RISK ASSESSMENT

COMMUNITY PROFILE

NATURAL HAZARDS

COMMUNITY RISK PROFILES

Introduction

The Risk Assessment identifies and characterizes Tillamook County's natural hazards and describes how each hazard can impact its communities. It reveals vulnerabilities and informs the mitigation strategy.

The Tillamook County MJNHMP assesses risk in unincorporated Tillamook County, the Cities of Bay City, Garibaldi, Manzanita, Nehalem, Rockaway Beach, Tillamook, Wheeler, and the Ports of Tillamook Bay and Garibaldi. Of the thirteen unincorporated communities that also populate the County, Neskowin, Oceanside and Netarts together, and Pacific City-Woods were selected for assessment as their population size and density are large enough to allow valid assessment relative to the other jurisdictions.

Risk Assessment Structure

The Risk Assessment consists of three components: Community Profile, Natural Hazards, and Community Risk Profiles.

Community Profile

The Community Profile discusses the unique geographic, demographic, economic, infrastructure, critical and essential facilities, built environment characteristics, and cultural and historic resources of the communities. This information is important for assessing local strengths and vulnerabilities with respect to natural hazard events and formulating mitigation strategies. For the first time, the Plan includes an analysis of the location of new residential construction since the last update (2012-2016) relative to areas subject to natural hazards.

Natural Hazards

The Natural Hazards section presents an overview of each natural hazard to which the communities of Tillamook County are subject, along with the impacted jurisdictions, historically significant hazard events, probability, and vulnerability including exposure, loss estimates, and the local assessment of relative hazard risk.

Community Risk Profiles

The Community Risk Profiles summarize DOGAMI's analyses by jurisdiction, providing statistics and maps that indicate the geographic extent and intensity of natural hazards potentially impacting each community. These Profiles also identify the critical or essential facilities located in each jurisdiction, identify potential vulnerabilities ("Areas of Mitigation Interest") and suggest mitigation strategies.

Tillamook County's Natural Hazards

Each of Tillamook County's communities is subject to some or all of ten natural hazards.

Table 1: Tillamook County Jurisdictions Subject to Natural Hazards

Jurisdiction	Coastal Erosion	Earthquakes	Floods				Landslides	Severe Weather			Tsunamis	Volcanic Ashfall	Wildfires
			Riverine	Coastal	Channel Migration	Dam Failure		Drought	Windstorms	Winter Storms			
Unincorporated Tillamook County	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓
• Neskowin	✓	✓	✓	✓		–	✓	✓	✓	✓	✓	✓	✓
• Oceanside-Netarts		✓		✓		–	✓	✓	✓	✓	✓	✓	✓
• Pacific City	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓
Bay City		✓	✓			–	✓	✓	✓	✓	✓	✓	✓
Garibaldi		✓	✓			–	✓	✓	✓	✓	✓	✓	✓
Manzanita	✓	✓		✓		–	✓	✓	✓	✓	✓	✓	✓
Nehalem		✓	✓		✓	–	✓	✓	✓	✓	✓	✓	✓
Rockaway Beach	✓	✓	✓	✓		–	✓	✓	✓	✓	✓	✓	✓
Tillamook		✓	✓		✓	–		✓	✓	✓	✓	✓	✓
Wheeler		✓	✓		✓	–	✓	✓	✓	✓	✓	✓	✓
Port of Tillamook Bay	✓	✓	✓	✓		–	✓	✓	✓	✓	✓	✓	✓
Port of Garibaldi	✓	✓	✓			–	✓	✓	✓	✓	✓	✓	✓

Loss Estimation and Exposure Assessment

The Oregon Department of Geology and Mineral Industries (DOGAMI) produced a Multi-Hazard Risk Report for Tillamook County (DOGAMI, 2016) which comprises much of this Risk Assessment. It includes a countywide building inventory developed from building footprint data, Tillamook County's tax assessor database, and a suite of datasets representing the best science for a variety of natural hazards. The full report may be found in the Appendices.

Depending on the natural hazard, either losses were estimated or exposure was assessed; both were performed for the flood hazard. Loss estimation was modeled using Hazus-MH, a tool developed by FEMA for calculating damage to buildings from flood and earthquake. Loss estimates identify buildings in hazard areas and apply damage functions based on the hazard severity and building characteristics.

Loss estimation is reported as a percentage of estimated loss relative to the total replacement value of a building. Loss estimation was performed for a Cascadia Subduction Zone (CSZ) Magnitude 9.0 earthquake and several flood scenarios.

Exposure is a determination of the number of buildings, building value, and people within a hazard zone. Population was determined by associating 2010 census data with residential buildings. Exposure is reported as the total value of buildings within a hazard zone and the number of potentially displaced residents. Exposure was assessed for floods, five CSZ tsunami scenarios, coastal erosion, landslides, and wildfires.

El Niño-Southern Oscillation (ENSO)

The El Niño-Southern Oscillation (ENSO) cycle plays an important role in Oregon's climate variability and by extension the frequency and intensity of certain natural hazard events.

The ENSO cycle is a scientific term that describes the fluctuations in temperature between the ocean and atmosphere in the east-central Equatorial Pacific. La Niña is sometimes referred to as the cold phase of ENSO and El Niño as the warm phase of ENSO. These deviations from normal surface temperatures can have large-scale impacts not only on ocean processes, but also on global weather and climate. El Niño and La Niña episodes typically last nine to 12 months, but some prolonged events may last for years. They often begin to form between June and August, reach peak strength between December and April, and then decay between May and July of the following year. While their periodicity can be quite irregular, El Niño and La Niña events occur about every 3 to 5 years. Typically, El Niño occurs more frequently than La Niña. (Source: NOAA, "*What are El Niño and La Niña?*" http://oceanservice.noaa.gov/facts/ninonina.html)

In Oregon, El Niño impacts associated with these climate features generally include warmer winter temperatures and reduced precipitation with drought conditions in extreme events. An El Niño winter may also lead to increased threat of large wildfires the following summer and autumn.

During La Niña events, heavy rain arrives in Oregon from the western tropical Pacific, where ocean temperatures are well above normal, causing greater evaporation, more extensive clouds, and a greater push of clouds across the Pacific toward Oregon. The prolonged heavy rainfall saturates the ground triggering landslides and debris flows and causing floods. During February 1996, for example, severe flooding — the worst in the state since 1964 — together with numerous landslides and debris flows killed several people and caused widespread property damage. Nearly every river in Oregon reached or exceeded flood stage, some setting all-time records.

Table 2. Recent ENSO Events in Oregon

El Niño Events	La Niña Events
1982-1983	1988-1989
1994-1995	1995-1996
1997-1998	1999-2000
2002-2003	
2004-2005	
2006-2007	2007-2009
2009-2010	2010-2012
2014-2016	

Source: NOAA, Multivariate ENSO Index (MEI) http://www.esrl.noaa.gov/psd/enso/mei/

Local Risk Assessment

Local assessment of relative hazard risk is accomplished using a methodology developed by the Federal Emergency Management Agency (FEMA) and refined by the Oregon Office of Emergency Management (OEM). It is called the "Local Risk Assessment Methodology" or "OEM Methodology" in this Plan. This methodology produces scores that range from 24 to 240. Vulnerability and probability are its two key

components. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

Conducting this analysis is a useful early step in planning for hazard mitigation, response, and recovery. The OEM Methodology not predict the occurrence of a particular hazard, but it does "quantify" the relative risk of one hazard compared with another.

Table 3: Local Risk Assessment Rankings

Jurisdiction	Coastal Erosion	Earthquakes	Floods	Landslides	Drought	Windstorms	Winter Storms	Tsunamis	Volcanic Ashfall	Wildfires
Unincorporated Tillamook County	High	Mod	High	Mod	N/A	High	High	Mod	Low	Low
• **Neskowin***	–	–	–	–	–	–	–	–	–	–
• **Oceanside-Netarts***	–	–	–	–	–	–	–	–	–	–
• **Pacific City***	–	–	–	–	–	–	–	–	–	–
Bay City	High	High	Low	Low	Low	High	Low	High	Low	High
Garibaldi	Low	Mod	Mod	Low	Low	Low	Low	Low	Low	Low
Manzanita	Low	Low	Low	Low	Low	High	High	Low	Low	Low
Nehalem	Low	Mod	High	Mod	High	High	High	Mod	Low	Mod
Rockaway Beach	High	Mod	High	Mod	High	High	High	Mod	Low	Mod
Tillamook	Low	High	High	Low	Low	High	High	High	Low	Low
Wheeler	Low	Mod	High	High	Mod	High	High	Low	Low	Low
Port of Tillamook Bay	High	High	High	Mod	Low	High	High	High	Low	Low
Port of Garibaldi	High	Mod	High	Low	Low	High	High	Mod	Mod	Low

**Included in Unincorporated Tillamook County N/A = Not Assessed*

Source: Tillamook County Multi-Jurisdictional NHMP Update Steering Committee, September-October, 2016