



Staff Report

For City Council Meeting - 2/3/2021

Subject - New Business - Discussion - Multi-Jurisdictional Natural Hazard Mitigation Plan (MJNHMP) Final Draft 2021

Synopsis: Across 2015-2017, the City of Gearhart developed its Natural Hazard Mitigation Plan (NHMP). Thanks to a FEMA grant Clatsop County received through the Department of Land Conservation and Development (DLCD), a Multi-Jurisdictional Natural Hazard Mitigation Plan (MJNHMP) was completed in 2018. That plan is having an update! Both the Planning Commission and City Council were involved with Gearhart's Risk Assessment portion of the plan throughout 2019. The public feedback portion was conducted through area surveys multiple times throughout 2020. All of the collected information was put into the updated plan draft. Since the public comment period officially ends February 5th, this is the last opportunity for residents and/or the Council to comment on the draft. The complete draft is over 500 pages and can be found online here:

https://www.co.clatsop.or.us/sites/default/files/fileattachments/emergency_management/page/512/clatsopmjnhmp_draft_01192021.pdf

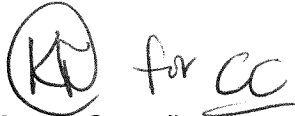
The attached document contains portions most relevant to Gearhart. In particular, please review pages 38-47, a draft of which you reviewed in the December 29th work session. On January 14th, the Planning Commission also reviewed those pages and have forwarded them back to you. Staff edits have focused on the Mitigation Actions table, reducing redundancy, adding clarity and specifying more projects for Gearhart. We believe the Gearhart portions of the plan are now ready for adoption.

Recommendation: Provide comments or suggested edits to the Mitigation Actions table. Direct staff to prepare a Resolution accepting the MJNHMP Final Draft for your approval on March 3, 2021.

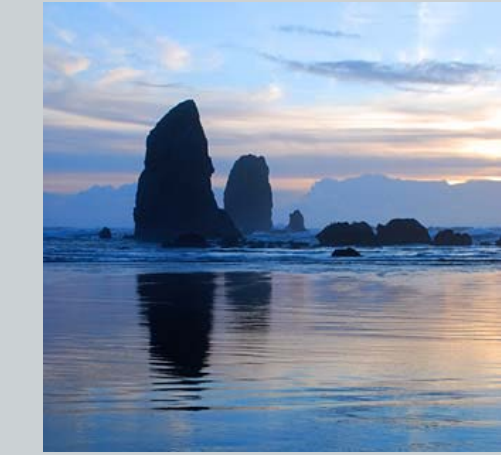
Legal Analysis: Not determined to be necessary

Financial Analysis: Not determined to be necessary

Respectfully Submitted,



Carole Connell
City Planner

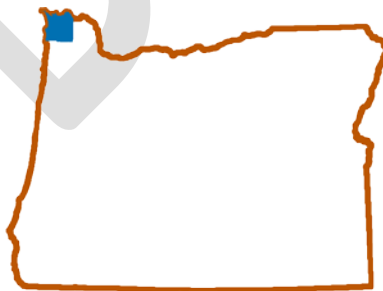


January 2021 DRAFT

Clatsop County

MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

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



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



FEMA

Effective Month date, 2021 through Month date, 2026

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A. Community Profile

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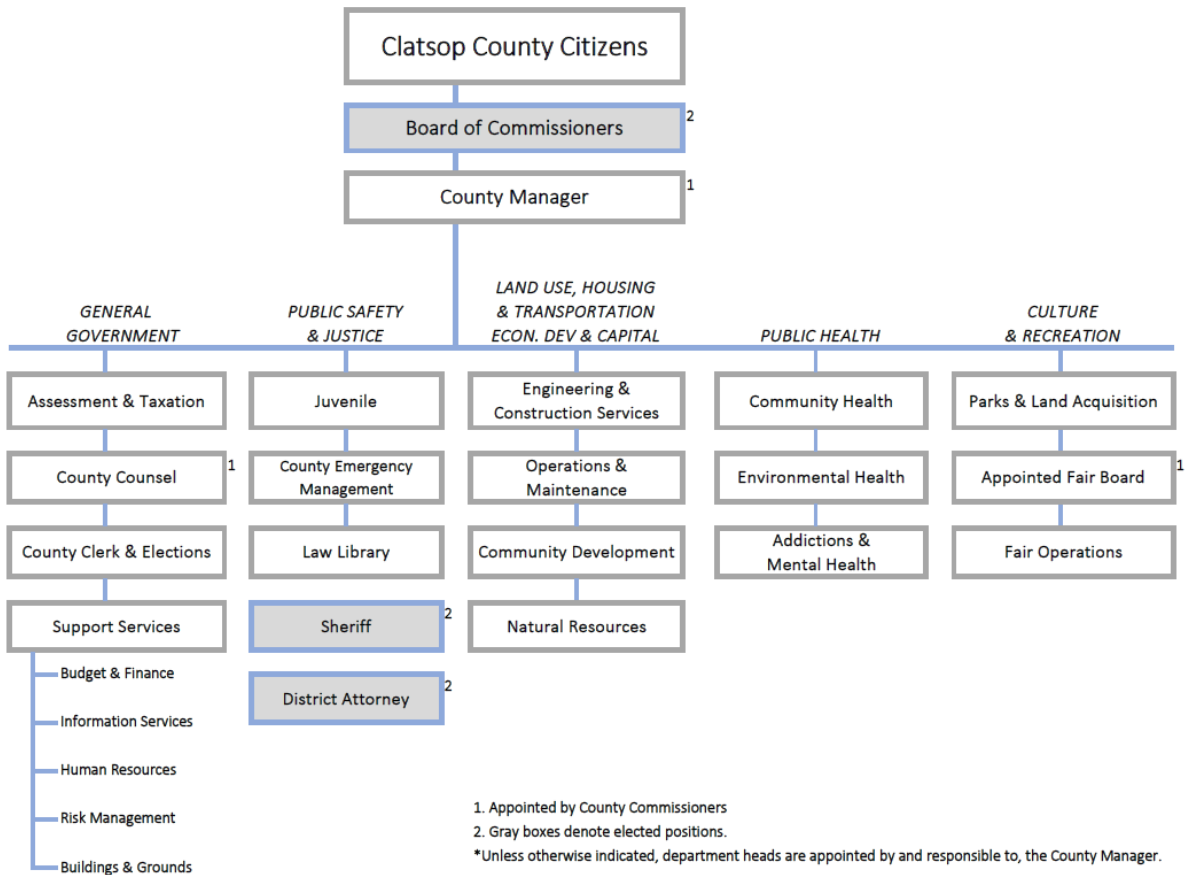
1. Government Organization

Clatsop County

Clatsop County is the policy making body for the unincorporated areas of the county. The County is also a coordinating entity for efforts that span across multiple jurisdictions or that intersect with state, federal, or regional efforts. Local government revenues are largely derived from a tax levied on real property. In 1997, voters approved Measure 50, which changed Oregon’s tax system from levy-based to rate-based. It created fixed tax rates and limited assessed value growth to three percent a year, except for new construction. The County Assessment & Taxation office collects and distributes these revenues to municipalities and special districts within its jurisdiction.

Figure II-1. Clatsop County Organizational Chart

CLATSOP COUNTY, OREGON Organizational Chart



Source: Clatsop County, 2020.

appointed by the Mayor, assists with the development of library policies. The City Council approves these policies and the library staff implements them.

City of Cannon Beach

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

City of Gearhart

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

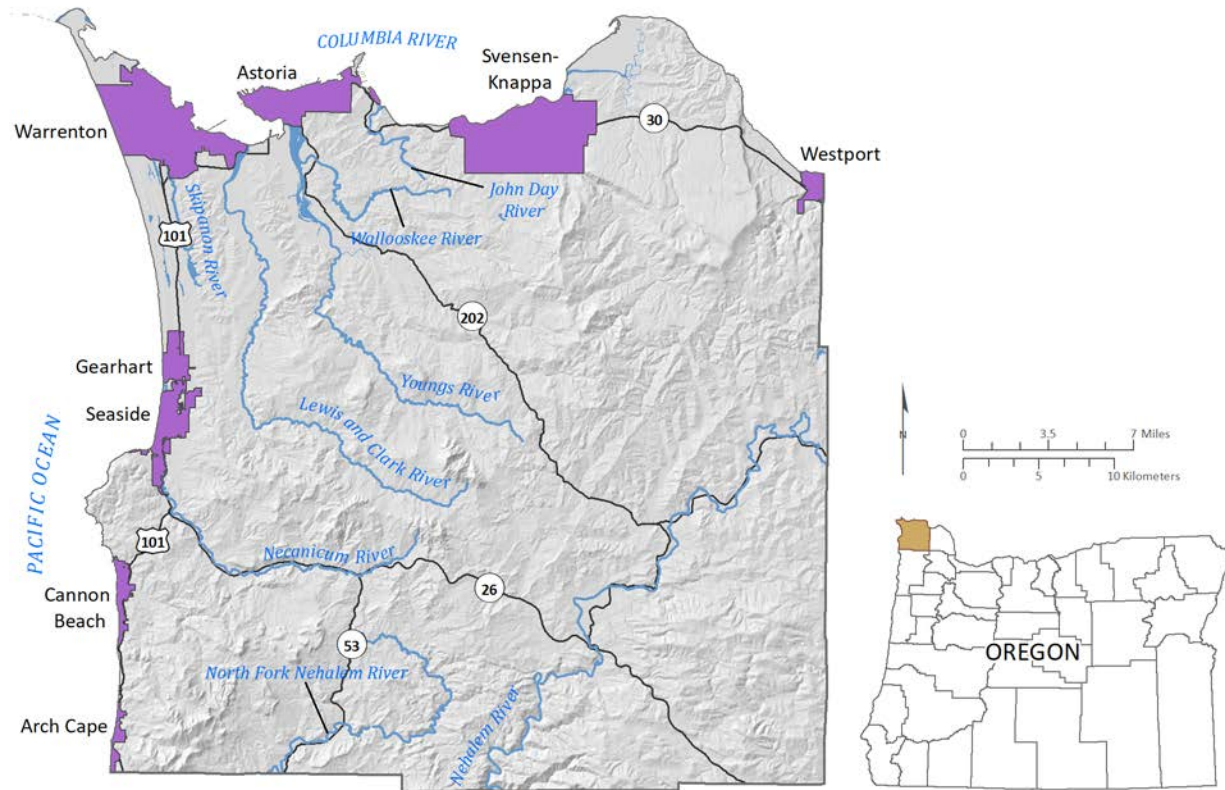
City of Seaside

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

2. Geography

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

Figure II-7. Political Geography: Clatsop County Map



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

Clatsop County

The most northwest county in Oregon, Clatsop County has a land area of 1,085 square miles, including 873 square miles of land and 212 square miles of water. It is bordered on the north by the Columbia River, on the west by the Pacific Ocean, south by Tillamook County, and on the east by Columbia and Washington counties. Much of Clatsop County is dominated by coastal terrain, and features include a coastal plain, numerous coastal valleys, and the Coast Range, whose peaks range from 2,000 to 5,500 feet above sea level and extend down the full length of the state (Clatsop County, 2020).

Unincorporated Communities

Arch Cape & Falcon Cove Beach

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

Jewell

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

Miles Crossing and Jeffers Garden

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

Olney-Walluski

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

Knappa-Svensen

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

Westport-Wauna

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

Hamlet

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

Elsie-Vinemapple

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

City of Astoria

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

City of Cannon Beach

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

City of Gearhart

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

City of Seaside

The City of Seaside is a popular beach destination with a large expanse of sand, a boardwalk of shops and hotels, and a famous surf break. Located just north of Tillamook Head and the intersection of highways 26 and 101, the City is situated perfectly to be one of the major places where tourists flock from Portland and beyond when summer temperatures spike. The Necanicum River flows through Seaside then out to the ocean after being joined by Neawanna and Neacoxie creeks, forming the tidally-influenced Necanicum estuary. The City of Seaside is home to Seaside-Providence Hospital, the Seaside School District, the Seaside Transit Center, and the Seaside Campus of Clatsop Community College. Seaside provides police and fire service, public works including water and sanitary service, and regulation of the local community. Water service is connected to Gearhart to allow for supply sharing.

6. Infrastructure

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

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

Critical Facilities

Critical facilities are those that support government services or first responders' ability to take action in an emergency such as: fire and police stations, hospitals, city halls and other public administration buildings, public works shops, water/ waste water treatment facilities, schools, or any other facility that is regularly used or easily allocated for public service in a disaster. Critical facilities include locally designated shelters and mass care facilities. These are all considered to be a part of the Emergency Services or Government Facilities sectors.

Critical facilities are a top priority in any comprehensive hazard mitigation planning effort. For the 2021 plan update, DOGAMI conducted an analysis of potential impacts to buildings by natural hazards. The following sections identify the status of these critical facilities by jurisdiction, as reported in the 2018 DOGAMI Natural Hazard Risk Report.

Clatsop County

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

and 1 Job Corps training center (in UGB area with joint fire response but law enforcement is handled by County).

City of Cannon Beach

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

Table II-15. City of Cannon Beach critical facilities

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

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

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

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

City of Gearhart

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

Table II-16. City of Gearhart critical facilities

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

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

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

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

City of Seaside

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

Table II-17. City of Seaside critical facilities

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

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

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

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

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

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

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

Gearhart Fire Department

Figure II-28. Gearhart Fire Department



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

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

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

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

Seaside Fire & Rescue Department

Figure II-29. Seaside Fire Department



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

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

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

http://www.cityofseaside.us/sites/default/files/docs/fire_department_annual_report_2018_.pdf

SF&R Equipment

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

Electricity and Gas

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

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

Transportation

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

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

Transportation and Evacuation Planning: Tsunami Mitigation

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

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

Table II-19. Tsunami Evacuation Planning by Jurisdiction

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

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

Roads

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

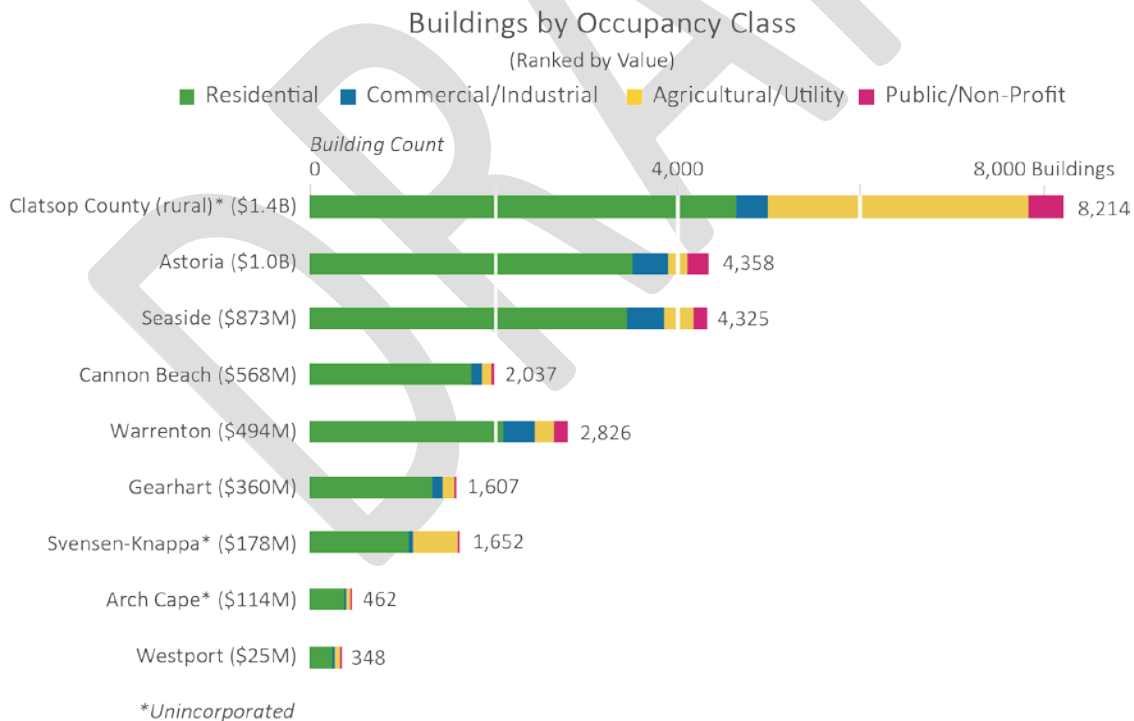
Two major transportation routes run through Astoria, Federal Highways 30 and 101. Highway 30 runs east to west from Westport to Astoria and Highway 101 comes into Astoria over the Columbia River on the Astoria-Megler Bridge to the north and into Warrenton via Young’s Bay to the south. State Highway 202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

7. Built Environment

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

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

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



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

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

(all dollar amounts in thousands)

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

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

Housing

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

Single-Family Dwellings

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

Multi-Family Dwellings

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

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

Mobile Home or Other

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

Table II-22. Mobile Home Housing Units

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

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

City of Cannon Beach

Housing

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

Land Use and Development

Development in Cannon Beach is primarily residential with a significant mixture of tourist accommodations, and is located between the Pacific Ocean and Highway 101. Most of the housing is located between the coast and Hemlock Street, the main road through Cannon Beach that connects to Hwy 101. According to the Cannon Beach Comprehensive Plan (2006), there were 288 undeveloped single-family lots within the city limits. Within the UGB there were an additional 127 lots available, resulting in 415 potential lots available for construction.

Cannon Beach also has a central business district that contains retail shops, restaurants, and other commercial buildings and hotels. There are two other commercial areas, Midtown and Tolovana Park, which also contain a mixture of commercial uses, including hotels. The ocean front is a mixture of dwellings.

City of Gearhart

Housing

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

Land Use and Development

Development in Gearhart is divided by US Highway 101. The majority of the residential housing is located west of US Highway 101 between the highway and the Pacific Ocean. Housing density east of US 101 increased rapidly between 2000 and 2014. High density condominium units and a higher density of single family dwellings are located near or on oceanfront. Commercial land use is dense east of US 101 and limited to neighborhood use in a small area west of US 101. Two golf courses are located west of US Highway 101.

Building permits are reviewed by the Gearhart administrator and the city building official for consistency with Oregon building codes/IBC, the National Floodplain Insurance Program, the Gearhart fire code, zoning ordinances, public works standards, and general ordinances. Issuance of every building permit notifies landowners of the tsunami risk in Gearhart and requires a signature of such notice.

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

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

HVA: Hazard Vulnerability Analysis

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

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

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

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

Table II-29. Hazard Vulnerability Analysis: Coastal Erosion

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

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

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

Vulnerability Assessment

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

- Buildings, parks, and infrastructure along low-lying areas adjacent to bays or the ocean and at higher elevations where buildings and infrastructure have been located on readily erodible materials (e.g., consolidated sand, weakly cemented sandstone, siltstone, etc.).
- Areas subject to flooding with wave action—while few of Oregon’s coastal developments are within FEMA-designated Velocity (V) zones, those that appear to be constructed according to V- zone standards which fall under the regulatory purview of local jurisdictions compliant with the National Flood Insurance Program (NFIP).
- Coastal highways are strongly impacted by coastal erosion. In Clatsop County much of the problem is linked to the local geology. Bedrock conditions change abruptly within very short distances. This results in an inconsistent highway foundation; some sections are more susceptible to erosion than others and require continuous maintenance.

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

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

Clatsop countywide coastal erosion exposure (Moderate hazard):

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

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

HVA: Hazard Vulnerability Analysis

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

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

Table II-37. Hazard Vulnerability Analysis: Flood

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

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

Flood Vulnerability Assessment

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

Clatsop countywide 100-year flood loss:

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

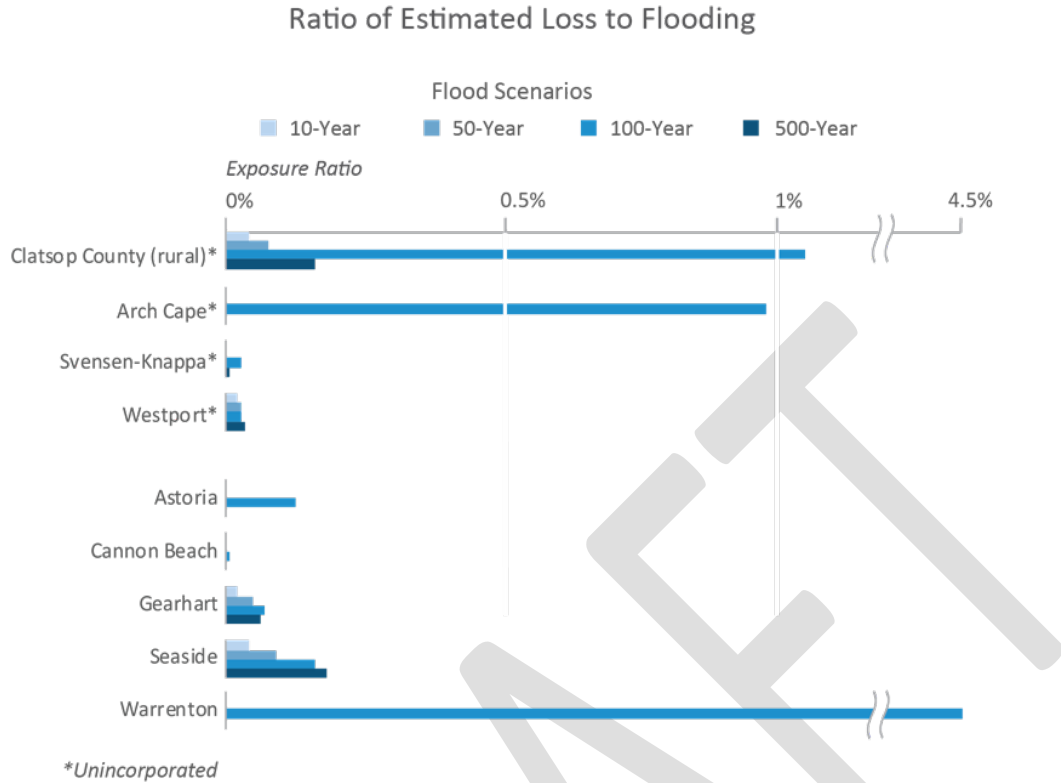
Source: Williams et al, 2020.

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

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

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

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



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

National Flood Insurance Program (NFIP) in Clatsop County

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

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

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

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

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

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

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

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

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

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

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

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

Table II-42. Flood loss estimates

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

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

Table II-43. Flood Exposure

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

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

Flood Hazard Codes and Overlay Districts

Clatsop County

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

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

City of Astoria

The City of Astoria has adopted a Flood Hazard Overlay Zone that regulates the use of those areas subject to periodic flooding, to promote public health, safety and general welfare, and to minimize public and private losses due to flood conditions. The Code was updated in 2009. The City's current effective date for the Flood Insurance Rate Maps is September 17, 2010. The City objected to the 2012 revised maps as they appeared to have inaccurate data and changed the flood zoning along the Columbia River to a Velocity Zone. The City continues to work with FEMA on revising the maps.

City of Cannon Beach

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

City of Gearhart

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

City of Seaside

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

[Flood Damage Prevention - City Ordinance - Chapter 152 - Amendments 2018](#)

It is the purpose of this chapter to regulate the use of those areas subject to periodic flooding, to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions. Amendments adopted in 2018 ensure compliance with the new FEMA Flood Insurance Rate Maps that became effective June 20, 2018.

City of Warrenton

The City of Warrenton has participated in the National Flood Insurance Program since 1978. The City adopted a Flood Hazard Overlay Zone that regulates the use of those areas subject to periodic flooding, to promote public health, safety and general welfare and to minimize public and private losses due to flood conditions. The Code was updated in 2018 with the update of FEMA maps with an effective date of June 20, 2018.

Future Climate Conditions: Flood

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

Risk Reduction Recommendations

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

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

HVA: Hazard Vulnerability Analysis

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

Table II-45. Hazard Vulnerability Analysis: Landslide

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

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

Landslide Vulnerability Assessment

Rain-induced landslides and debris flows can potentially occur during any winter in Clatsop County. To minimize future landslide impacts to new development, hazards areas must be identified and siting standards applied as the incidence of landslides and their impact on people and property can be accelerated by community development. Increasing population in western Oregon and the resultant growth in housing development has caused the siting of more development in or near landslide areas. Often these areas are highly desirable owing to their location along the coast, rivers and on hillsides. Developers who are uninformed about geologic conditions and processes may create conditions that can increase the risk of or even trigger landslides.

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

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

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

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

Williams et al, , 2020.

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

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

Table II-46. Landslide Exposure

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

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

Future Climate Conditions: Landslide

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

Risk Reduction Recommendations

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

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4. City of Gearhart

The City has included data from the DOGAMI Open-File Report 0-20-16 Table A-13 and A-14 City of Gearhart Hazard Profile. This is a risk assessment utilizing quantitative building and population data for the City of Gearhart provided by the Clatsop County Tax Assessor and the 2010 U.S. Census. For these purposes, the report is based on a population of 1,462 and a building inventory of 1,607 structures.

Hazard Vulnerability Analysis

On May 9, 2019, City of Gearhart staff met with the DLCD project manager for a risk assessment meeting where staff developed the following rankings for hazards for the City. These rankings were also reviewed by the Gearhart City Council in December 2020.

Table II-79. City of Gearhart Hazard Vulnerability Analysis

Jurisdiction	Coastal Erosion	Drought	Earthquake	Flood	Landslide	Tsunami	Volcanic Ashfall	Wildfire	Wind/Winter Storm
Gearhart	L	L	H	L	M	H	L	H	H

Source: City of Gearhart Risk Assessment, May 2019.

Coastal Erosion

Coastal erosion occurs through a complex interaction of geologic, atmospheric and oceanic factors, including sea level rise. Beaches and dunes are highly susceptible to erosion during large storms coupled with high ocean water levels near the beach or coastal bluffs. The DOGAMI report indicates Gearhart has a low to moderate risk of coastal erosion wherein 81 buildings are exposed affecting a potential displacement of 7 residents.

Drought

Historically, Clatsop County has very few drought years. However, when drought conditions prevail, area creeks and fish can suffer. In addition, the surrounding forest lands are more susceptible to disease and the Clatsop plains and forests are susceptible to wild land forest fires during drought.

Earthquake

The DOGAMI Risk Report for Clatsop County conducted in 2020 built upon previous studies by the department and identified locations within the study area that are comparatively more vulnerable or at greater risk to CSZ M9.0 earthquake hazard. Very high liquefaction soils are found throughout most of the populated coastal portions of Clatsop County, which include the communities of Astoria, Cannon Beach, Gearhart, Seaside, and within the low-laying areas around the City of Warrenton. In the event of a CSZ M9.0 earthquake scenario, Gearhart has the potential of 278 damaged buildings including 3 critical facilities, and 160 potentially displaced residents.

Flood

Flooding generally occurs quickly due to heavy concentrated rainfall. Tidal changes in conjunction with high winds and/or snow accumulation at higher elevations have influence on the severity as well. Flood season is in effect from November 1 through March 31. Principal riverine flood sources in Gearhart are the Neacoxie Creek, the Neawanna Creek, and the Necanicum River Estuary. The above referenced DOGAMI report indicates a potential for 34 damaged buildings and 50 displaced residents in the event of a 100 - year flood.

Landslide

This hazard is the downslope movement of rock, soil, or other debris or the opening of sinkholes. These hazards are often associated with other incidents such as heavy rainfall, snow melt run-off, floods or earthquakes. Our past history has been that we have frequent landslides during the rainy months on our mountain roads, highways, and city streets. The landslide hazard within Gearhart is documented in the foothills on the east side of the city (DOGAMI Hazards Study 2020). Erosion can also occur on the banks of the Neacoxie Creek, and the Necanicum estuary. The DOGAMI report indicates Gearhart has 55 exposed buildings and 75 displaced residents in the event of a landslide.

Tsunami

This is a series of traveling ocean waves of extremely long length and period, generated by disturbances associated with earthquakes. As it enters the shoaling water of coastlines in its path, the velocity of its waves diminishes and wave height increases. In shallow waters they can crest to heights of more than 100 feet and become a threat to life and property. The Gearhart coastline is particularly vulnerable with many residents in need of early warning. The DOGAMI report indicates a CSZ-Medium tsunami will expose 808 buildings and 775 residents. There is a potential of 1,275 exposed buildings and 1,103 displaced residents in the event of the SB 379 Regulatory line (XXL) tsunami event.

Volcanic Event

Little risk of significant impact to the City.

Wildfire

Generally, Gearhart is at low risk from a wildfire event due to high coastal humidity. However, in the intermittent dry periods with east winds from summer to late fall wildfire risk can elevate quickly. The 2020 DOGAMI Report indicates there are 2 exposed buildings and 1 potentially displaced resident in the event of a wildfire.

Windstorm and Winter Storm

Wind storms hazards are common in Gearhart and usually results in localized power outages or large-scale power outages, which can affect all of Clatsop County. Windstorms can reach hurricane strength in the exposed areas and damage to homes and property is not unusual during the winter months. Structures the most vulnerable to high winds include insufficiently anchored manufactured homes and older buildings in need of roof repair. It is essential that tie down standards are enforced. Fallen trees can be a hazard. They can block roads, rails, and affect emergency operations. They can down power and utility lines. Strategic pruning working with utility companies and establishing a tree removal and maintenance program is prudent.

Risk Assessment Summary

Table II-80. City of Gearhart Critical Facility Loss Exposure

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

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

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Hazard Profile

Table II-81. City of Gearhart hazard profile.

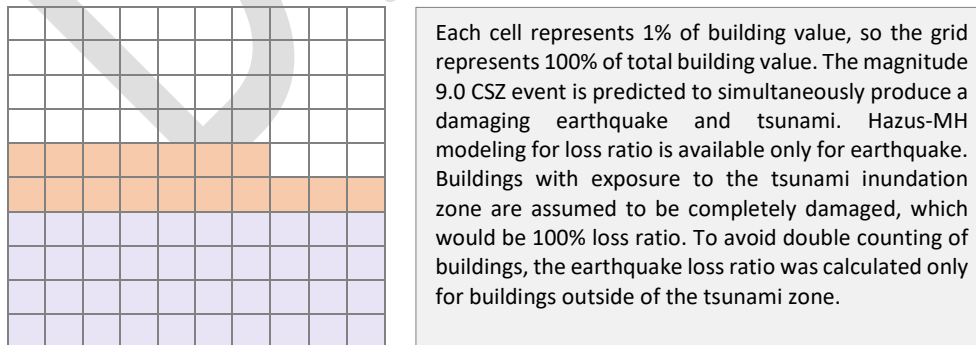
Community Overview							
Community Name	Population	Number of Buildings	Critical Facilities ¹	Total Building Value (\$)			
Gearhart	1,462	1,607	4	359,970,000			
Hazus-MH Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Damaged Buildings	Damaged Critical Facilities	Loss Estimate (\$)	Loss Ratio
Flood ²	1% Annual Chance	50	3.4%	34	0	245,000	0.1%
<i>Earthquake *</i>	<i>CSZ M9.0 Deterministic</i>	156	11%	219	0	61,778,000	17%
Earthquake (within Tsunami Zone)		160	11%	278	3	50,774,000	14%
Exposure Analysis Summary							
Hazard	Scenario	Potentially Displaced Residents	% Potentially Displaced Residents	Exposed Buildings	Exposed Critical Facilities	Building Value (\$)	Percent of Exposure
<i>Tsunami</i>	<i>CSZ M9.0 – Medium</i>	775	53%	808	4	144,823,000	40%
Tsunami	Senate Bill 379 Regulatory Line	1,103	76%	1,275	3	252,553,000	70%
Landslide	High and Very High Susceptibility	75	5.2%	55	0	9,783,000	2.7%
Coastal Erosion	High Hazard	7	0.5%	81	0	27,241,000	7.6%
Wildfire	High Hazard	1	0.1%	2	0	148,000	0.0%

*Earthquake losses were calculated for buildings outside of Medium tsunami zone.

Rows with italicized text and shaded background indicate results should be considered in tandem as they are expected to occur within minutes of one another.¹Facilities with multiple buildings were consolidated into one building complex.

²No damage is estimated for exposed structures with “First floor height” above the level of flooding (base flood elevation).

Figure II-81. City of Gearhart loss ratio from Cascadia subduction zone event



†Each cell represents 1% of building value.

= Estimated losses due to tsunami.

= Estimated losses due to earthquake (outside of tsunami zone).

Source: Williams et al, 2020.

Plans and Policies

Table II-82. City of Gearhart Plans and Policies

Plan/ Policy Name	Date	Author/ Owner	Description	Relation to Natural Hazard Mitigation
City of Gearhart Comprehensive Plan	2020	City of Gearhart	The purpose of the City's Comprehensive Plan is to control and promote development which is most desirable to the majority of the residents and property owners of the City. The Plan establishes a set of policies and guidelines within this context.	The Comp Plan outlines how the City addresses the statewide land use planning Goal 7, areas subject to natural hazards. Identifies how the City manages development in geologic, tsunami, flood, dune, and other hazard areas.
City of Gearhart Zoning Ordinance	Jan. 2020	City of Gearhart	Outlines zones for use within the City and the uses within them	Contains three hazard-specific zones: flood; beaches and active dunes; and tsunami overlay zones. The purpose of the overlay zones are to increase community resiliency by establishing standards, requirements, incentives, and other measures to be applied in the review and authorization of new land use and development activities in areas subject to hazards.
Transportation System Plan Volumes I & II	2017	City of Gearhart, ODOT/ DKS Associates	The TSP outlines the transportation system, needs and necessary improvements.	A TSP allows for effective tsunami evacuation planning to be situated upon current data and existing conditions for pedestrian networks and other infrastructure.
Hazard Acknowledgement Disclosure Statement (tsunami)	2019	City of Gearhart	Discloses the tsunami risk to developers in a formal disclosure.	Ensures new development includes an understanding of tsunami risk.
City of Gearhart Water Master Plan	2018	City of Gearhart	Describes the City's water system and guides its operation.	Managing water supply is key to anticipating and preventing the impacts of drought.
City of Warrenton Water Master Plan		City of Warrenton	Describes the City's water system and guides its operation. City of Gearhart infrastructure is addressed in the Warrenton Plan.	Managing water supply is key to anticipating and preventing the impacts of drought.

Mitigation Actions

Table II-83. City of Gearhart Mitigation Actions

Hazard	City of Gearhart 2020-2025 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Multi-Hazard, Earthquake, Tsunami	Develop and implement a community disaster education and preparedness program.	H	On-going	Cache containers available funded by SHSP program thru OEM. Short Term Rental financial incentive provides evacuation go- packs. Periodic City Blog & Website disaster preparedness announcements. Medical supplies are strategically located through the City. Tsunami hazard building permit disclaimer signature required at issuance of building permits. Need to assess social vulnerability thru CERT Map your Neighborhood program.	City of Gearhart, CERT, Great Oregon Shakeout training
Multi-Hazard	Rebuild City Hall to withstand earthquakes and aid in recovery	M	5 years	Priority is to build Fire Station, not City Hall.	City of Gearhart
Multi-Hazard, Earthquake, Tsunami	Evaluate the construction of critical facilities, structures & public utilities; retrofit, relocate or bury to withstand disaster.	H	2-5 years	Relocate the Gearhart Fire Station to a site outside of the large tsunami zone. Reconstruct /harden Neacoxie Creek crossings at G Street, Pacific Way, Gearhart Lane and Highland Road per TSP. New critical facilities and high-density dwellings are restricted in CSZ-Medium event by Tsunamis Hazard Overlay (THO) Zone	City of Gearhart
Multi-Hazard	Evaluate City ordinances and capital improvement plans regularly. Require new development and provide incentives for existing development to reduce the potential for natural hazards.	M	2-5 years	New critical facility structures are restricted by the City THO Zone. Need to develop a City CIP to include hazard mitigation projects.	City of Gearhart
Multi-Hazard	Train Certified Emergency Response Teams (CERT) for each neighborhood. Develop an emergency shelter and operations center.	H	On-going	CERT training is complete and on-going. Emergency training and operations facility to be included in a new city fire station.	City of Gearhart, CERT

Hazard	City of Gearhart 2020-2025 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Coastal Erosion	Conduct a periodic survey of vegetation on the dune and exposed sand areas. Require the maintenance of vegetation on exposed sand dune areas to increase resilience.	L	5+ years	Dune vegetation removal controlled by zone code. Invasive vegetation removal permitted. Vegetation maintenance is managed on city park land and by property owner permit.	City of Gearhart
Coastal Erosion	Continue to protect the dunes as an important buffer to coastal erosion and flooding.	L	5+ years	City updated Beaches and Active Dunes Overlay Zone in 2018. Consider a future evaluation of this code or dune conditions or coastal processes.	City of Gearhart, DLCD
Drought	Implement a water conservation plan to ensure adequate water supply.	L	5 years	City Water Master Plan identifies need. Water service fee structure encourages water conservation. Need to enhance conservation measures.	City of Gearhart
Flood	Comply with FEMA Floodplain recommendations for development within a floodplain.	L	Complete	City updated Floodplain Overlay Zone per FEMA standards in 2018. City provides periodic FIRM insurance rate announcements.	City of Gearhart
Flood	Ensure that runoff does not pollute ground water supplies.	L	None	City does not have a formal storm water collection system. Building setbacks from Neacoxie Creek are enforced.	City of Gearhart, Clatsop Co. Health/DEQ
Winter Storms	Implement winter storm preparation for high winds	L	On-going	Remove trees near power lines. Assure tie-downs for manufactured homes. Fire Dept. provides tree removal assistance.	Property owners, Building Code, Pacific Power, City of Gearhart
Landslide	Install drainage systems where necessary to prevent soil erosion.	L	On-going 2 years	Building Permit compliance required. Strengthen Land Division requirements for geotechnical analysis.	Building Code, City of Gearhart
Landslide	Require maintenance of vegetation on bare soils and site investigation/engineering in areas of slope hazard.	L	5+ years	Adopt 2020 DOGAMI landslide protections for new development	City of Gearhart
Wildfire	Ensure adequate space between structures to reduce vulnerability	L	5 years	Development permit review requires setback compliance. Identify needed urban/wildland interface setbacks.	Planning, Building code regulations

Hazard	City of Gearhart 2020-2025 Mitigation Actions	Priority	Timeline	Status & Explanation	Partners/ Funding Sources
Wildfire	Construct fire access roadways and turnarounds within vulnerable neighborhoods, purchase land where right-of-way is not available.	L	2-5 years	Identify vulnerable areas and additional measures.	Building code, Fire Dept.
Wildfire	Conduct periodic fire inspections for vegetative fuels reduction and maintenance program to provide fire buffer to structures.	H	On-going	Per Fire Chief recommendations	City Fire, Planning
Wildfire	Initiate and maintain a routine fire inspection and prevention within the neighborhoods.	M	On-going	Per Fire Chief recommendations	Fire, City, Planning

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Completed/Ongoing Mitigation Actions

Tsunami

Tsunami Wayfinding Signage

In 2013, the City worked with regional partners to develop new tsunami maps for the area, and a few tsunami evacuation signs were installed at that time. In 2014-15, Gearhart enhanced the wayfinding system by installing “You Are Here” signs in four key locations to specifically direct evacuees to high ground following an earthquake/tsunami. In 2018-19, the City participated with other jurisdictions in the countywide Wayfinding Assessment project, which served to identify gaps in the wayfinding system and creating a record of existing sign location to provide an easier way to maintain the system over time. Finally, in conjunction with the 2019-20 tsunami overlay project, the city was able to secure grant funding to purchase/install signs to complete the sign system for tsunami evacuation. Future steps include maintaining and exploring ongoing opportunities for improvement as well as conducting evacuation exercises.

Emergency Cache Container Program

The City launched the cache container program in spring 2019. The COVID pandemic delayed the project initially, but first access drop off date occurred in August 2020 and the second in October 2020. The program currently maintains 7 registered drums, and 9 residents are on the waiting list for the 2021 spring event.

Pre-Disaster Mitigation Reserve Fund

The city budget holds a Hazard Mitigation Fund where the fiscal year begins with \$15,000 in reserves available for planning and projects that seek to protect life and property from future natural disasters. Its existence has funded projects such as the Conex bins for the soon-to-start Emergency Cache program, emergency supplies including medications and first aid, a HAM radio hut for emergency communications, and a starter supply of shelf-stable MRE's (Meals Ready to Eat).

Tsunami Hazard Overlay Zone Adoption

In August 2019, the City of Gearhart adopted Ordinance No. 924 amending the Gearhart Comprehensive Plan and Zoning Ordinance to update tsunami hazard background, policies, and development standards. These components were established via Section 3.14 of the Gearhart Zoning Code—the Tsunami Hazard Overlay Zone (THOZ). The purpose of the Tsunami Hazard Overlay Zone is to increase the resilience of the community to a local source (Cascadia Subduction Zone) tsunami by establishing standards, requirements, incentives, and other measures to be applied in the review and authorization of land use and development activities in areas subject to tsunami hazards. Significant public and private investments have been made in development in areas which are now known to be subject to tsunami hazards. These standards are not intended to require the relocation of or otherwise regulate existing development within the Tsunami Hazard Overlay Zone. These standards are intended to limit, direct and encourage the development of land uses within areas subject to tsunami hazards in a manner that will reduce loss of life,

reduce damage to private and public property, reduce social, emotional, and economic disruptions; and increase the ability of the community to respond and recover.

Tsunami Studies and Information

The City of Gearhart was a key participant and driver for technical analyses and policy development completed by the State of Oregon with federal funding. Specifically, Oregon Coastal Management Program applied for and was successful in securing two grants from the National Oceanic and Atmospheric Administration (NOAA) to address identified gaps in local land use planning for tsunami hazards, both a Project of Special Merit (which concluded in September 2019) and a Coastal Resilience Grant (to conclude in June 2021). The Oregon Department of Geology and Mineral Industries (DOGAMI) was a lead partner in these efforts to complete innovative analyses, including time/distance evacuation modeling, called “Beat the Wave,” and casualty and building damage estimates for a local tsunami. These analyses covered many coastal jurisdictions, including the cities of Gearhart and Port Orford, all of Tillamook and Lincoln Counties, and the Coos Bay Estuary.

Leading up to the release of these publications were many in-person meetings, workshops, and open houses where the information was shared and revised (based on feedback) with elected officials, practitioners, emergency preparedness groups, and the public. This information has and will continue to help inform specific evacuation and mitigation improvement projects that will have the most impact in terms of lives saved. For example, many communities have utilized the Beat the Wave maps to inform where they place evacuation route signs to ensure the most efficient routes to safety are signed appropriately.

V. PLANNING PROCESS

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Websites

In this 2021 plan update, the following websites were used as a primary method of outreach by Clatsop County, the five cities, and many of the ten special districts who joined the mitigation planning process:

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

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

Clatsop County

<https://www.co.clatsop.or.us/>

City of Astoria

<https://www.astoria.or.us/>

City of Cannon Beach

<https://www.ci.cannon-beach.or.us/>

City of Gearhart

<https://www.cityofgearhart.com/>

City of Seaside

<http://www.cityofseaside.us/>

City of Warrenton

<https://www.ci.warrenton.or.us/>

Port of Astoria

<https://www.portofastoria.com/>

Sunset Empire Transportation District

<https://www.nworegontransit.org/agencies/sunset-empire-transportation-district/>

Clatsop Community College

<https://www.clatsopcc.edu/>

Seaside School District

<http://www.seaside.k12.or.us/>

<http://www.seaside.k12.or.us/?DivisionID=22431&ToggleSideNav=ShowAll>

Cannon Beach Rural Fire Protection District

<https://www.cbfire.com/>

<https://www.cbfire.com/natural-hazards-mitigation-and-emergency-operations-plans>

<https://www.cbfire.com/earthquakes>

<https://www.cbfire.com/floods>

<https://www.cbfire.com/severe-storms>

Lewis and Clark Rural Fire Protection District

<https://www.facebook.com/Lewis-Clark-Volunteer-Fire-Dept-142191469145305/>

Knappa-Svensen-Burnside Rural Fire Protection District

<https://www.knappafire.com/>

Arch Cape Domestic Water Supply District

<https://www.archcapewater.org/>

Arch Cape Sanitary District

<https://www.archcapewater.org/>

Falcon Cove Beach Domestic Water Supply District

No website. Email, utility bills, and public posting used to communicate with customers.

Hazard Survey

As part of the review and update process and to ensure a plan that meets the needs of the whole community, we need input from the citizens who live and/or work in Clatsop County. The Multi-Jurisdictional Natural Hazards Mitigation Plan Survey for Clatsop County asked the public's opinion on topics such as identified hazards, personal impacts, and personal preparedness. Three methods were provided completing the survey (online survey via SmartSheets, fillable PDF, and print PDF).

Clatsop County Plan Update Website: <https://www.co.clatsop.or.us/em/page/multi-jurisdictional-natural-hazards-mitigation-plan-mjnhmp-update-2021>

Survey (SmartSheet, Fillable PDF, and print PDF):

<https://app.smartsheet.com/b/form/68ac314866304d8c8a1e6017b4140796>

https://www.co.clatsop.or.us/sites/default/files/fileattachments/emergency_management/page/18941/nhmp_survey-fillable.pdf

https://www.co.clatsop.or.us/sites/default/files/fileattachments/emergency_management/page/33668/nhmp_survey.pdf

The survey was opened in July 2020 and data was gathered about preparedness and hazard concerns until early December 2020. Then once the plan update was posted, the survey was revised and reissued until January 15, 2021.

See Appendix B2 for the Hazard Survey Documentation.

City of Gearhart

Figure V-4. Gearhart blog 1

OFFICIAL CITY OF GEARHART BLOG BACK TO MAIN CITY OF GEARHART WEBSITE ABOUT GEARHART BLOG HOME

Keeping our residents informed while maintaining the quality & stability of our community.

WE WANT TO HEAR FROM YOU! - 2021 Natural Hazards Mitigation Plan (NHMP)
January 8, 2021 by Gearhart City Staff

FROM THE CLATSOP COUNTY EMERGENCY MANAGEMENT HAZARD MITIGATION HOME PAGE:

Multi-Jurisdictional Natural Hazards Mitigation Plan (MJNHMP) Update 2021

WE WANT TO HEAR FROM YOU! The Natural Hazards Mitigation Plan (NHMP) identifies hazards that threaten our communities, evaluates our vulnerability to those threats, and outlines strategies to reduce or eliminate the risk posed by those threats.

Citizen participation is a critically important piece of the update, because the NHMP has greatest value to the whole community when it relies on input from the whole community. So, please take some time to share your perspective on the draft Plan and how natural disasters impact Clatsop County, and pass the Plan along to others so they can take the opportunity to do the same. We appreciate your time and interest in the Clatsop County NHMP.

Clatsop Community Survey

As part of the review and update process and to ensure a plan that meets the needs of the whole community, we need input from the citizens who live and/or work in Clatsop County. The survey asks the public's opinion on topics such as identified hazards, personal impacts and personal preparedness.

CLICK HERE TO QUICKLY COMPLETE THE SURVEY

2021-26 Natural Hazards Mitigation Plan Review

The NHMP is a lengthy document, so to avoid feeling overwhelmed by its contents, we recommend starting with the **Table of Contents**, which will give you a feel for how the plan is laid out and which areas are of greatest interest to you. Are you interested in a particular community or jurisdiction? If so, each of the participating entities is featured most comprehensively in the **Community Risk Profiles** section. Click **HERE** to view the 2021 NHMP draft Plan then use the survey or email clatsopem@clatsopcounty.us to provide comments and feedback.

The draft NHMP and surveys are available for public review and comment through Friday, January 15, 2021.

FOLLOW BLOGS VIA EMAIL
Enter your email address to follow this blog and receive notifications of new posts by email.
I am interested in following this blog.
I am not interested in following this blog.
I am not sure.
I am interested in following this blog.
I am not interested in following this blog.
I am not sure.
I am interested in following this blog.
I am not interested in following this blog.
I am not sure.

RECENT POSTS

- GEARHART POLICE: Mental Health Calls For Service
- Mayor's Report January 15, 2021
- FREE RASGO: Drive-Up Event!
- Gearhart Parks Master Plan Open Advisory Committee Presentation
- Governor Kate Brown Announces Update to County Risk Levels: Clatsop Science Risk (Effective January 15th)

CATEGORIES

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- Art of July
- Events
- Historical Photos
- Mayor's Blog
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January 8, 2021: <https://cityofgearhart.wordpress.com/2021/01/08/we-want-to-hear-from-you-2021-natural-hazards-mitigation-plan-nhmp/>

Figure V-5. Gearhart blog 2

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Keeping our residents informed while maintaining the quality & stability of our community.

Mayor's Report for January 2021
January 8, 2021 by Gearhart City Staff

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Covid remains throughout the greater Clatsop County community. The county has a website with vaccine information and FAQs at <https://www.clatsopcounty.us/health/wellness/vaccine-information-faqs>. Information on vaccines will be available on that website as more vaccine comes into the county and distribution schedules are updated. In the meantime keep socially distanced, wear a mask as needed and required indoors on when not able to maintain at least 6 ft from others (except those in your household), wash hands frequently and keep groups small. Diligent use of these measures might keep the county from moving into the "Extreme Risk" category again. Here is a link to a video from the Oregon Health Authority: <https://youtu.be/9T7Pge6Dg>

The Council had a work session last week to learn more about the Oregon Settlements EA Collaborative. I would like to plan a virtual town hall sometime in mid-January or early February to outline the various aspects of a Gearhart EA Management Plan. The EA population has roughly tripled in the past 10 years. We have had flood sources for the EA and it seems they can't get enough of living the life in Gearhart, much like the rest of us. As a result, I have started a power-point presentation to share some of the information I have learned and look forward to sharing it soon.

The City Council has also reviewed the draft of the Gearhart Natural Hazard Mitigation Plan part of the Clatsop County Plan. This update has been on the works for a while, and we will be sending it to the Planning Commission next month for their review and for public comment. The Council made some minor changes in the priorities, but for the most part they remain the same as for the last 8 years:

1. Mitigate the Gearhart Fire Station to a size suitable for large events.
2. Develop a community self-sustainability program to provide food, shelter, water, communication and other live here stay here for as long as possible for the full of month prior to the City staff, CEST team, and the help of some grant funding.
3. Develop and implement a community disaster preparedness program.
4. Evaluate the community about hazard risks and hazard mitigation. Consider that prior suggested a new committee or coordinate hazard mitigation activities and if you would like to volunteer for such a committee or for loan and or will work to resolve our biggest.

The city council is completing work on the Fire Station due diligence report and I hope to have that available to the public later in the first quarter. I am excited to see this process move forward. I know the firefighters need a larger training space, storage for equipment, and a decontamination room, as well as many other things that would be a part of the new station. Thanks to all the volunteers and our staff who have worked throughout the pandemic to ensure our folks 500 lots year!

The Council was able to distribute 23 grants to Gearhart small businesses before the end of the year. It was great to see the entire Gearhart community as we delivered checks. Thanks to the city staff and council who worked through 3 special meetings to get this important task done. The grants were part of the CARES act money the city received.

The Business Committee has been working on an inventory of Gearhart businesses, the Parks Master Plan Committee has just sent out a survey and we have received a great response so far. If you haven't filled one out for your family, please look for it in your next bill or a link on the blog or city website. Finally, Gearhart is participating in a planning project for improving safety on Highway 101 throughout Gearhart, this is a long-term project that is described in the Gearhart Transportation Plan for the city website.

Stay safe Gearhart! Here's to a happy and healthy 2021!

Mayor Paulina

January 8, 2021: <https://cityofgearhart.wordpress.com/2021/01/08/mayors-report-for-january-2021/>

Figure V-6. Gearhart blog 3.1

Mayor's Report for August 2019
August 9, 2019 by Mayor Brad Brown

NEW FIRE STATION UPDATE
I wanted to give a brief update on the quest for a new Emergency Response & Resiliency Station and go over the entirety of the timeline to far.

November 2006: A new fire station/hall was proposed on a ballot of registered voters in Gearhart to be built in the current location. 558 registered voters voted in the election. The ballot measure failed 227 to 231.

July 2015: Mayor Oldgood and the City Council wanted to begin looking at the potential to once again build a new fire station and formed a citizen committee made up of 11 volunteers to look into possible locations and concepts.

March 2017: The citizen committee hosted a town hall at the fire station to go over their findings to far and to give public information on the 3 locations that they were doing research on. The public was able to weigh in on some of the top sites and give feedback. The city presented more information for the need of a new fire station/public safety building.

January 2019: The committee narrowed down the locations to 3 concepts and presented them at a town hall meeting. The meeting was well attended, and attendees included Mayor Brown, City Manager Chad Sweet, Chief Bill King, Geologist Tom Homing, and Map Read from CCO. The 3 locations/concepts presented were Gearhart Park Station, Pacific City Station (Current Location), and High Point Station (located on N. Marine just north of the Gearhart by the Sea Center).

Highpoint Station

The Highpoint Station conceptualization was the public's most popular choice.

January, 2019: The town hall also kicked off an extensive 3 month public feedback process where every resident of Gearhart including parkhome, full-time, and registered voters could fill out a survey showing if they supported a new station, if they support a bond, what location they support, and how they believe the community should pay for it.

April 2019: 847 people participated in the survey. The city gathered over 1000 pages of feedback. Among registered voters who would be voting on a bond, 62.3% supported a new station, 79.4% supported a bond, 52% supported the High Point location compared to 30.7% supporting the current location, and 17.3% supporting the park location. A public report of the survey results was presented at the May 2019 city council meeting. The report is available online.

May 2019: The Gearhart city council voted 4-0 to take the park location off the table due to the survey results. The council directed staff to begin detailed due diligence on the High Point location to determine if it would be a feasible location for a new station.

August 9, 2020: <https://cityofgearhart.wordpress.com/2019/08/09/mayors-report-for-august-2019/>

Figure V-7. Gearhart blog 3.2

Highpoint Station

The Highpoint Station conceptualization was the public's most popular choice.

Emergency Preparedness Update

As many of you know the city council and City of Gearhart has had emergency preparedness as one of its top priorities for some time. I wanted to give you an update on what the city has done recently and continues to be involved in to help prepare our community for hazard mitigation.

Hazard Mitigation Plan: Gearhart updated its Hazard Mitigation Plan in 2014/2015 in accordance with state regulations. This process involved extensive work by our Planning Commission and was approved by the city council.

Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan: The city of Gearhart has been actively involved with Tiffany Brown and the Clatsop County Emergency Management team. City Manager Chad Sweet attended the April 3rd, 2019 Steering Committee meeting, where Matt Williams, Geohazard Analyst with the Oregon Dept. of Geology and Mineral Industries presented the Multi-Hazard Risk Report which is available for download online. The City of Gearhart will continue to be actively involved with Clatsop County and other government agencies such as FEMA in assessing current risk and preparing for all types of natural disasters. Please stay tuned for more information on this Multi-Jurisdictional Plan.

Emergency Operations Center
Clatsop County Emergency Management Division

Emergency Supply Grant: In February 2018 the City of Gearhart applied for and won an emergency supply grant for \$54,000 from State Homeland Security Grant Program. The grant was approved in May 2019 and the grant agreements will be presented in mid-October with funding available shortly after signed agreements are received.

Emergency Storage Conexes: Earlier this year the council approved the acquisition of 2 conexes to be placed in high elevations within the city limits. These conexes will be used to store emergency and medical supplies in case of all types of natural disasters including tsunamis and earthquakes. They will also be used for an emergency cache container program for our residents and businesses.

Joint Naval Exercise: On June 3rd, 2019 the city council and city staff were invited to participate with other Clatsop County officials in a joint naval exercise to simulate landing supplies on the beaches after a Caspasia level event. Tiffany Brown, Emergency Manager of Clatsop County along with military officials presented the likely scenarios in such an event. LCAC hover crafts were dispatched from the USS Anchorage to simulate bringing supplies and equipment on shore for the aftermath of an earthquake and Tsunami.

August 9, 2020:

Figure V-8. Gearhart blog 3.3

Tsunami Hazard Overlay Zone: The city has been working with DLCD to update our Tsunami Hazard Overlay Zone. This was initiated by the Gearhart Planning Commission for the state Coastal Resiliency Grant process. We will be discussing the proposed zone amendments this evening. This process could help to allow grant funds to be available for emergency preparedness projects in Gearhart. Some projects that have been discussed by citizens so far are new evacuation route signage including painted signs on the road surfaces, tsunami evacuation towers, new evacuation maps for Gearhart that are easier to read and focus on specific neighborhoods and where their quickest and safest routes are, emergency supply storage, etc. If passed by Gearhart, we would be the first community in Clatsop county and on the north Oregon coast to do so and would help protect important city infrastructure and our citizens in the case of a tsunami.



CERT Team: A special thanks to our CERT volunteers for their continued hard work to help keep us prepared. The CERT team has been working on emergency family cache project as well as working on emergency communications through ham radio. CERT was instrumental in helping the city install an emergency ham radio station east of HWY 101.

New Fire Station: If a new Emergency Response and Resiliency Station was built above 60' it would be a safe evacuation area for 95% of simulated Cascadia tsunami events. This would in effect make an ideal vertical evacuation location and emergency and medical supply cache. It would also double as an Emergency Operations Center (EOC) for all levels of disasters, coordinating our first responders in the case of medical, fire, and safety issues brought on by natural disasters.

Thank you to our citizens for being a positive voice for this community and giving crucial feedback to help keep us be prepared and safe!


All the best,
Mayor Matty

August 9, 2020: <https://cityofgearhart.wordpress.com/2019/08/09/mayors-report-for-august-2019/>

Figure V-9. Gearhart blog 4: Plan Review Outreach

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Keeping our residents informed while maintaining the quality & livability of our community.



Gearhart! Share Your Feedback!
June 9, 2020 by Gearhart City Staff

Hello Gearhart — Progress in hazard mitigation planning marches forward. The citizen input portion of our plan update is in full swing and we want to hear from you. [We NEED to hear from you!](#)

From Clatsop County Emergency Management:



Clatsop Community Survey

2020-25 Natural Hazards Mitigation Plan

As part of the review and update process, input is needed from the citizens who live and/or work in Clatsop County. Clatsop County Emergency Management has created an online survey to allow for the citizen input. The survey asks the public's opinion on topics such as identified hazards, personal impacts, personal preparedness, etc. [To make sure everyone is able to participate, we've created three different ways to participate:](#)

- Take the survey online - [CLICK HERE](#).
- Print the survey and fill it out - [CLICK HERE](#).
- Complete a fillable PDF of the survey - [CLICK HERE](#).

What is the Hazard Mitigation Plan? The Hazard Mitigation Plan is a framework that guides our community in making

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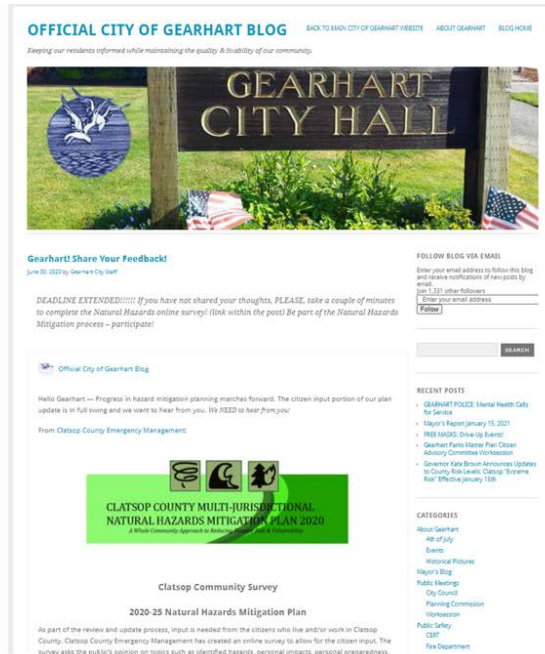
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- Mayor's Report (January 15, 2021)
- FREE! (ASAP) Civic-Ed Event!
- Gearhart Public Master Plan Citizen Advisory Committee Worksession
- Governor Kate Brown Announces Updates to County Risk Levels: Clatsop 'Extreme Risk' Effective January 15th

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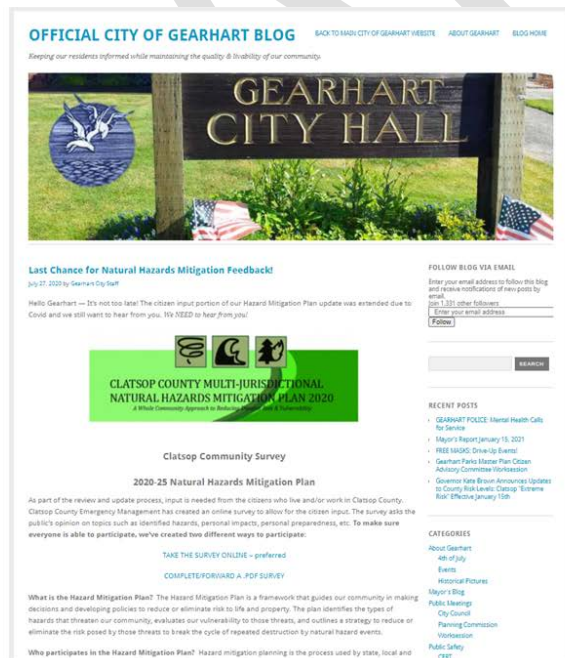
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- City Council
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- Public Safety
- CERT

June 9, 2020: <https://cityofgearhart.wordpress.com/2020/06/09/gearhart-share-your-feedback/>

Figure V-10. Gearhart blog 5: Plan Review Outreach



June 20, 2020: <https://cityofgearhart.wordpress.com/2020/06/30/gearhart-share-your-feedback-2/>



July 27, 2020: <https://cityofgearhart.wordpress.com/2020/07/27/last-chance-for-natural-hazards-mitigation-feedback/>

Plan Update Comment Matrix

Table V-1. Comments and Responses

#	Commenter	Comment	Response
	n/a	Why is hazard mitigation limited to physical events like earthquakes and not inclusive of public health/pandemic like events?	Pandemics have not been widely included in hazard mitigation plans, however mitigation can include public health events like pandemics. Unfortunately the multi-jurisdictional coordination on the emerging event was beyond the capacity of the group to include in this plan update.
	n/a	Make sure utilities companies are involved and resilient and / or have emergency backup such as solar. Our population depends daily on electricity, gas and communications. Water and sewer need utilities to function properly too.	Great point. The Clatsop County Emergency Manager does a good deal of coordination with utilities as do the participating jurisdictions in their capacity as drinking water and sanitary service providers.
	n/a	No mention here of tornado hazard, which seems to be a growing threat in this area.	Thank you for the feedback on the survey. The tornado hazard is included in the Windstorm and winter storm plan section.
	Sherri Gray	Need better info about the location and contents in the community emergency kits stationed in the neighborhoods in town and more of these kits.	Community emergency kits are a priority for many of the participating jurisdictions in this plan update. Please see the City of Seaside Community Risk Profile section for more information on this topic.
	n/a	No information given to public outside of city council meeting - again no community involvement to those who actually live work here.	Thank you for the feedback on the survey. The plan update process included five public steering committee meetings during plan development and a public review period for the plan after this comment was received.
	n/a	Moving the high school was the wrong choice in my opinion. Instead for the money we could have built a new tsunami-proof facility including an upper level escape platform thereby saving countless lives during the initial event, whether it hits during school times or any other time.	Thank you for the feedback and honest opinion. Consider two factors that informed this decision: a) the availability of state monies for seismic school safety; and b) the grave concern of decision makers that in the event of a tsunami, every parent will rush into the tsunami zone to save their child if it occurs

#	Commenter	Comment	Response
			during the school day. Fortunately, the school relocation does not preclude other relocations and the manner in which the project was implemented demonstrates the deep commitment and professionalism of civic leaders who are capable of doing more, like constructing a tsunami evacuation tower with future public support.
	Dolores Matthys	It's a lot to wrap your head around and plan for as a single homeowner with multiple pets to consider.	Thank you for taking the time to consider these hazards. It can be overwhelming, but by taking small steps towards preparedness, a good amount of progress can be made.
	Neil Grubb	With age comes wisdom that we really can't forecast what Mother Nature will throw at us: Columbus Day Storm, Mt. St. Helens, Floods of 1996. All happened in a different way than predicted. Let's plan for the known events like traffic accidents and winter storms and not for those that Mother Nature will decide how, and when.	Thank you for the feedback and honest opinion. This plan update is conducted in accordance with Stafford Act requirements so that the participating jurisdictions will continue to qualify for hazard mitigation funds from the Federal Emergency Management Authority. Mitigation activities can save \$6 for each one spent and is thus considered a fiscally responsible course of action.
	Suzanne Myhra	I'm one of "those" Portland people who have a second home in Gearhart. I've gone through emergency preparedness in my HOA in Portland and know some of this but not things unique to the coast.	Thank you for your feedback and interest in coastal hazards. Please consider signing up for email alerts from Clatsop County Emergency Management if you haven't done so already. https://www.co.clatsop.or.us/em/page/clatsopalerts
	Stephen Davis	"Note: I am retired, so did not answer workplace questions. For the majority of the categories of concern I agree in general with the planning and preparation being considered. In the case of tsunami: EARLY WARNING should be THE PRIME CONCERN. That is the only thing that will save lives. In the case of a major Cascade Fault quake, the resulting tsunami will be totally devastating to the entire OR North Coast. Preservation of property within the contact zone, if	Thank you for the feedback on the survey. Unfortunately you are correct about the relative risk of a Cascadia subduction event. You will likely find the specific data included in the newly-published final Natural Hazard Risk Report for Clatsop County to be of significant interest. We also think you'll appreciate much of the updated plan sections on earthquake and tsunami.

#	Commenter	Comment	Response
		<p>anything should be a minor subject. There won't be any structural and in some areas geographical property remaining. Finances and efforts to reinforce infrastructure, other than bridge quake reinforcement are a waste of time and effort. There won't be anything there. And anyone who isn't out of the danger zone by the time the tsunami comes ashore---won't come out. That may sound harsh, but take a look at the Japan disaster videos for confirmation. Again, Early Warning is the only thing that will save lives. That should be where all effort is focused. Secondary planning for food, water, medical need to be in the plan, but first people have to survive.</p> <p>I really don't think that most citizens here fully understand what will happen. There seems to be an attitude of---Oh my, a big wave could come in, and we will need to get up to the hill while it happens, and then go back home.</p> <p>I hope the Emergency Planning Committee understands that there won't be any home to go to, if fact there won't be any Seaside---and that is the scenario that has to be planned for.</p> <p>Any assistance from military sources should probably be forgotten. Especially those on the coast--they won't be there.</p> <p>Any plan involving tsunami disaster should have a control center located inland and well designed for earthquake protection. And people expected to manage the event and aftermath should not live in the coastal zones.</p> <p>One last comment. The existing Seaside early warning system speaker system from where I live is terrible. It is mushy and not understandable. Also, constant testing has made it commonplace practice and consequently people tune it out.</p> <p>Enough out of me.</p>	<p>Fortunately we do know that seismic improvements to buildings DO save lives and money in the variability of events that occur as evidenced by the seismic resilience of Chile after decades of significant rehabilitation efforts following numerous earthquake disasters. But the potential impact of improvements like this do vary by location and again, the new Risk Report addresses this subject with some model results.</p> <p>Early warning is beyond the scope of local mitigation, but it is supported by the group.</p> <p>Finally, thank you for your note about the Seaside early warning speaker system—the public officials there are working to improve hazard mitigation tools like this so your input is valuable.</p>

#	Commenter	Comment	Response
		Thanks for all your hard work and concern. It is appreciated."	
	n/a	Confidential Please! As a employee of Safeway I have carded people from all over th US with Covid 19 going & some of these poeple are from hot zones. Yes I understand they pay are wages, but this does scares me for my safety & other in are community.	Thank you for the feedback on the survey. Essential workers like yourself are on the frontlines of the war against this virus. Successful methods for encouraging or requiring the public to stay home over an extended time period is proving to be one of the biggest challenges of this long-duration pandemic event. We wish you health and safety.
	n/a	Why not mention t o r n a d o destruction, more of which can be expected here owing to climate change. Manzanita has already experienced severe tornado damage twice. First responders need to have mitigation and cleanup equipment, which they don't currently.	Thank you for the feedback on the survey. The tornado hazard is included in the Windstorm and winter storm plan section.
	Matthew Johnson	Does the county have redundant back up plans for shelter/first aid?	Clatsop County recently completed a Mass Care Plan which augments the Emergency Operations Plan. Hopefully these documents address your question.
	Rosemary Johnson	SHPO has a great site for information about cultural resources and disasters. We need to reference it somehow. https://www.oregon.gov/oprd/OH/Pages/DisasterPrep.aspx	Yes, thank you. The link and this text was added to the Cultural and Historical Resources section of the Community Profile (page 115). See SHPO resources on Disaster Preparedness, Recovery, and Resilience for heritage sites and museums. The website includes models, guidebooks, tools, etc. to assist in the preparation of local plans and best practices for management of the cultural resources in a disaster.
	Meg Reed	Can you please add the local web-page that we manage? www.oregonkingtides.net	Yes, thank you. It has been added to the Future Climate Conditions, Coastal Erosion Hazard section (page 129).
	Meg Reed	As Coastal Shores Specialist with DLCD, I am working on a communication toolkit for the DOGAMI tsunami hazard models (Hazus). This could go well alongside the community	Yes, thank you. The language from the toolkit could assist communities in the next plan update or as a plan maintenance revision.

#	Commenter	Comment	Response
		hazard profiles for better clarity about the meaning of this data for the layperson.	

DRAFT

A. Appendix A

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DRAFT

1. DOGAMI O-20-16 Risk Report for Clatsop County

This report forms the basis of the risk assessment for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update. It

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

After the first in-text citation by section, this report is cited as Williams et al, 2020.

What's in this report?

This report describes the methods and results of a natural hazard risk assessment for Clatsop County communities. The risk assessment can help communities better plan for disaster.

Report downloads:

- [Text report, including all appendices](#) (93 p., 21 MB PDF)
- [Appendix E. Map Plates](#) (7 plates; 23 MB PDF; view/download individual plates below)
- [GIS metadata bundle](#) (3 .xml files; 11 KB zip file)
- [Full GIS data bundle](#), with .xml metadata (4.5 MB, zip file; view .xml metadata links below)
- [Complete publication bundle](#) (86 MB zip file)

Executive Summary (excerpt):

This report was prepared for the communities of Clatsop County, Oregon, with funding provided by the Federal Emergency Management Agency (FEMA). It describes the methods and results of the natural hazard risk assessment performed in 2018 by the Oregon Department of Geology and Mineral Industries (DOGAMI) within the study area. The purpose of this project was to provide communities with a detailed understanding of their risk from natural hazards, to give communities the ability to compare their risk across multiple hazards, and to prioritize and take actions that will reduce risk. The results of this study can also inform the natural hazard mitigation planning process. We arrived at our findings and conclusions by completing three main tasks: compiling an asset database, identifying and using the best available hazard data, and performing a natural hazard risk assessment. Results were broken out for the following geographic areas:

- Unincorporated Clatsop County (rural)
- Community of Svensen-Knappa
- City of Astoria
- City of Gearhart
- City of Warrenton
- Community of Arch Cape
- Community of Westport
- City of Cannon Beach
- City of Seaside

2. OCCRI Future Climate Projections: Clatsop County

This report informs the consideration of hazards for the local risk assessment evaluations conducted for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update. The production of this report was contracted by the Oregon Department of Land Conservation and Development for the purpose of the plan update. The report is only publically available as an appendix to this plan update.

Dalton, Meghan M. (2020, Feb.). *Future Climate Projections: Clatsop County*. Oregon Climate Change Research Institute. College of Earth, Ocean and Atmospheric Sciences, Oregon State University.
https://www.oregon.gov/lcd/CL/Documents/Clatsop_County_Future_Projections_Report_02132020.pdf

DRAFT

3. DOGAMI Earthquake and Tsunami Impact Reports

DRAFT

DOGAMI O-20-10 Earthquake and tsunami impact analysis for coastal Clatsop County, Oregon

This report informs the consideration of earthquake and tsunami hazards for the local risk assessment evaluations conducted for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Allan, Jonathan C., Fletcher E. O'Brien, John M. Bauer, and Matthew C. Williams. (2020, Dec.) *Earthquake and tsunami impact analysis for coastal Clatsop County, Oregon* (Open-File Report O-20-10). Portland, OR: Oregon Department of Geology and Mineral Industries.
<https://www.oregongeology.org/pubs/ofr/p-O-20-10.htm>

- After the first in-text citation, this report is cited as Allan et al, 2020.
- Reissued 12-11-20 – This report supersedes the file set originally released 10-29-2020. The reissue includes a spreadsheet containing data that are the basis for the report's tables and figures. Appendix community profile Figures C and D are revised to subtract 10 mins from the tsunami wave arrival time, which then determines the travel distance threshold.

DOGAMI O-20-03 Analysis of earthquake and tsunami impacts for people and structures inside the tsunami zone for five Oregon coastal communities: GEARHART EXCERPT

This report informs the consideration of earthquake and tsunami hazards for the local risk assessment evaluations conducted for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Bauer, John M., Jonathan C. Allan, Laura L. S. Gabel, Fletcher E. O'Brien, and Jed T. Roberts. (2020).

Analysis of earthquake and tsunami impacts for people and structures inside the tsunami zone for five Oregon coastal communities: Gearhart, Rockaway Beach, Lincoln City, Newport, and Port Orford (Open-File Report O-20-03). Portland, OR: Oregon Department of Geology and Mineral Industries. <https://www.oregongeology.org/pubs/ofr/p-O-20-03.htm>

- After the first in-text citation, this report is cited as Bauer et al, 2020.
- Only the Gearhart section is proposed for this appendix, although the methods and overall findings are relevant.

4. DOGAMI Earthquake and Tsunami Evacuation Analyses

Large-Extent Tsunami Evacuation Maps

These maps informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Oregon Tsunami Clearinghouse. (2013). *Large-Extent Tsunami Evacuation Maps*. Newport, OR: Oregon Department of Geology and Mineral Industries.

<https://www.oregongeology.org/tsuclearinghouse/pubs-evacbro.htm>

Warrenton & Clatsop Spit

https://www.oregongeology.org/pubs/tsubrochures/WarrentonEvacBrochure-5-29-13_onscreen.pdf

Astoria

https://www.oregongeology.org/pubs/tsubrochures/AstoriaEvacBrochure-6-6-13_onscreen.pdf

Sunset Beach & Del Rey Beach

https://www.oregongeology.org/pubs/tsubrochures/SunsetDelReyEvacBrochure-6-7-13_onscreen.pdf

Youngs River Valley

https://www.oregongeology.org/pubs/tsubrochures/YoungsRiverValleyEvacBrochure-6-7-13_onscreen.pdf

Seaside & Gearhart

https://www.oregongeology.org/pubs/tsubrochures/SeasideGearhartEvacBrochure-6-3-13_onscreen.pdf

Cannon Beach

<https://www.oregongeology.org/pubs/tsubrochures/CannonBeachEvacBrochure-5-21-13onscreen.pdf>

Arch Cape

https://www.oregongeology.org/pubs/tsubrochures/ArchCapeEvacBrochure-5-21-13_onscreen.pdf

DOGAMI O-16-08 Beat the Wave WARRENTON, CLATSOP SPIT

This report informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Gabel, Laura L. S. and Jonathan C. Allan. (2016). *Local tsunami evacuation analysis of Warrenton and Clatsop Spit, Clatsop County, Oregon* [Beat the Wave] (Open-File Report O-16-08). Newport, OR: Oregon Department of Geology and Mineral Industries.

<https://www.oregongeology.org/pubs/ofr/p-O-16-08.htm>

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DOGAMI O-15-02 Beat the Wave SEASIDE, GEARHART

This report informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Priest, George R., Laura L. Stimely, Ian P. Madin, and Rudie J. Watzig. (2015). *Local tsunami evacuation analysis of Seaside and Gearhart, Clatsop County, Oregon* [Beat the Wave] (Open-File Report O-15-02). Newport, OR: Oregon Department of Geology and Mineral Industries.
<https://www.oregongeology.org/pubs/ofr/p-O-15-02.htm>

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5. DOGAMI Hospital Resilience Guidance

This report informed the consideration of earthquake and tsunami hazards for the local mitigation strategies developed or updated for the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update.

Wang, Yumei and K.L. Nourse. (2019.) *Resilience Guidance for Oregon Hospitals* (Open-File Report O-19-02). Portland, OR: Department of Geology and Mineral Industries.

https://www.oregongeology.org/pubs/ofr/O-19-02/O-19-02_report.pdf

Cascadia Region Earthquake Workgroup (CREW) Guidance Documents

The guidance documents provide basic information on the importance of preparing hospitals by addressing issues related to building structures and the power and water services required to operate the hospital. They are designed to be easy to understand, promote resilience action planning, and point to detailed reference documents.

- [Preparing Hospitals for Earthquakes: Structural and Nonstructural Issues](https://www.oregongeology.org/pubs/ofr/O-19-02/CREW_Fact_Sheet_9_Hosp_07-23-2018_final.pdf) (CREW Fact Sheet 9, 659 KB PDF) https://www.oregongeology.org/pubs/ofr/O-19-02/CREW_Fact_Sheet_9_Hosp_07-23-2018_final.pdf
- [Emergency Power for Hospitals: Preparing for Cascadia](#) (CREW Fact Sheet 10, 1,033 KB PDF)
- [Emergency Water for Hospitals: Preparing for Cascadia](#) (CREW Fact Sheet 11, 808 KB PDF)
- https://www.oregongeology.org/pubs/ofr/O-19-02/CREW_Fact_Sheet_10_Hosp_power_07-23-2018_final.pdf

6. 2020 State Plan Oregon Coast Risk Assessment

This report was completed after this plan update, but can be referred to in plan maintenance and grant applications during the 2021 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan implementation process.

State of Oregon. (2020). *Risk Assessment Region 1 – Oregon Coast, Oregon Natural Hazards Mitigation Plan*. Salem, OR: Department of Land Conservation and Development.

https://www.oregon.gov/lcd/NH/Documents/Approved_2020ORNHMP_07_RA1.pdf

For links to the full plan and other sections, see:

<https://www.oregon.gov/lcd/NH/Pages/Mitigation-Planning.aspx#NHMP>

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7. Local Risk Assessment

During the 2020 Clatsop County Multi-Jurisdictional Natural Hazard Mitigation Plan Update, jurisdiction staff met with the DLCD project manager for risk assessment meetings during which staff developed hazard rankings using the Oregon Emergency Management (OEM) methodology as adapted on the following pages.

Office of Emergency Management. (2015, May). *Hazard Analysis Methodology*. Salem, OR: Oregon Military Department.

https://www.oregon.gov/lcd/NH/Documents/Apx_9.1.19_OEM_Hazard_Analysis_Methodology_OPT.pdf

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Hazard Vulnerability Analysis Methodology

Clatsop County MJNHMP 2020 Plan Update Adaptation of: Oregon Office of Emergency Management (OEM) HAZARD ANALYSIS METHODOLOGY

BACKGROUND AND OVERVIEW

This hazard analysis methodology was first developed by FEMA circa 1983, and gradually refined by OEM over the years. During 1984, the predecessor agency to OEM (Emergency Management Division) conducted workshops around the State of Oregon that resulted in all of Oregon's 36 counties (and many cities and districts) producing an analysis using this methodology.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible), one order of magnitude from lowest to highest. Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

For local governments, conducting the hazard analysis described in this document is a useful early step in planning for hazard mitigation, response, and recovery. This method provides the jurisdiction with a sense of hazard priorities, or relative risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest.

Among other things, this hazard analysis can:

- ▶ Help establish priorities for planning, capability development, and hazard mitigation;
- ▶ Serve as a tool in the identification of hazard mitigation measures;
- ▶ One tool in conducting a hazard-based needs analysis;
- ▶ Serve to educate the public and public officials about hazards and vulnerabilities; and
- ▶ Help communities make objective judgments about acceptable risk. For OEM and other state and regional organizations such as the Oregon Department of Land Conservation & Development, this analysis allows comparison of the same hazard across various local jurisdictions. Each local hazard analysis produced using this methodology is ultimately comprised of two main pieces: a hazard analysis matrix (table) and a narrative.

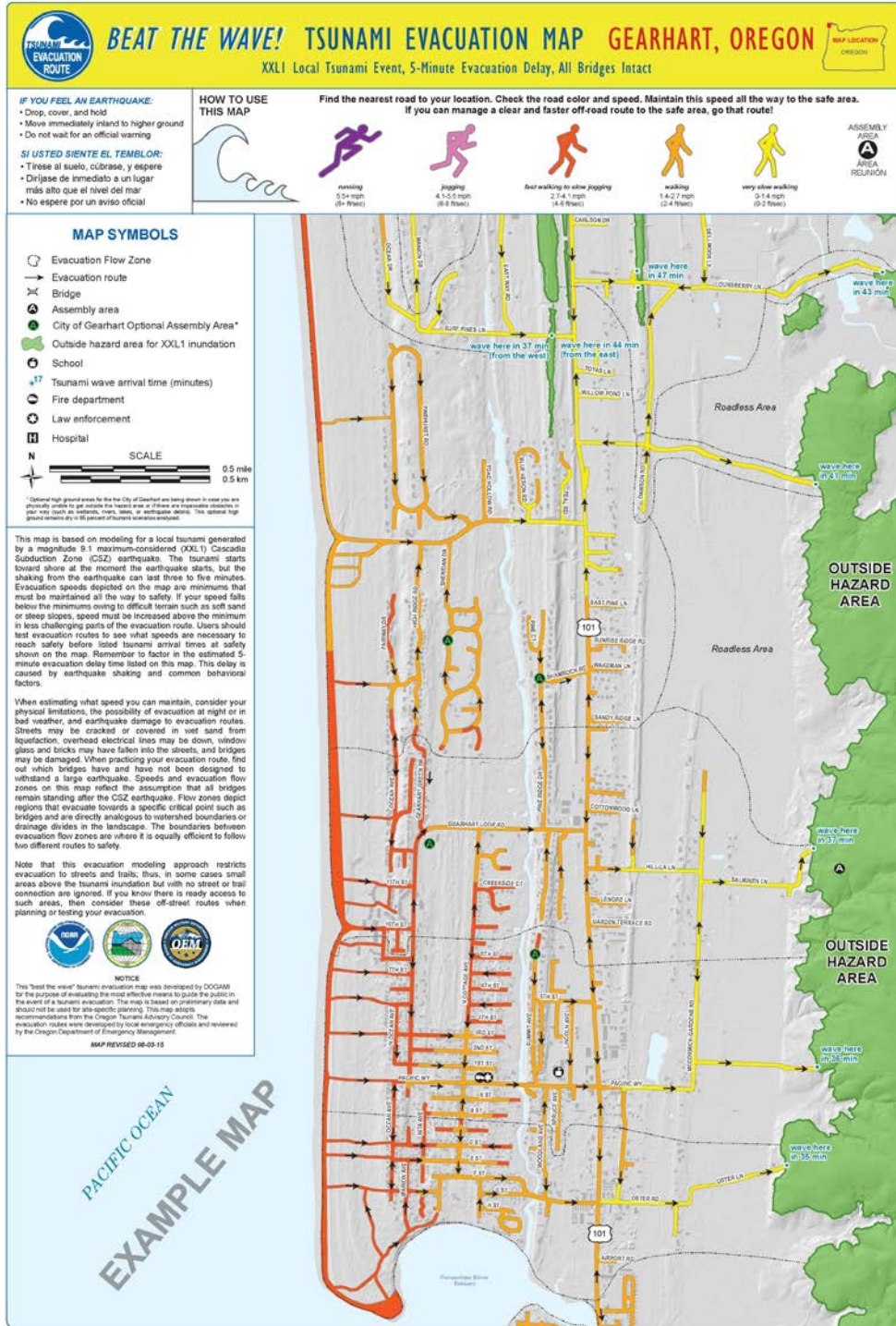
POSSIBLE HAZARDS TO CONSIDER

NATURAL HAZARDS

In accordance with Statewide Planning Goal 7, jurisdictions must examine the following hazards when they overlap with their legal boundary: earthquakes and related hazards, wildfires, floods (coastal and riverine), landslides and debris flows, coastal erosion, and tsunamis. Jurisdictions should also develop scores, where applicable, for coastal hazards other than erosion, for drought, dust storms, windstorms, winter storms, and for volcanic hazards. With respect to volcanic hazards, score direct hazards such as blast and lahar separately from secondary hazards such as ashfall.

Jurisdiction Appendix C City of Gearhart

Figure VI-1. Gearhart Beat the Wave Map



Source: Oregon Tsunami Clearinghouse, 2013.