75125 Highway 202, Clatskanie, OR	$80,956.00
	Mist-Birkenfeld Rural Fire Protection District – Station # 3	71921 N Shore Drive, Clatskanie, OR	$99,554.00
	Mist-Birkenfeld Rural Fire Protection District – Sub Station # 4	65551 Nehalem Highway, Vernonia, OR	$84,238.00
	Mist-Birkenfeld Rural Fire Protection District – Storage	67131 Burris Road, Vernonia, OR	$49,230.00
	Mist-Birkenfeld Rural Fire Protection District – Storage	11131 Highway 202, Birkenfeld, OR	$73,298.00
	Scappoose Rural Fire Protection District (RFPD) Main	52751 Columbia River Highway, Scappoose, OR	$2,526,046.00
	Scappoose RFPD – Boathouse Lighthouse Moorage	34323 Johnson Landing Road, Scappoose, OR	$29,538.00
	Scappoose RFPD – Chapman	27713 Chapman Road, Scappoose, OR	$271,312.00

Table 8. Critical Facilities and Infrastructure			
Facility Type	**Name / Number**	**Address**	**Value[1]**
	Scappoose RFPD – Holbrook	19260 NW Cleetwood Dr, Portland, OR	$80,956.00
	County Sheriff's Sub Station Delena Fire Station	76015 Atkins Rd. Clatskanie, OR 97016	$5,432.80
	Mist-Birkenfeld County Sheriff's Substation	12525 Hwy 202, Mist, OR	$2,635.45
Care Facility	Legacy Clinic	500 Columbia River Hwy, St. Helens, OR 97051	$1,183,161.00
	Providence Medical Center	510 Bridge Street, Vernonia, OR 97064	Unknown
	OHSU Clinic	53177 Old Portland Road, Scappoose, OR	$294,986.16
	Clatskanie Family Health Center	401 SW Bel Air Drive, Clatskanie, OR	Unknown
	Avamere at St. Helens	2400 Gable Road, St. Helens	$191,450.00
	Clatskanie Care Center	203 SW Bel Air Drive, Clatskanie, OR	Unknown
	Columbia Care	33910 Columbia Avenue, Scappoose, OR	Unknown
County Roads	There are 553 miles of county-maintained roads in Columbia County	County wide	**553 x $415,720 = $229,893,160.00**
Railroads	Portland and Western Railroad	51 miles	
Bridges	There are 97 county maintained non state or federally owned bridges in Columbia County		Total value of all bridges estimated at: $80,349,752.24
Transportation Facilities	Dixieline Lumber Co (deep water dock)	62420 Columbia River Hwy, Columbia County, OR	**Unknown**
	Knife River Dock	63180 Columbia River Hwy, Deer Island, OR	**Unknown**
	Port of St Helens Facility, Port Westward	(deep water port, 1,250 ft dock) Clatskanie, OR 97016	**Unknown**
	Port of St Helens Facility, Rainier – Teevins Bros	(deep water access) Rainier, OR 97048	**Unknown**

Table 8. Critical Facilities and Infrastructure			
Facility Type	**Name / Number**	**Address**	**Value[1]**
	Columbia County Rider	1155 Deer Island Road St Helens, OR 97051	Unknown
Utilities	Meissner Radio Repeater		$20,639.40
	Fishhawk Lake Recreation Club Inc, Water Treatment Plant		$39,723.14
	KOHI Radio Station		$1,312,800.00
	Rainier Waste Water Treatment Plant		Unknown
	Transfer Station		$757,321.50
	Clatskanie PUD, Main Office		Unknown
	Clatskanie PUD, Conservation Bldg		$202,556.29 Building $46,420.61 Contents
	Clatskanie PUD, Warehouse		$2,328.00 Building $11,605.15 Contents
	Clatskanie PUD, Pole Yard		$2,133,399.55 Building $1,740,772.80 Contents
	Clatskanie PUD, Bradbury Substation		$58,196.42
	Clatskanie PUD, Clatskanie Substation		$5,716,150.00
	Clatskanie PUD, Delena Substation		$1,790,265.36
	Clatskanie PUD, Rainier Substation		$1,783,438.80
	Clatskanie PUD, Rainier Switching Station		$1,790,265.36
	Clatskanie PUD, Wauna Substation		$178,343.88
	Clatskanie PUD, Gas Turbine		$9,145,840.00
	Columbia River PUD		$6,885,636.00
	Western Oregon Electric Coop, Inc (WOEC), Headquarters		$24,138,203.07
	WOEC Warehouse		$898,721.00
	WOEC Overhead Transmission Lines		$459,480.00
	WOEC Underground Transmission Lines		$7,548,600.00
	WOEC Storage Buildings		$153,160.00
	WOEC Substation 1		$2,188,000.00
	WOEC Substation 2		$2,188,000.00

Table 8. Critical Facilities and Infrastructure			
Facility Type	**Name / Number**	**Address**	**Value[1]**
	WOEC Substation 3		$2,188,000.00
	WOEC Substation 4		$2,188,000.00
	Deer Island Water Works		Unknown
	Fishhawk Lake Recreation Club Inc, Sewage Treatment Plant		Unknown
	McNulty Water PUD Association		Unknown
	Quincy Water Association		$23,061.52
	Woodson Water Association		$202,411.88
	Scappoose Water Treatment Plant – Primary		Unknown
	Scappoose Water Treatment Plant – Secondary		Unknown
	Scappoose Waste Water Treatment Plant		Unknown
	St. Helens Waste Water / Sewage Treatment Plant		$29,829,624.30
	Vernonia Water Treatment Plant		$3,428,596.00
	Vernonia Waste Water Treatment Plant		Unknown
	Northwest Natural - Natural Gas and Pipelines		Unknown
	BPA and PGE transmission		Unknown
Dams	Vernonia Log Pond		Unknown
	James O. Fisher Reservoir		Unknown
	Petes Slough		Unknown
	Deep Lake Reservoir		Unknown
	Ruby Lake Reservoir		Unknown
	Millionaire Lake Reservoir		Unknown
	Salmonberry Reservoir		Unknown
	Sherman Stock Reservoir # 1		Unknown
	Sherman Stock Reservoir # 2		Unknown
	Bauder Reservoir		Unknown
	Beaver Drainage District	P.O. Box 201, Clatskanie, OR 97016	Unknown
	Clatskanie Drainage Improvement Company	P.O. Box 201, Clatskanie, OR 97016	Unknown
	Columbia Drainage #1	33491 NW Reeder Road, Portland, OR 97231	Unknown

Table 8. Critical Facilities and Infrastructure			
Facility Type	**Name / Number**	**Address**	**Value**[1]
	Deer Island Drainage	St. Helens, OR 97051	Unknown
	Fishhawk Lake	9997 Beach Drive, Clatskanie, OR (Birkenfeld, OR)	Unknown
	John Drainage Improvement Company	79338 Stewart Creek Road, Clatskanie, OR 97016	Unknown
	Marshland Drainage Improvement	12589 Hwy 30, Clatskanie, OR 97016	$1,094.00
	Magruder Drainage Improvement Company	15914 Colvin Road, Clatskanie, OR 97016	Unknown
	Midland Drainage Improvement	15694 Luxford Road, Clatskanie, OR 97016	$744,707.68
	Rainier Drainage Improvement	75442 Fern Hill Road, Rainier, OR 97048	Unknown
	Sauvie Island Drainage Improvement	34856 E. Columbia Avenue, Scappoose,	Unknown
	Scappoose Drainage Improvement	53466 E. Honeyman Road, Scappoose, OR 97056	Unknown
	Westland Drainage Improvement Company	P.O. Box 201, Clatskanie, OR 97016	Unknown
	Clatsop Diking Improvement Company	P.O. Box 201, Clatskanie, OR	Unknown
	Woodson Drainage District	77521 Woodson Road, Clatskanie, OR 97016	Unknown

[1] The valuations of these properties were calculated as the 2014 insured values of the buildings multiplied by 8.6% in order to account for inflation between 2014-2019 as referenced by the Bureau of Labor Statistics

Vulnerability Analysis

A vulnerability analysis predicts the extent of exposure, and the impacts that may result from a hazard event of a given intensity in each area. The analysis provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing communities to focus attention on areas with the greatest risk of damage.

The Tables 9, 10, 11 are derived from the best available data for facility locations and values. In many cases, values were unavailable, and therefore the totals listed below should be considered incomplete and likely less than the actual costs associated with the respective hazards

Methodology

A conservative exposure-level analysis was conducted to assess the risks of the identified hazards. This analysis is a simplified assessment of the potential effects of the hazards on values at risk without consideration of probability or level of damage.

Using census block level information, a spatial proportion was used to determine the percentage of the population and residential and nonresidential structures located where hazards are likely to occur. Census blocks that are completely within the boundary of a hazard area were determined to be vulnerable and were totaled. A spatial proportion was also used to determine the amount of linear assets, such as highways, within a hazard area. The exposure analysis for linear assets was measured in miles.

Replacement values or insurance coverage were developed for physical assets. For facilities that didn't have specific values per building in a multi-building scenario (e.g., schools), the buildings were grouped together and assigned one value where available. Value information is not available for all critical facilities at this time and will be collected as it becomes available. For each physical asset located within a hazard area, exposure was calculated by assuming the worst-case scenario (that is, the asset would be destroyed and would have to be replaced). Finally, the aggregate exposure, in terms of replacement value or insurance coverage, for each category of structure or facility was calculated.

Data

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in an approximation of risk. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment as well as the use of approximations and simplifications that are necessary for a comprehensive analysis.

Table 9. Columbia County Potential Hazard Exposure Analysis Overview – Population and Buildings							
			Population	Buildings			
				Residential		Non-Residential	
Hazard Type	Hazard Area	Methodology	Number	Number	Value ($)[1]	Number	Value ($)[1]
Flood	Moderate	500-year floodplain	31,889	9,337	1,407,085,900	49	unknown
	High	100-year floodplain	22,145	8.686	1,308,980	48	unknown
Winter Storm		descriptive	49,163	17,572	2,648,100,400	91	unknown
Landslide	Moderate	>14-32 degrees	34,155	13,075	1,970,402,500	63	unknown
	High	>32-56 degrees	21,896	8,437	1,271,455,900	34	unknown
Wildland Fire	Moderate	Moderate fuel rank	44,470	16,784	2,529,348,800	91	unknown
	High	High fuel rank	38,825	14,793	2,229,305,100	75	unknown
	Very High	Very high fuel rank	25,791	9,856	1,485,299,200	38	unknown
	Extreme	Extreme fuel rank	11,856	4,559	687,041,300	20	unknown
Earthquake	Strong	9-20% (g)	44,113	16,552	2,494,386,400	91	unknown
	Very strong	20-40% (g)	726	404	60,882,800	0	unknown
	Severe	>40-60% (g)	0	0	0	0	0
Volcano		descriptive	49,163	17,572	2,648,100,400	91	unknown
Wind		descriptive	49,163	17,572	2,648,100,400	91	unknown
Erosion		within 300' of potential areas of erosion	--	925	139,397,500	11	unknown
ENSO (El Niño and La Niña)		descriptive	49,163	--	--	--	--
Expansive Soils	Low	<3% percent	--	14,482	2,182,437,400	71	unknown
	Moderate	3-6 percent	15,320	6,038	909,926,600	26	unknown
	High	6-9%	623	250	37,675,000	0	unknown
	Very High	>9%	0	0	0	0	0
Drought		descriptive	--	--	--	--	--

[1] Average insured structural value of all residential buildings (including single-family dwellings, mobile homes, etc., is $150,700 per structure).

Table 10. Columbia County Potential Hazard Exposure Analysis Overview – Critical Facilities

Hazard Type	Hazard Area	Methodology	Government		Emergency		Educational		Care		Community	
			No.	Value ($)[1]	No.	Value ($)[1]	No.	Value ($)[1]	No.	Value ($)[1]	No.	Value ($)[1]
Flood	Moderate	500-year floodplain	6	13.5M	7	7M	7	21M	--	--	--	--
	High	100-year floodplain	8	13.3M	14	10.5M	--	--	3	341K	9	21.3M
Winter Storm			25	24.3M	36	32.6M	55	201.2M	16	792K	122	15M
Landslide	Moderate	>14-32 degrees	15	19.2M	20	9.6M	32	82.8M	7	720K	73	7.9M
	High	>32-56 degrees	8	14.4M	6	1.1M	7	42M	4	175K	27	3.2M
Wildland Fire	Moderate	Moderate fuel rank	25	24.3M	32	31.8M	54	200M	16	792K	116	14.7M
	High	High fuel rank	19	21.6M	27	3.2M	39	129.9M	9	450K	94	12.5M
	Very High	Very high fuel rank	5	1M	14	26.3M	17	48.7M	3	175K	37	4.8M
	Extreme	Extreme fuel rank	1	150K	2	425K	--	--	--	--	2	unknown
Earthquake	Strong	9-20% (g)	25	24.4M	35	32.5M	55	201.2M	16	792K	118	15.1M
	Very strong	20-40% (g)	--	--	1	67K	--	--	--	--	4	unknown
	Severe	>40-60% (g)	--	--	--	--	--	--	--	--	--	--
Volcano			25	24.3M	36	32.6M	55	201.2M	16	792K	122	15M
Wind			25	24.3M	36	32.6M	55	201.2M	16	792K	122	15M
Erosion		within 300' of potential areas of erosion	8	13.5M	3	3M	6	20.4M	4	341K	10	1.6M
ENSO (El Niño and La Niña)		descriptive	25	26M	36	33M	57	162M	16	792K	117	15M
Expansive Soils	Low	<3% percent	--	--	--	--	--	--	--	--	--	--
	Moderate	3-6 percent	--	--	1	8.8K	--	--	--	--	1	840K
	High	6-9%	--	--	--	--	--	--	--	--	--	--
	Very High	>9%	--	--	--	--	--	--	--	--	--	--
Drought		descriptive	25	26M	36	33M	57	162M	16	792K	117	15M

Table 11. Columbia County Potential Hazard Exposure Analysis Overview – Critical Infrastructure

			Highways		Railroads		Bridges		Transportation		Utilities		Dams	
Hazard Type	Hazard Area	Methodology	Miles	Value	Miles	Value	No.	Value	No.	Value	No.	Value	No.	Value
Flood	Moderate	500-year floodplain	--	--	--	--	21	21.9M	2	unk	9	6.5M	4	unk
	High	100-year floodplain	--	--	--	--	88	64M	2	unk	9	6.5M	8	680K
Winter Storm			--	--	unk	unk	100	73M	9	720K	29	84.2K	20	686K
Landslide	Moderate	>14-32 degrees	unk	unk	--	--	75	49.4M	4	719K	19	39.7M	13	unk
	High	>32-56 degrees	--	--	--	--	43	29.4M	3	719K	4	32.2M	8	unk
Wildland Fire	Moderate	Moderate fuel rank	--	--	--	--	98	69.3M	8	720K	26	68.1M	15	681K
	High	High fuel rank	--	--	--	--	91	66M	5	719K	20	37.1M	14	unk
	Very High	Very high fuel rank	--	--	--	--	55	35.6M	--	--	10	33.5M	9	unk
	Extreme	Extreme fuel rank	--	--	--	--	4	2.3M	--	--	1	1.6M	2	unk
Earthquake	Strong	9-20% (g)	--	--	--	--	95	67.8M	9	719K	22	67.7M	16	680K
	Very strong	20-40% (g)	--	--	--	--	6	8M	--	--	7	16.5M	4	5K
	Severe	>40-60% (g)	--	--	--	--	--	--	--	--	--	--	--	--
Volcano			--	--	unk	unk	100	73M	9	720K	29	84.2K	20	686K
Wind			--	--	unk	unk	100	73M	9	720K	29	84.2K	20	686K
Erosion		within 300' of potential areas of erosion	--	--	--	--	10	7M	2	720K	4	1.1M	2	unk
ENSO		descriptive	4	206M	51	unk	--	--	9	720K	38	123M	29	686K
Expansive Soils	Low	<3% percent	--	--	--	--	--	--	--	--	--	--	--	--
	Moderate	3-6 percent	--	--	--	--	--	--	--	--	--	--	--	--
	High	6-9%	--	--	--	--	--	--	--	--	--	--	1	unk
	Very High	>9%	--	--	--	--	--	--	--	--	--	--	--	--
Drought		descriptive	4	206M	51	unk	--	--	9	720K	38	123M	29	686K

National Flood Insurance Policy

National Flood Insurance Program data were obtained from the State Department of Land Conservation and Development. This data is significant for the vulnerability assessment as it identifies the impact of flooding, one of the most often repeated natural hazards for the county. This data is displayed in Table 12 and 12a.

Table 12. Columbia County NFIP Insurance Report

Jurisdiction	Effective FIRM and FIS	Initial FIRM	Total Policies	Pre—FIRM Policies	Policies by Building Type				Minus Rated A Zone	Minus Rated V Zone
					Single Family	2 to 4 Family	Other Residential	Non-Residential		
Columbia County	11/26/2000	8/16/1988	315	196	292	1	0	20	13	0

Source: FEMA Community Information System 02/21/2019

Table 12a. Columbia County NFIP Insurance Report

Jurisdiction	Insurance in Force	Total Paid Claims	Pre-Firm Claims Paid	Substantial Damage Claims	Total Paid Amount	Repetitive Loss Structures	Severe Repetitive Loss Structures	CRS Class Rating	Last Community Assistance Visit
Columbia County	$76,844,600	112	74	33	$3,149,235	5	0	10	4/28/2000

Source: FEMA Community Information System 02/21/2019

Mitigation Strategy

The following section defines mitigation action identification and analysis as stipulated in DMA 2000 and its implementing regulations.

DMA 2000 Requirements: Mitigation Strategy	
Planning Requirements	
§201.6(c)(3)	The plan shall include the following: A mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
§201.6(c)(3)(i)	The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
§201.6(c)(3)(ii)	The hazard mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.
§201.6(c)(3)(iii)	The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
§201.6(c)(3)(iv)	For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
§201.6(c)(4)(ii)	The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.
Planning Elements	
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? 44 CFR 201.6(c)(3)	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? 44 CFR 201.6(c)(3)(ii)	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? 44 CFR 201.6(c)(3)(i)	
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? 44 CFR 201.6(c)(3)(ii) and 44 CFR 201.6(c)(3)(iv)	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? 44 CFR 201.6(c)(3)(iii) and 44 CFR (c)(3)(iv)	
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? 44 CFR 201.6(c)(4)(ii)	

Identify Mitigation Goals

Columbia County Steering committee adopted the Goals in Table 13 for the current planning period.

Table 13. Columbia County Mitigation Goals

Goal Number	Goal Description
1	**Reduce the Threat to Life Safety** Enhance life safety by minimizing the potential for deaths and injuries in future disaster events.
2	**Protect Critical Facilities and Enhance Emergency and Essential Services** • Implement activities or projects to protect critical facilities and infrastructure. • Seek opportunities to enhance, protect, and integrate emergency and essential services. • Strengthen emergency operations plans and procedures by increasing collaboration and coordination among public agencies, non-profit organizations, businesses, and industry.
3	**Reduce the Threat to Property** • Seek opportunities to protect, enhance and integrate emergency and essential services. • Strengthen emergency operations plans and procedures by increasing collaboration and coordination among public agencies, non-profit organizations, businesses, industries and the citizens of Columbia County.
4	**Create a Disaster Resistant and Disaster-Resilient Economy** • Develop and implement activities to protect economic well-being and vitality while reducing economic hardship in post disaster situations. • Reduce insurance losses and repetitive claims for chronic hazard events. • Work with State and Federal Partners to reduce short-term and long-term recovery and reconstruction costs. • Work with local and County organizations, such as Columbia Emergency Planning Association (CEPA). • Expedite pre-disaster and post-disaster grants and program funding.
5	**Increase Public Awareness, Education, Outreach, and Partnerships** • Coordinate and collaborate, where possible, risk reduction outreach efforts with the Oregon Partners for Disaster Resistance & Resilience and other public and private organizations. • Develop and implement risk reduction education programs to increase awareness among citizens, local, county, and regional agencies, non-profit organizations, businesses, and industry. • Promote insurance coverage for catastrophic hazards • Strengthen communication and coordinate participation in and between public agencies, citizens, nonprofit organizations, businesses, and industry.

Evaluate and Prioritize Mitigation Actions

Mitigation actions are activities, measures, or projects that help achieve the goals of a mitigation plan. Table 14 lists the mitigation actions developed during this mitigation planning process or offered during whole community planning activities. It is not intended that this plan will attempt to act on all of these action items, but the list will be maintained in order to provide documentation for future planning efforts.

Mitigation strategies were evaluated using FEMA's recommended STAPLEE process. This process addresses all major factors when weighing the costs and benefits of implementing one action over another. Important factors to be considered when ranking the strategies include the prohibitive costs, the community's resource capabilities, the community's desires and concerns, and the overall feasibility of the action. STAPLEE criteria were used to evaluate the potential

benefits of each participant's listing of mitigation alternatives or actions. The STAPLEE evaluation includes consideration of the social, technical, administrative, political, legal, economic, and environmental benefits of the mitigation actions, which are summarized below.

- S – Social: Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the communities social and cultural values.
- T – Technical: Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
- A – Administrative: Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
- P – Political: Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support of the action. L – Legal: It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
- E – Economical: Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
- E – Environmental: Sustainable mitigation actions that do not have an adverse effect on the environment, comply with Federal, State, and local environmental regulations, and are consistent with the community's environmental goals provide mitigation benefits while being environmentally sound.

STAPLEE criteria were reviewed and applied to proposed mitigation actions in order to provide a prioritized list in each jurisdiction. HSEMC and other key personnel and members attending the public meetings were asked to take into account all of the STAPLEE criteria and to come up with a cumulative priority ranking that maximizes the benefits of each alternative. The projects with the greatest benefits and lowest relative costs as determined by the STAPLEE criteria were assigned a higher priority, while alternatives with lower benefits and relatively higher costs were assigned a lower priority.

In the future, a more detailed and formal formulation of the costs and benefits of each mitigation strategy could be established to better prioritize the participant action items. A final list of strategies, or actions, was established including information on the associated hazard mitigated and a description of the action, responsible party, cost estimate, potential funding sources and timeline.

Table 14. Columbia County Mitigation Actions – Existing and Newly Considered			
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
Multi-Hazard			
Multi-Hazard	*Ongoing*		Inventory and protect critical facility glass breakage associated with wind, seismic, fire, terrorism, and other hazards to ensure occupant safety.
Multi-Hazard	*Ongoing*		Review ordinances and develop outreach programs to assure propane tanks are properly anchored and hazardous materials are properly stored and protected from known natural hazards such as seismic or flooding events.
Multi-Hazard	*Ongoing*		Cross-reference and incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, land use, transportation plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.
Multi-Hazard	*Ongoing*		Develop and incorporate mitigation provisions and recommendations into zoning ordinances and community development processes to maintain the floodway and protect critical infrastructure and private residences from other hazard areas.
Multi-Hazard	*Ongoing*		Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short-term power disruption. (i.e. first responder and medical facilities, schools, correctional facilities, and water and sewage pump stations, etc.)
Multi-Hazard	*Ongoing*		Install lightning rods and lightening grade surge protection devices on critical electronic components such as warning systems, communications equipment, and computers for critical facilities.
Multi-Hazard	*Ongoing*		Develop, produce, and distribute information materials concerning

Table 14. Columbia County Mitigation Actions – Existing and Newly Considered			
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
			mitigation, preparedness, and safety procedures for all natural hazards.
Multi-Hazard	*Ongoing*		Explore the need for, develop, and implement hazard-zoning ordinances for high-risk hazard area land-use.
Multi-Hazard	*Ongoing, Partially Complete*		Identify and list repetitively flooded structures and infrastructures, analyze the threat to these facilities, and prioritize mitigation actions to acquire, relocate, elevate, and/or flood proof to protect the threatened population.
Multi-Hazard	*Ongoing, and Partially Complete*		Install storm shutters, hurricane clips, bracing systems, etc. as part of retrofit to meet applicable building codes while reducing disaster damages.
Multi-Hazard	*Ongoing, and Partially Complete*		Retrofit structures to protect them from seismic, flood, high wind, earthquake, or other natural hazard events.
Multi-Hazard	*Ongoing& Partially Complete*		Acquire, demolish, or relocate structures from hazard prone areas. Property deeds shall be restricted for open space uses in perpetuity to keep people from rebuilding in hazard areas.
Multi-Hazard	*Ongoing, and Partially Complete*		Harden utility infrastructure located along transportation corridors and river embankments to mitigate potential flood, debris, and erosion damages.
Multi-Hazard	*Ongoing*		Regularly Maintain a plan to develop a sustainable process to implement, monitor, and evaluate countywide mitigation actions.
Multi-Hazard	*Ongoing*		Pursue funding opportunities to implement mitigation actions.
Multi-Hazard	*Ongoing*		Develop public and private sector partnerships to foster hazard mitigation activities.
Flood			

Table 14.	Columbia County Mitigation Actions – Existing and Newly Considered		
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
Flood	*Ongoing*		Complete inventory of critical facilities within 100-year and 500-year floodplains, with GIS mapping if possible.
Flood	*Ongoing*		Complete inventory of residential and commercial buildings within 100-year and 500-year floodplains, with GIS mapping if possible.
Flood	*Ongoing*		Consult with property owners and explore mitigation actions for any Columbia County properties on FEMA's national repetitive loss list
Flood	*new*		Explore mitigation options with critical facilities property owners and implement mitigation measures within the 100-year floodplain and for other structures deep within the 100-year floodplain.
Flood	*Ongoing*		Determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches for locations with repetitive flooding and significant damages or road closures,
Flood	*Ongoing*		Support FIRM Update.
Flood	*Ongoing*		Develop an outreach program to educate public concerning NFIP participation benefits, floodplain development, land use regulation, and NFIP flood insurance availability to facilitate continued compliance with the NFIP.
Flood	*Ongoing*		Develop, implement, and enforce floodplain management ordinances.
Flood	*Ongoing*		Install new stream flow and rainfall measuring gauges.
Flood	*Completed*		Develop or revise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention basins.
Flood	*Ongoing*		Increase culvert size to increase its drainage efficiency.
Winter Storms			

Table 14. Columbia County Mitigation Actions – Existing and Newly Considered			
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
Winter Storms	*Ongoing*		Enhance tree-trimming efforts especially for transmission lines and trunk distribution lines.
Winter Storms	*Ongoing*		Encourage prudent tree planting (avoid service lines) and safe, professional tree trimming where necessary.
Winter Storms	*Ongoing*	Partially complete	Ensure that all critical facilities in Columbia County have backup power and emergency operations plans to deal with power outages.
Winter Storms	*Ongoing*		Determine and implement mitigation measures such as upsizing culverts or storm water drainage ditches for locations with repetitive flooding and significant damages or road closures.
Winter Storms	Ongoing		Consider upgrading lines and poles to improve wind/ice loading, undergrounding critical lines, and adding interconnect switches to allow alternative feed paths and disconnect switches to minimize outage areas.
Winter Storms	*Ongoing*		Encourage new developments to include underground power lines
Winter Storms	*Ongoing*		Install new stream flow and precipitation measuring gauges and develop monitoring and early warning program.
Winter Storms	*Ongoing*		Develop outreach program with school districts.
Winter Storms	*Completed*	Enforcement continuing	Implement and enforce the most current Uniform International, and State, Building Codes to ensure structures can withstand winter storm hazards such as high winds, rain, water and snow.
Winter Storms	*Ongoing*		Increase power line wire size and incorporate quick disconnects (breakaway devices) to reduce load on power lines to prevent severe wind or winter ice storm event failure.
Landslide			

Table 14. Columbia County Mitigation Actions – Existing and Newly Considered			
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
Landslide	*Ongoing*		Complete the inventory of locations where critical facilities, other buildings and infrastructure are subject to landslides.
Landslide	*Ongoing*		Consider landslide mitigation actions for slides seriously threatening critical facilities, other buildings or infrastructure.
Landslide	*Complete*		Limit future development in known landslide potential areas.
Landslide	*Ongoing*		Develop comprehensive geological landslide and rockslide prone area maps. (LIDAR)
Wildland Fire			
Wildland Fire	*Ongoing*		Identify specific parts of Columbia County at high risk for urban/wildland urban interface fires because of fuel loading, topography and prevailing construction practices.
Wildland Fire	*Ongoing*		Identify evacuation routes and procedures for high-risk areas and educate the public.
Wildland Fire	*Complete*		Develop Community Wildland Fire Protection Plans for all at-risk communities.
Wildland Fire	*Ongoing*		Encourage fire-safe construction practices for existing and new construction in high-risk areas.
Wildland Fire	*Ongoing*		Continue to encourage home landscape cleanup (defensible space) and debris disposal..
Wildland Fire	*Ongoing*		Identify potential fuel breaks and fuel reduction zones and implement mitigation actions.
Wildland Fire	*Complete*		Implement SB360 Wildland Urban Interface Act of 1997 in Columbia County.
Wildland Fire	*Deferred*	Considered 2008 Lack of funding and staff	Identify critical facilities and vulnerable populations based on mapped high hazard areas.
Earthquake			

Table 14. Columbia County Mitigation Actions – Existing and Newly Considered			
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
Earthquake	*Deferred*	Considered 2008 Lack funding and staff	Complete inventory of public and commercial buildings that may be particularly vulnerable to earthquake damage.
Earthquake	*Ongoing*		Disseminate FEMA pamphlets to educate homeowners about structural and non-structural retrofitting of vulnerable homes and encourage retrofit.
Earthquake	*Ongoing*		Complete seismic vulnerability analysis of important public facilities with significant seismic vulnerabilities.
Earthquake	Ongoing		Obtain funding and retrofit important public facilities with significant seismic vulnerabilities.
Earthquake	*Ongoing*		Retrofit bridges that are not seismically adequate for lifeline transportation routes.
Earthquake	*Deferred*	Considered 2008 Lack of staff and funding	Identify high seismic hazard areas; develop a wood-frame residential building inventory and an outreach program to educate population concerning facilities particularly vulnerable to earthquake damage, such as pre-1940s homes and homes with cripple wall foundations.
Earthquake	*Ongoing*		Retrofit critical public facilities with significant seismic vulnerabilities, such as unreinforced masonry construction.
Earthquake	*Ongoing*		Complete seismic vulnerability analysis of important public facilities with significant seismic vulnerabilities.
Volcano			
Volcano	*Ongoing*		Update public emergency notification procedures and develop an outreach program for ash fall events.
Volcano	*Ongoing*		Update emergency response planning for ash fall events.
Volcano	*Ongoing*		Update emergency response planning and develop client focused outreach

Table 14. Columbia County Mitigation Actions – Existing and Newly Considered			
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
			program for ash fall events affecting river, air, and highway transportation, and industrial facilities and operations.
Wind			
Wind	*Ongoing*		Review ordinances and develop outreach programs to assure mobile homes and manufactured buildings are protected from severe wind hazards. (Anchoring, elevation, siting, and other methods as applicable) (Based on wind exposure areas)
Wind	*Ongoing*		Identify and prioritize critical facilities' overhead utilities that could be placed underground to reduce power disruption from windstorm / tree blow down damage.
Wind	*Ongoing*		Corridor tree removal to protect utilities.
Wind	*Ongoing*		Increase power line wire size and incorporate quick disconnects (breakaway devices) to reduce ice load power line failure during severe wind or winter ice storm events.
Erosion			
Erosion	*Ongoing*		Maintain and update erosion hazard locations, identify critical facilities potentially impacted and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce the threat.
Erosion	*Ongoing*		Enforce through existing ordinance new construction standards regarding development in erosion hazard areas.
Erosion	*Ongoing*		Apply for grants/funds to implement riverbank protection methods.
Erosion	*Ongoing*		Hold series of community meetings and other outreach efforts to provide erosion hazard specific information to residents dependent upon erosion hazard location data.

Table 14. Columbia County Mitigation Actions – Existing and Newly Considered			
Hazard	**Status Complete, Deferred, Deleted, Ongoing, or New**	**Comment**	**Description**
Erosion	*Ongoing*		Install bank protection where needed.
Erosion	*Ongoing*		Develop outreach program to educate the public concerning planting processes and materials used to stabilize hill slopes or stream banks. This is known as bioengineering; which uses logs, root wads, or wood debris or other vegetation to reduce scour and erosion.
Erosion	*Ongoing*		Install erosion control during new construction.
ENSO (El Niño / La Niña)			
ENSO	*Ongoing*		Educate public regarding weather patterns associated with El Niño / La Niña.
Expansive Soils			
Expansive Soils	*Completed*	Must determine how to access data/maps	Develop and maintain inventory of expansive soils throughout Columbia County.
Drought			
Drought	*Ongoing*		Encourage the USACOE to prioritize dams according to hazard risks such as seismic vulnerability and make seismic improvements as necessary.
Drought	*Ongoing*		Evaluate the adequacy of dams and dike systems for both floods and earthquakes and implement mitigation measures as necessary.

Mitigation Action Plan

The Steering Committee has evaluated and prioritized considered mitigation actions to determine which would be included in the Mitigation Action Plan. The Committee then determined the responsible agency and potential funding sources. The Mitigation Action Plan represents mitigation projects and programs to be implemented through the cooperation of multiple entities.

Upon review, the Steering Committee assigned a high priority ranking to actions that best fulfill the goals of the NHMP and are appropriate and feasible for the County and responsible entities to implement during the 5-year lifespan of this version of the NHMP. As such, the Steering

Committee determined that only the mitigation actions that received a high priority ranking would be included in the County's Mitigation Action Plan. Table 15 depicts the County's mitigation actions grouped by hazard and in descending priority order within each hazard.

Table 15. Columbia County Mitigation Action Plan Matrix

Hazard	Description	Managing Department / Agency	Timeframe	Potential Funding Source(s)	Benefit-Costs / Technical Feasibility
Multi-Hazard (MH)					
MH	Purchase and install generators with main power distribution disconnect switches for identified and prioritized critical facilities susceptible to short term power disruption. The Priority will be the County Fairgrounds which has been identified as the primary mass care and COOP location for the county.	Public Works	3-5 years	General Fund, HS, HMGP	BC: TBD TF: Yes
MH	Electronic surge protection devices on critical electronic components such as warning systems, communications equipment, and computers for critical facilities.	Public Works	1 yr	General Fund	BC: TBD TF: Yes
MH	Update or develop, implement, and maintain jurisdictional debris management plans.	County Admin/ Public Works	1-3 yrs	General Fund	BC: TBD TF: Yes
MH	Develop and implement strategies and educational outreach programs for debris management.	County Admin/ Public Works	1-3 yrs (Plan) 3-5 (outreach)	General Fund	BC: TBD TF: Yes
MH	Cross reference and incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, land use, transportation plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.	County Admin/ Planning	1-5 yrs	General Fund	BC: TBD TF: Yes
MH	Develop outreach program for educating private facility owners/operators concerning alternative or emergency power source acquisition to enable them to deliver services during disaster emergency response and recovery efforts.	County Admin Public Works	2-5 yrs	General Fund	BC: TBD TF: Yes
MH	Develop critical facility list needing emergency back-up power systems, prioritize, seek funding and implement mitigation actions.	Public Works	1-2 yrs	General Fund	BC: TBD TF: Yes

Table 15. Columbia County Mitigation Action Plan Matrix					
Hazard	**Description**	**Managing Department / Agency**	**Timeframe**	**Potential Funding Source(s)**	**Benefit-Costs / Technical Feasibility**
MH	Update public emergency notification procedures and develop an outreach program for all emergencies	County Admin	3-5 years	General Fund, NOAA/NWS, HMPG	BC:TBD TF: Yes
Flood					
Flood	Develop and implement a plan with local stakeholders to address Fox Creek repeated flooding issues	County Admin	1-2 yrs	General Fund	BC: TBD TF: Yes
Flood	Develop system of flood gauges at rivers in the county that frequently flood and make provisions to provide that telemetry to locations including the EOC and NWS	County Admin Public Works	2-5 yrs	General Fund	BC: TBD TF: Yes
Flood	Develop, implement, and enforce floodplain management ordinances.	County Admin	1-3 yrs	General Fund	BC: TBD TF: Yes
Flood	Develop, or revise, adopt, and enforce storm water ordinances and regulations to manage run-off from new development, including buffers and retention basins.	County Admin/Planning/ Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Flood	Create detention storage basins, ponds, reservoirs etc. to allow water to temporarily accumulate. Water ultimately returning to its watercourse at a reduced flow rate.	Public Works/ Engineers	0-5 yrs	Street Fund, FMA, HMGP, PDM	BC: TBD TF: Yes
Flood	Implement flood protection to mitigate damage and contamination of wastewater systems.	Public Works	5-10 yrs	Sewer Fund, FMA, HMGP, PDM	BC: TBD TF: Yes
Winter Storm					
Winter Storm	Develop and implement programs to coordinate maintenance and mitigation activities to reduce public infrastructure from severe winter storms.	Public Works	Ongoing	General Fund	BC: TBD TF: Yes
Winter Storm	Review critical facilities and government building energy efficiency, winter readiness, and electrical protection capability. Identify, prioritize, and implement infrastructure upgrade or rehabilitation project prioritization and development.	Public Works	Ongoing	General Fund, HMGP	BC: TBD TF: Yes
Landslide					

Table 15. Columbia County Mitigation Action Plan Matrix					
Hazard	**Description**	**Managing Department / Agency**	**Timeframe**	**Potential Funding Source(s)**	**Benefit-Costs / Technical Feasibility**
Landslide	Inventory high risk landslides that repetitively impact county roads and state highways in the county. Develop and implement solutions to stabilize high risk areas and minimize disruption to travel corridors.	Public Works	Ongoing	General Fund, HMGP	BC: TBD TF: Yes
Landslide	Develop process to limit future development in steep slope areas (permitting, geotechnical review, soil stabilization techniques, etc).	Planning/ Engineering	Completed	General Fund	BC: TBD TF: Yes
Wildland Fire					
Wildland Fire	Update Community Wildland Fire Protection Plan	Fire District	Ongoing	General Fund, FMAP	BC: TBD TF: Yes
Wildland Fire	Provide wildland fire information in an easily distributed format for all residents.	County Admin Fire District	Ongoing	General Fund, FMAP	BC: TBD TF: Yes
Wildland Fire	Develop, adopt, and enforce burn ordinances that require burn permits, restricts campfires, and controls outdoor burning.	County Admin/ Fire District	Ongoing	General Fund	BC: TBD TF: Yes
Earthquake					
EQ	Identify, evaluate, and prioritize critical public facilities' seismic performance.	County Admin/ Public Works/ Engineering	3-5 yrs	General Fund	BC: TBD TF: Yes
Volcano					
Volcano	Evaluate ash impact on storm water drainage system and develop mitigation actions.	Public Works/ Engineering	3-5 yrs	General Fund	BC: TBD TF: Yes
Wind					
Wind	Identify and prioritize critical facilities' overhead utilities that could be placed underground to reduce power disruption from wind storm / tree blow down damage.	Public Works	1-5 yrs	General Fund, Utility Co., HMGP, PDM	BC: TBD TF: Yes
Erosion					

Table 15. Columbia County Mitigation Action Plan Matrix					
Hazard	**Description**	**Managing Department / Agency**	**Timeframe**	**Potential Funding Source(s)**	**Benefit-Costs / Technical Feasibility**
Erosion	Maintain and update erosion hazard locations, identify critical facilities potentially impacted and develop and implement mitigation initiatives	Public Works	3-5 yrs	General Fund, HMGP, PDM	BC: TBD TF: Yes
Erosion	Periodically provide available information to residents on riverbank erosion and methods to prevent it in an easily distributed format.	Public Works	3-5 yrs	General Fund	BC: TBD TF: Yes
Erosion	Install riprap, or pilings to harden or "armor' a stream bank where severe erosion occurs.	Public Works	3-5 yrs	General Fund, FMA, HMGP, PDM	BC: TBD TF: Yes

Plan Adoption and Maintenance

The following section provides documentation of the formal adoption of this annex by the governing board of the district or the County council/county commission of the jurisdiction. It also identifies the standing committee that will be responsible for future reviews between update periods.

DMA 2000 Requirements: Plan Review, Evaluation, Implementation, and Adoption	
Planning Requirements	
§201.6(d)(3)	A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit if for approval within 5 years in order to continue to be eligible for mitigation project grant funding.
§201.6(c)(5)	The plan shall include...] Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., County Council, County commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
Planning Elements	
D1. Was the plan revised to reflect changes in development? *44 CFR201.6(d)(3)*	
D2. Was the plan revised to reflect progress in local mitigation efforts? *44 CFR 201.6(d)(3)*	
D3. Was the plan revised to reflect changes in priorities? *44 CFR 201.6(d)(3)*	
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? *44 CFR 201.6(c)(5)*	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? *44 CFR 201.6(c)(5)*	

Resolution of Adoption (Example)

BEFORE THE BOARD OF COUNTY COMMISSIONERS FOR COLUMBIA COUNTY, OREGON

In the Matter of Adopting the 2014) Columbia County Multi-Jurisdictional) RESOLUTION NO. 40-2014 Hazard Mitigation Plan Update)

WHEREAS, Columbia County, Oregon has experienced repetitive disasters that have damagedcommercial,residentialandpublicproperties,displacedcitizensandbusinesses, and presented general public health and safety concerns; and

WHEREAS, Columbia County has prepared a Multi-Jurisdictional Hazard Mitigation Plan that outlines the options to reduce overall damage and impact from natural hazards; and

WHEREAS, the Multi-Jurisdictional Hazard Mitigation Plan has been reviewed by community residents, business owners, and federal, state and local agencies, and has been revised to reflect their concerns;

NOW, THEREFORE, BE IT RESOLVED that:

1. 1. The Multi-Jurisdictional Hazard Mitigation Plan is hereby adopted as an official plan of Columbia County.

2. 2. A Hazard Mitigation Planning Group is hereby established as a permanent advisory body. The Hazard Mitigation Planning Coordinator shall designate its members, subject to the approval of the County and the participating jurisdictions. They shall serve one-year terms. The group's duties shall be as designated in the Hazard Mitigation Plan.

3. 3. The Hazard Mitigation Planning Coordinator is charged with supervising the implementationofthePlan'srecommendationswithinthefundinglimitations as provided by Columbia County or other sources.

4. 4. TheHazardMitigationPlanningCoordinatorshallgivepriorityattentiontothe goals identified in Table A-13 of the Columbia County Appendix, and the actions listed in Table A-14 of the Columbia County Appendix to the Hazard Mitigation Plan and;

5. 5. The Hazard Mitigation Planning Coordinator shall convene the hazard mitigation planning group annually. The planning group shall monitor implementation of the plan and shall submit an annual review worksheet to the Board of County Commissioners in accordance with the following format:

a. A review of the original plan.

b. A review of any disasters or emergencies that occurred during the previous calendar year.

c. A review of the actions taken, including what was accomplished during the previous year.

d. A discussion of any implementation problems.

e. Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by the Columbia County.

Dated this 27th day of August, 2014.

BOARDOFCOUNTYCOMMISSIONERS FOR COLUMBIA COUNTY, OREGON

By:_____ Anthony Hyde, Chair

By:_____ Henry Heimuller, Commissioner

By:_____ Earl Fisher, Commissioner

Standing Review Committee

The following table identifies the members of the Standing committee that will meet quarterly to review the NHMP annex and provide a running update.

Table 16. Columbia County Standing Hazard Mitigation Committee	
Name	**Agency/Department/Affiliation**
Anne Parrott	Columbia County Public Health – PHEP Coordinator
Johnathan Baker	Columbia County Emergency Management
Dan Brown	Columbia County – Community Action Team
Michael Carter	Rainier School District - Superintendent
Sean Clark	Port of Columbia County
Dave Crawford	Mist Birkenfeld RFPD
Della Graham	Columbia County Emergency Management
Diane Dillard	Sacagawea Health Center
Mike Fletcher	Columbia 911 Communications District - Director
Mike Greisen	Columbia River Fire and Rescue - Chief
Doug Hayes	Port of Columbia County – Executive Director
Greg Hinkleman	Clatskanie – City Manager
Pat LaPointe	Citizen Member
Lonny Welter	Columbia County – Roads Department
Margaret Magruder	Columbia County – County Commissioner
Mike McGlothlin	Columbia City – Chief of Police
Michael Paul	Columbia County Public Health - Director
Mike Deroia	City of St. Helens – Building Official
Norm Miller	Scappoose – Chief of Police
Kelly Niles	Chair - Oregon Department of Forestry
Ian O'Connor	Columbia River Fire and Rescue – Division Chief
Bob Perry	Western Oregon Electrical Coop - Director
Shaun Brown	Columbia County Emergency Management
Steve Pegram	Columbia County Emergency Management - Director
Scot Stockwell	St. Helens School District - Superintendent
Todd Meunier	Citizen Member
Jeff VanNatta	Vice – Chair Citizen Member
Casey Wheeler	Columbia County Food bank